QUANTITATIVE DETERMINANTS OF NEED AND DEMAND FOR PRIMARY CARE IN THE DISTRICT OF COLUMBIA

by

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Submitted in fulfilment of the requirements for the degree of

DOCTOR OF LITERATURE AND PHILOSOPHY

in the

Department of Health Studies

at the

UNIVERSITY OF SOUTH AFRICA

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FEBRUARY 2015

DEDICATION

TO: John Christian Andoh, Sr. and Margaret Narchiah Andoh,
My beloved parents:

Although you have made the transition to the ancestral realm, you are always present with us. You instilled in my siblings and me the love of education and learning. I will always be indebted to you for what I have learned, achieved and accomplished in my lifetime.

Student Number: 4808-954-0

DECLARATION

I hereby declare that:

QUANTITATIVE DETERMINANTS OF NEED AND DEMAND FOR PRIMARY CARE IN THE DISTRICT OF COLUMBIA is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references. This work has not been submitted before for any other degree at any other institution.

____________________________ ____________________________

Jacob Yankson Andoh Date

ACKNOWLEDGEMENTS

To my dear and immediate family – my wife, Joan Wright-Andoh, MPH, CPM and our two sons, Kwesi Richard Andoh and Kofi John Andoh - I owe my greatest debt of gratitude for the constancy of your love, encouragement and support.

I am indebted to several individuals for their support and assistance in completing this work. I extend special thanks to Dr. Mary Maria Moleki, UNISA's Chairperson of the Department of Health Studies, Prof. L. Roets, Chairperson of the Higher Degrees Committee, and to the Supervisor of my doctoral studies, Prof. Sarie P. Human, for their administrative/academic support and guidance. My thanks go to Dion Van Zyl, Statistician and Manager, Information Services, UNISA's Directorate of Information and Analysis (DIA), for his helpful review and comments. For *inspiring* this work, my eternal gratitude, respect and thanks go to Andrew Dennis McBride, MD, MPH, former Commissioner of Public Health of the District of Columbia Commission of Public Health.

I also extend sincere gratitude to the following friends and colleagues in academia, health care, research and systems for their support and friendship:

● Emilio Morante, MPH, Health Planner/Executive, New York City, NY

● Audrey P. Harvey, MA, former Special Assistant to the Commissioner of Public Health

● Raymond T. Terry, Sr, Ph.D., Emmanuel Nwokolo, Ph.D., Larry DeNeal, Ph.D, MPH, Vincent Y. Kofie, Ph.D., Athanasius Nzeribe, DPH, Feseha Woldu, M.D., Regina Knox Woods, MA, Amha Selassie, CPM, Carl Wilson, MPH, Joy Phillips, Ph.D., Fern Johnson-Clarke, Ph.D. - my colleagues at the D.C. Department of Health

● Simon Holliday, Chief/OHPD, Janice Diggs, Dana Mitchener, Susana Batres, Loretta Profater, Lucy Agwa Tanyi, James Burroughs, Susan Williams, Gail Smith, MA - all of the former D.C. CPH/Office of Health Planning and Development, Washington, DC

● Olive Shisana, Ph.D., my former colleague at DC CPH/DHS and former Chief, Research and Statistics Division, Department of Human Services, Washington, DC

● James McCormack, PhD, Executive Director, Phil Vernon, PhD, Director, and Dan Gordon, MS, Beverly Paisley, MS and Dwight Williams, MPA – my colleagues at the New York State Health Planning Commission, Albany, NY

● A. Sue Brown, MSW, LICSW, former Administrator, DC/CPH Long Term Care Administration & DC/DHS Commission of Social Services, Washington, DC

● Samuel C. Ndubuisi, Ph.D., US Department of Health and Human Services, Administration for HIV/AIDS, Rockville, Maryland

● Anthony Boakye, M.D. of Kaiser Permanente Health Centre, Annapolis, Maryland

● Adeola Molajo, PhD, Mathematical Statistician, The Molajo Group, Inc., Wash., DC

● Kwasi O-Ahoofe, PhD, Systems Engineer & Software Developer, Orchard Park, NY

● A. Dallas Williams, MSW, Program Manager, DHS/Family Services Administration, Washington, DC

● Carlos Mamani, PhD., Emmanuel Gominho, MS., Mufit Cinali, MS, MBA., Amateka Morgan, MS., Lisa Spraragen, MA., Florence Marie Wellington Shadlen, MD., Ernest Osei-Tutu, MD., Isaac Tuah-Poku, MS., Richard K. Frimpong, MA, Joe Kwame Debra, MS, John Kofi Adu, MBA, *Robert Benson, Prof. Elbert Robertson, JD, Steve Green, David Collier and Keith Medley* – my friends and colleagues from Brown University, Providence, RI

● Mampela Mamphela, Nich Adi-Dako, MPH, Njoki Ndugu, MSUP, Demetress Danzy, MSUP, Denise Notice-Scott, MSUP, MPH, Dr. O. J. Appiah – my Columbia University graduate school colleagues/former residents of The International House, New York, NY

● Samuel H. Dean, Donna J. Dean, Andrea Toney-Thomas, Esq., Ramsey Daminabo, CPA and Michael Thompson, MBA, MPA - mentors and community leaders, Lake Arbor, Mitchellville, MD.

● Last but not least:
To: John Christian Andoh, Jr. (*Emu*), Emmanuel Andoh (*Paapa Enoh*), Christiana Andoh (*Maame Bɛneɛ*), Sara Andoh (*Manyi*), Gifty Andoh (*Adwo Anyeboso*) – my dear siblings in our homeland and hometown of Sekondi-Takoradi, Ghana - and to our extended family at home and abroad, I offer much love. From: Jacob Andoh (*Akenyah*).

QUANTITATIVE DETERMINANTS OF NEED AND DEMAND FOR PRIMARY CARE IN THE DISTRICT OF COLUMBIA

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ABSTRACT

This study, quantitative determinants of need and demand for primary health care in the District of Columbia (DCPC), analysed data over a twenty-year period from 1985 to 2004, on need and demand for primary care using standard and epidemiologically innovative statistical measures for physician distributions and socio-demographic characteristics in the District of Columbia (DC). The study attempted to answer the question: Using U.S census-based small area aggregations, Census Tract Groupings (CTGs), that are not zip-code areas or legislative/political boundaries, can a multivariate predictive model be developed using physician distributions, primary care service index (PCSI) and composite need scores (CNS) to explain variations in *primary care visits shortages*? Primary care visits shortages and priority scores (PCPS) were calculated, analysed and presented for CTGs in the District of Columbia from 1985 to 2004. Results indicated that the abundant supply of DC-based physicians – indicated by decreasing *population per physician ratios* of 239 (1985) to 146 (2004) – appear to be a long-term trend. As raw physician counts increased, the *ratio of satisfied visits to demand* decreased, from 2.62 (1985) to 1.80 (in 2004). This result appears to indicate that, due to inequities in distribution of primary care physicians in DC's small areas, the increasing numbers of primary care physicians were by themselves, not sufficient to address the city's overall *primary care visits need*. Epidemiological profiles and physician distribution analytical methods appear to be useful for small area analysis of urban primary care shortage areas and for setting priorities. *Physician rates per 1,000 pop may be* a necessary but not sufficient statistic for estimating urban primary health care needs.

KEY CONCEPTS

Primary care; need methodology; census tract grouping; physicians distribution; primary care service index; composite need score; primary care priority score; potential demand; satisfied demand; primary care visits shortage; primary care planning.

KEY TERMS USED IN THE STUDY

- Census Tract Grouping
- Composite Need Score (CNS)
- Demand / Primary Care Demand
- District of Columbia Primary Care (“DCPC”)
- “The District” (District of Columbia)
- General Primary Care
- General Primary Care Physicians
- Health care system
- Health Professional Shortage Area(s)
- Low Birth-weight
- Need / Primary Care Need
- Non-Primary Care Physicians
- Poverty status / poverty level / poverty thresholds
- Primary Health Care
- Primary Care Physicians
- Primary Care Physician Visits
- Primary Care Physicians
- Primary Care Visits Demanded / Potential primary care visits **demand**ed
- Primary Care Visits Satisfied / Satisfied visits / satisfied demand / Visits available
- Primary Care Service Index (PCSI)
- Priority Score / Primary Care Priority Score
- Primary Care Shortage Area
- Specialist Primary Care
- Specialist Primary Care Physicians
- Visits / Primary Care Visits

DEFINITION OF TERMS USED IN THE STUDY

- **"Census Tract Grouping"**

This term is operationally defined and used in this study as follows: A Census Tract Grouping (CTG) in this study is a collection of several (usually between 11 and 20) census tracts or small areas, which analytically tend to cluster together when factors such as housing density, ethnic mix, access to community health facilities and community identity are analysed. CTGs are the units of analysis used in this study.

- **"Demand"**

Demand is defined in general usage as a strong request for something (Merriam-Webster 2013). In economics, the term "demand" is used to describe the quantity of a commodity or service wanted and purchasable at a specified price and time (Econlib 2011). Demand is operationally defined in this study as a quantitative concept representing the number of annual office-based primary care *visits* available to the population of a given area. "Demand" is therefore synonymous with *actual visits made to primary care physicians* (Chandra et al 2013:1-18). It represents the number of "visits" to primary health care physicians (that is, "actual visits demanded") made by the population as it seeks care to prevent, alleviate, treat or cure primary (basic) health problems or conditions. In this study, "demand" (or visits) is estimated (calculated) from composite indices (or indexes) which are created by using variables such as population (by age and income levels) and the types, visits and numbers of primary care physicians practicing medicine in an identified, small community area (Beaucage, 2013:1-47; Snow 2010:1-15; Vernon et al 1984:1-23).

- **District of Columbia Primary Care ("DCPC")**

This acronym is coined by this researcher and is used as a descriptive term to summarise the design, conduct and results of this study. When used in this study "DCPC" stands for "District of Columbia Primary Care". It is the summary descriptive and analytic study of primary care need and demand estimates for the District of Columbia. It describes quantitative measures of primary care "need" (scores) and "demand" (visits). DCPC thus encompasses data, estimates, and methods for conceptualising, analysing and presenting indices data by census tract and by Census Tract Groupings (CTG) for the District. The ratios, indices and indicators calculated may then be used to calculate primary care shortages as well as test the statistical significance of the six null hypotheses of the study.

- **Health care system**

Health care system is an overarching conceptual framework that shows the inter-relationships and dependencies between health problems, health services, health resources, and health status (NEHI 2010).

- **HPSA**

HPSA stands for Health Professional Shortage Area. It is defined by, and designated for US areas, by the US federal government's Bureau of Primary Health Care of the HRSA/DHHS. (ARF 2009). Designation as a HPSA or Medically Underserved Area (MUA) is based on the availability of health professional resources within a rational service area. HPSA is a type of Health Manpower Shortage Area (HMSA). They have the disadvantage of not having non-primary care facilities taken into account. Also, HPSA, unlike Census Tract Grouping (CTG) used in this study, may cross county boundary lines. Phillips (2013), for example, summarises the differences between the federal HPSA and MUA shortage area definitions and designation processes.

- **"Need"**

The dictionary definition of "need" is a "lack of something wanted or deemed necessary" (Merriam-Webster 2013). For this study, "need" is synonymous with the "Composite Need Score", a numerical index or number which is meant to be a quantitative descriptor of what a local community "numerically" lacks in access to primary care. "Need" is developed from the following two (of the study's three) objective measurement indices: (i) % population with incomes below the federal poverty level and (ii) percentage of births which are low birth-weight.

> "Need" is used interchangeably with the term "Composite Need Score (CNS)". Need (or CNS) is calculated by using the formula for the computation of Composite Need Score (CNS). See chapter 3: methods. Specifically, "need" as operationalised and used in this study refers to a numeric number. It ranges from a minimum of zero (0) to a maximum of 100. It is a calculated numerical summary indicator of health deprivation in a given small-area community. (Bradshaw 1972; Matthew 1971:27-46; Vernon et al 1984:1-25).

- **Primary Health Care**

The World Health Organisation WHO defines the ultimate goal of primary health care as better health for all in its classic work (WHO 1946). Primary health care is a general concept denoting all health services which exist at the health care “gateway” (initial entrance) level. It refers to all services at the primary level (private physicians, neighbourhood health centres, community health clinics, etc.) and some services at the secondary level (hospital out-patient department, ambulatory visits). All visits made to a neighbourhood/community health centre are classified as primary care visits except for some specialty services such as cardiology, podiatry, etc. Primary health care services are provided by or under the auspices of a primary care physician.

In the US, the National Academies Press (NAP) and the Institute of Medicine (IOM) have defined primary care, classically, as the provision of:

> *“integrated, accessible health care services* by *clinicians* who are *accountable* for addressing a large *majority of personal health care needs,* developing a *sustained partnership* with *patients,* and practicing in the *context of family and community.” (NAP IOM 1994).*

From a medical practice perspective, there are accepted standards of practice which define the domain of primary care. This includes disease screening, disease prevention and disease management (Esherick, Clark, Slater 2012; and Ross, Williams, Pavlock 1998*).*

- **Primary Care Physicians**

Two groups are operationally defined in this DCPC study – General Primary Care Physicians (GPC) and Specialist Primary Care Physicians (SPC). General Primary Care refers to all physicians who are licensed and practice in any of the following five specialties:

- GP – General Practice
- FP – Family Practice
- OB/GYN (or OBG) – Obstetrics/Gynaecology
- PED (or PD) – Paediatrics
- IM (or INT) – Internal Medicine.

- **Primary Care Physician Visits**

These are visits made to primary care physicians in the five primary care specialties (listed above) who work in any primary care setting including private practice (solo or group), physician office, neighbourhood health centre, hospital outpatient department, or HMO/Managed Care Clinic or other health centre.

- **Poverty status / poverty level / poverty thresholds**

These three terms are synonymous and are derived from the US federal government's census definitions. As used in this study, "poor" persons are defined as persons living below the *poverty threshold*. "Near poor" persons have incomes of 100 percent to less than 200 percent of poverty threshold. "Non-poor" persons have incomes of 200 percent or greater than the poverty threshold. As applied in this study, percent of persons at or below 100 percent of the US federal poverty level is used as the measure of *poverty* in a small area in the USA. These three terms are thus interchangeable. The standard definition of poverty is "the condition of having little or no money or means of support" or the condition of being poor. Synonyms include privation, neediness, destitution, indigence, pauperism (Webster: 2013). The *poverty thresholds* are the original limits defined in the federal US poverty programs. The poverty thresholds are updated each year by the federal US Census for use by US cities, counties and states. The thresholds are used mainly for statistical purposes - for instance, preparing estimates of the number of Americans in poverty each year. (DHHS: http://aspe.hhs.gov/poverty/08poverty.shtml (accessed 24 October 2014).

- **Primary Care Physicians**

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- GP – General Practice
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- PED (or PD) – Paediatrics
- IM (or INT) – Internal Medicine.

LIST OF ABBREVIATIONS USED IN THE STUDY

- CT Census Tract
- CTG Census Tract Grouping(s)
- CNS Composite Need Score
- DC District of Columbia or “The District” or Washington, DC
- DCPC District of Columbia Primary Care (acronym for this study)
- DHHS Federal US Department of Health and Human Services
- HMSA Health Manpower Shortage Area (as defined by US federal government, DHHS)
- HPSA Health Professional Shortage Area
- LBW Percent of live births which are of low birth-weight (< 2500 gm)
- MUA Medically Underserved Area
- NCHS National Centre for Health Statistics
- NHIS National Health Interview Survey

- PC Primary Care (as in PC Physicians, PC visits, etc)
- PCPS Primary Care Priority Score
- PCSA Primary Care Shortage Area
- PCSI Primary Care Service Index
- POV Poverty rate or percent of population below federal poverty level
- PPPPP "The Five P's" – major stakeholders in issues and discussions of primary care planning, organisation, delivery and financing. They are:

  (i) planners (ii) policymakers (iii) primary care practitioners/physicians (iv) other providers, and (v) the public.

- PPACA US Patient Protection and Affordable Care Act 2010
- US/USA United States; United States of America
- WHO World Health Organisation

ORGANISATION AND STRUCTURE OF THE STUDY

Chapter 1: Introduction to the Research

The chapter provides the exposition of the problem, the research objectives and research questions; as well as the validity/reliability of the study and the salient ethical considerations that had to be observed in the execution of the study.

Chapter 2: Literature Review

In this chapter, a review of the literature is undertaken to examine the nature and extent, historically and contemporaneously, of primary health care and its related issues and trends in the United States generally and in the District of Columbia specifically. The literature review also focused on classical and more recent and innovative data analysis and methodological concepts, techniques and tools available for use in this study.

Chapter 3: Research Design, Research Methodology and Data Collection Approaches

The chapter focuses mainly on the new study-specific and extant technical approaches utilised during the exploration, conduct and completion of the research. Extant (authoritative sources) data files and databases collected specifically for this research were structured and utilised to construct both an exploratory and analytical framework and process for the implementation of this study. This chapter focuses on the design and derivation of the three main indices for this study – the primary care service index, the composite need score and the priority score. Additionally, a physician data collection survey was conducted and used. The questionnaire itself, which was a primary means of data collection for the study, appears in the List of Appendices.

Chapter 4: Data Presentation and Data Analysis

The main thrust of this chapter is on the presentation, interpretation and analysis of the findings obtained from the multiple data files assembled for the study periods of 1984-1985, 1990-1992 and 2004-2005 and the questionnaire-based physician licensing survey. The analysis focused on data trends for primary care from 1985 through 2004. The study data and findings were then compared and contrasted with independently available data for 2005 through 2014 to see if the trends observed in the 1985-2004 data could be discerned in recent (2010, 2013 independent) data. The analysis provided the means for accumulating the study findings and results. The findings have been presented analytically, graphically, in tabular form, and descriptively.

Chapter 5: Conclusions and Recommendations

The chapter draws conclusions based upon the study findings and explores the implications of the analysed data for the study period as a whole. It contains the research summary, recommendations, discussion, limitations, areas of further study and the overall conclusion. The interpretation of results, conclusions, recommendations, limitations and planning implications for DC primary care are presented and discussed. It is on the basis of the study's validity, reliability and transferability that the study's contributions to the District's urban health practice and literature as well as its socio-economic and scientific worth are thus promulgated and advocated.

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CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION / RATIONALE

This introductory chapter will present the `rationale for the study, sources and background of the problem, the research problem, research questions and significance of the study. It will also outline definitions of concepts and key terms, research design, research methods, validity and reliability, and ethical considerations relevant for this research. This chapter will address the research context - why it is important in this research to study primary care in the District of Columbia (the District) for the significant period of 1985 to 2004 while linking them to findings for the period 2005 to 2013. The rationale for this study is to attempt to answer the question: for the District, can the variables - percent of residents at or below the federal poverty level, percent of births which are of low birth-weight, and types, specialties and location of District physicians - be used to generate primary care indices (PCSI, CNS, PCSI) and the quantities of primary care visits shortages which, when organised by Census Tract Groupings (CTGs), differ significantly by CTG? The CTGs, which are original contributions of this study, will be newly-created rational health service areas (as defined by US HRSA) for the District. The study variables (poverty%, low birth-weight% and physician counts by specialty) will be used to develop three new composite primary care indices which will then be used for identifying and delineating primary care shortage areas. The three indices to be developed for the District in this study, for the very first time, are as follows:

(i) primary care service index (PCSI),
(ii) composite need score (CNS) and
(iii) primary care priority score (PCPS).

The study's approach will be to use quantitative methods to address three problems facing primary care in the District of Columbia: (i) the lack of composite *urban primary care planning indices*, (ii) the absence of *rational health service areas* (Census Tract Groupings or CTG) for geographically analysing and presenting indices and other primary care data, and (iii) the non- use of primary care need and demand estimates for identifying *primary care visits shortage areas* in the District. In this study, the researcher will collect data on sentinel variables (poverty%, low birth-weight% and physician supply and location) from raw data available from valid and reliable governmental sources. The researcher will use the variables from the raw data to define and create original, new variables (PCSI, CNS, PCPS, CTG) and new databases linked to one another by CTG. The researcher will then calculate and present the indices by CTG for the District and attempt to evaluate the proposed six research hypotheses.

The original contribution of this study is that it will, for the very first time, use the variables - physician supply and location, percent below poverty and percent of low birth-weight births - to generate new, quantitative estimates of *primary care need* and *primary care demand* for the District, by Census Tract Groupings (CTG). The significance of this is that the *new* indices and the *new* CTGs will contribute to the District's primary care literature and also be immediately useful and applicable for primary care planning activities in the District. To generate indices from physician-based data, this study will use the US National Library of Medicine's (NLM) and the National Institutes of Health's (NIH) definition of primary care physicians as physicians with specialties in General Practice, Family Practice, Internal Medicine, Paediatrics and Obstetrics/Gynaecology (MedlinePlus, NLM, NIH 1997-2014). In earlier works, this definition had been adopted by researchers and planners in large, mostly non-urban geographic areas on the eastern seaboard of the United States including New York State, Vermont, Connecticut, New Hampshire and Maine (Snow 2010:1-15; Beaucage et al 2013:1-47; Vernon et al 1984:1-23).

The District of Columbia, also known as Washington, D.C., is often referred to as *the District*. In this study, primary care *need*, as originally defined in the literature, refers to the *numerical* composite need score. Primary care *demand* refers to the *numerical* quantity of primary care visits demanded (Vernon et al 1984;1-23 Snow 2010:1-15). These terms from the literature have specific quantitative meanings when applied to the health of residents of a given geographic area. Specifically, Primary care need is used as a synonym for the calculated composite indicator called Composite Need Score (CNS) while Primary care demand is used as a synonym for total potential primary care visits demanded or simply "visits demanded". To reiterate, these terms are quantitative (and singular) as used in the relevant literature and in this proposed study. An abbreviation for this study is "DCPC" and it is an original concept and acronym coined by this researcher. As used in this study, DCPC stands for "District of Columbia Primary Care".

1.2 RESEARCH PROBLEM

The research problem is as follows: for the District, can the variables poverty, birth-weight and physician location be organised by rational health service areas and used to develop composite primary care indices which can then be used for identifying and delineating primary care shortage areas? In addition to lacking generally-accepted rational health service areas (as defined by US HRSA), the District has not used the variables poverty, birth-weight, physician location and Census Tract Grouping to develop composite primary care indices which can then be used for identifying and delineating primary care shortage areas. There is a gap in the primary care literature for the District of Columbia on census-tract-based primary care indices for need, demand, physician visits and shortage areas. This gap hampers the ability of the District's planners, researchers and practitioners to plan, implement, evaluate and expand the District's supply of primary care physicians and visits.

1.2.1 SOURCE AND BACKGROUND OF THE PROBLEM

This section is focused on the source and background of the problem of primary care planning, data and systems deficiencies in the District. The District has abundant, governmental and authoritative health data files containing a large number of sentinel variables. These variables are, for several reasons, mostly not linked together geographically for generation of composite indices or for use in planning and analysis activities. Transforming physician location data and District-specific, sentinel, health status variables (such as percent of low birth-weight births) and community socio-demographic variables (such as poverty and age) into primary care indices and analysing and presenting the indices by rational service areas (CTGs) is the aim of this study.

The review of the literature which will be presented in chapter 2 of this study will show that there are certain factors that could influence primary care need and demand in the US and the District (Sun 2013:1; Watson & Soyer 2013:10-19; Beaucage, Finison, Kinner, Moody, Spaulding et al. 2013:1-47). Researchers have stated that primary and specialty care physician supply measures in the District are not appreciably different from benchmark rates in similar US cities, but that the distribution of providers in the District does not align with population needs (*Ann Fam Med* 2012: no. 6, 503-509; USDHHS NCHS Rand 2008: 96). Rising rates of admissions of District residents for ambulatory care sensitive conditions among youth and adults aged 40-64 suggest that there is worsening access to non-hospital-based care, to wit, primary care.

The Washington Post (Sun, L: 2011 & 2013) and DC Board of Medicine (2013:1-169) have reported that the District has had, in the past, high numbers of physicians but relatively poor health status, and that relatively few of these physicians are primary care physicians who, additionally, have historically been inequitably distributed within the city, especially in its poorer eastern communities. Brookings (2010), and separately, Rand (2008) report that primary and specialty care physician supply measures in the District are not appreciably different from benchmark rates in similar US cities, but that the distribution of providers in the District does not align with population needs.

Past and current data indicators show that the District's primary care system continues to be fragmented and community health outcomes continue to lag behind those of comparable US cities, especially for the under-served and mostly minority resident populations (Chandra, Blanchard, Ruder 2013: 1-18; Rand 2008:1-22; HCSD 2000: 1-13). In the District's current public health system and physician licensing infrastructure, there is a lack of linked sentinel variables – percentage of residents below poverty level, percentage of low birth-weight live births, and numbers of physicians and their geographic distribution – which may be used in systemic and annualised primary care need and demand estimations (HPLA 2012: 1). Because *linked* sentinel variables are not readily available for use in the District, this study compiled and linked certain sentinel variables and used them to develop the three composite indices in order to be able to measure the quantitative levels of *need* and *demand* for primary care in the District.

The District possesses political and legislative boundaries (such as wards, police districts, etc) within its borders but lacks geographic units of analysis that are *rational service areas* for health planning and analysis purposes. This study generated for the District, *Census Tract Groupings (CTG), each one consisting of a collection of census tracts, generally between 11 and 20, which often cluster together based on factors such as urban housing density, ethnic mix, access to primary care facilities and community identity.* These CTGs are rational health service areas and were defined and developed using factors that define rational health service areas. The CTG are used in this study to aggregate, analyse and present the primary care need, demand and shortage area data for the District. It is anticipated that the CTGs can and will be used to assist with data analysis and policy development activities for the District's health planners and leaders. Figure

1.1 below is a new and original diagram, created specifically for this study by this researcher to encapsulate the researcher's initial thinking about the subject of approach to the topic of linking variables to need and demand estimations, which shows sentinel variables which exist as stand-alone variables in government databases (Price 2008:81).

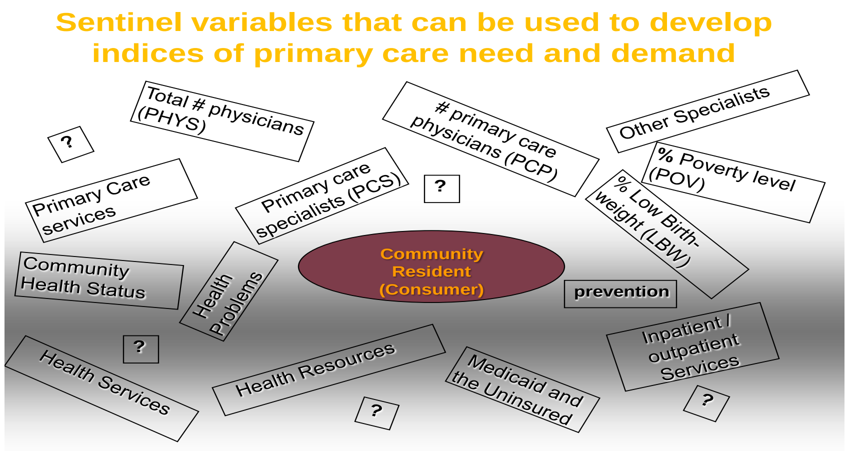

Figure 1.1: Variables for computing urban primary care "need" & "demand" indices. Source: Researcher's own derivation

Three of these variables above – poverty%, low birth-weight% and physician supply and location - will be operationalised, assembled by Census Tract Grouping, database-programmed/linked and mathematically combined to create, for the very first time, three new diagram composite indices (PCSI, CNS, PCPS) for primary care need and demand estimation for the District of Columbia.

Figure 1.2 below, is also new and original and was created for this study by this researcher. It illustrates the researcher's conceptualisation of the "What" and "How" as well as the anticipated "Outcomes" of this study. Study variables were assembled by CTG and mathematically combined into three composite indices which, subsequently, produced priority scores for identifying primary care shortage areas in the District. The processes for CTGs and index development will be described in detail in the Methods chapter (Chapter 3). CTGs were defined, created and used in this study as geographical, urban health planning tools for delineating communities that are primary care shortage areas so that planning and intervention strategies may be targeted to them. Such directed targeting may help to improve overall community health status indicators, specifically low birth-weight.

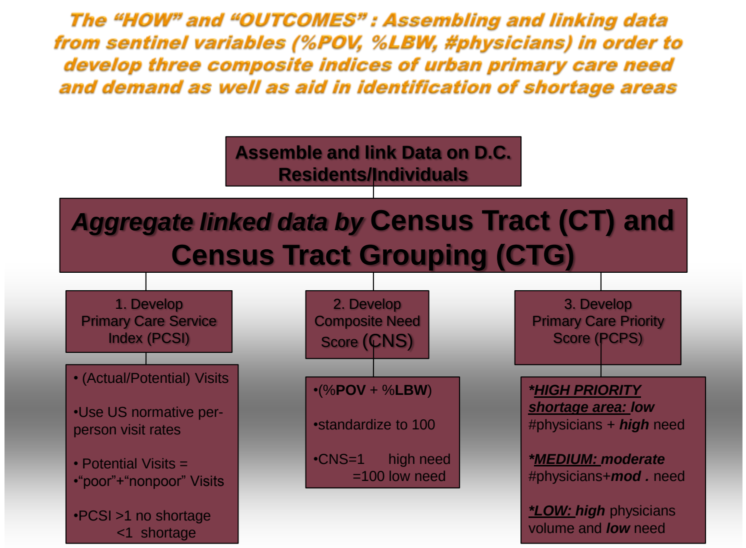

Figure 1.2: Proposed indices of primary care "need" and "demand" for the District. Source: Researcher's own derivation

1.3 STATEMENT OF THE RESEARCH PROBLEM

This section states and contextualizes the research problem which will be addressed by this study. The research problem will link the research methodologies, sampling, analysis methods, and the study's findings, conclusions.

The statement of the research problem is as follows: for the District, can the variables poverty%, low birth-weight% and physician location be organised by rational health service areas (CTG) and used to develop composite primary care indices (PCSI, CNS, PCPS) and primary care visits which can then be used for identifying and delineating primary care shortage areas?

The context for the research problem is as follows: Health and demographic data files exist and contain many sets of variables. However, these variables are mostly not linked by rational service areas. This is due, in part, to the amount of the required and the difficulty of converting and connecting some of this data (for example, physicians data) to District (and US) census tracts or rational health service areas. The city, however, has a plethora of separate, unlinked and multi-disciplinary health care databases which exist in isolation in historical as well as governmental and private, health and social services data. The District's lack of a generally accepted geographical unit of analysis or rational health service area definition for primary health care is particularly significant. This study will address this absence *of linked primary care indices and rational health service analysis areas* by developing one plausible, objective process for identifying *primary care visits shortage areas* within the city.

This research will address the deficiencies listed above by specifically answering the following question:

Can the variables poverty, birth-weight and numbers of available physicians distributed in small areas of the District (CTGs), be used to develop composite indices, rational service areas and shortage area designations which, taken and used together, can describe and quantify the need and demand for primary health care for the District's residents?

An alternative, related and extended form of the research problem is as follows:

Can primary care visits shortage areas, *defined as the numerical difference between the "need" estimates for primary care visits and the "demand" estimates for primary care visits* in a given CTG area, be calculated and presented for the District?

Can this study's new, calculated indices and new rational service area designations (CTGs) be used by planners and policy-makers to determine and describe primary care shortage areas for possible ameliorative interventions in the District, currently and for future years?

1.3.1 PURPOSE / AIM OF THE RESEARCH

The aim of this research is to contribute to the literature by developing for the District of Columbia a methodology for identifying and delineating primary care shortage areas by using the variables – poverty%, low birth-weight%, physicians location and primary care visits - to generate three new primary care indices (PCSI, CNS and PCPS) which differ by CTGs. This study will develop for the District eleven (11) new health rational service areas (CTGs). The new primary care indices and new CTGs will be used in combination in order to define and delineate primary care visits shortage areas for the District. To achieve the aims of this study, index development methods, described in detail in the Methods section of this thesis (chapter 3), will be used. The original contribution of this study is that the variables poverty%, low birth-weight%, physicians supply and location and primary care visits – will be used, for the very first time for the District of Columbia, to generate new quantitative indices (PCSI, CNS and PCPS) of primary care need and demand estimates as well as to produce eleven new CTGs for shortage area delineation.

Primary care indices exist in the literature but only for certain large, mostly non-urban US states. They are absent for the District and for many similar US cities and urban communities. The need and demand estimates for primary health in the District will be developed and presented in this study by aggregating them via the eleven new Census Tract Groupings (CTG) for three significant, historical and cross-sectional periods: 1984-1985, 1990-1992 and 2004-2005.

1.3.2 RESEARCH OBJECTIVES

The objectives of the research will be as follows:

1 To *collect and analyse sentinel physician supply variables and health status (low birth-weight%) and population demographic (poverty%) variables* which have an impact on need and demand estimates for primary care in the District

2 To *develop a new, appropriate and rational geographical unit of analysis (CTG)* for describing need and demand estimates for primary care in the District which can assist planners in more effectively designing appropriate and cost-effective interventions for reducing primary care shortage areas

3 To *develop composite indices* (PCSI, CNS and PCPS) for the District using the selected sentinel variables and aggregating them by newly-conceptualized, newly-developed, rational geographic units (CTG), which can be used to describe and delineate primary care need and demand estimates

4 To *identify and delineate primary care shortage areas* for the District (that is, areas where primary care physicians demand exceeds primary care physicians supply)

5 To present a practical, mathematical model (indices, CTG, shortage areas definition) for quantitatively analysing and describing primary care resources and shortage areas in the District.

1.4 RESEARCH QUESTIONS

The following research questions will be addressed by this study:

1 Can the study variables percent of population below poverty level, low birth-weight percent, and physician specialty and location be shown to be *critical variables* which have an impact on the determination of need and demand estimates for primary care in the District?

2 Is it possible to *develop Census Tract Groupings (CTG) for the District as new, appropriate and rational geographical units of analysis* which can be used to describe need and demand estimates for primary care in the District as well as to identify and delineate the District's primary care shortage areas?

3 Is it feasible to link heretofore unlinked, sentinel poverty, low birth-weight and physicians location variables by CTG and then use such linked variables to *calculate new PCSI, CNS and PCPS composite indices* for primary care need and demand estimates for the District?

4 Is it feasible and practical to *identify and delineate primary care shortage areas* for the District by obtaining the (numerical) differences between the calculated values of primary care visits needed and primary care visits demanded?

5 Can the index-based quantitative model for analysing primary care need and demand estimates for the District described in 1 to 4 above be described and presented in a manner which makes it amenable to effective use by the District's physicians, planners and analysts?

1.4.1 SIGNIFICANCE OF THE STUDY

First, the significance of this study is that it will provide a theoretical conceptualization and practical approach for developing multi-sourced, communally-linked, data-based indices whose utility is that they may be used for measuring the *quantitative levels of primary care need and demand for the District of Columbia*. Second, this study will define and describe *new geographic rational service areas (CTG)* for the District which can then be used by District health planners and policy-makers, for planning and analysis of health, social services and primary care resources. Third, this study is significant because it will provide a new mechanism for identifying *primary care visits shortage areas* in the District so that planning interventions could be initiated, targeted to and evaluated for areas in need by using an objective, rational, community-based and quantitative process.

The literature shows that significant changes have occurred, during the study period of 1984 to 2005, in the number of operating primary care centres and their ownership and management in the District (Rand 2008; HCSD 2000; Chandra, Blanchard, Ruder 2013). The effects of these changes on the volume, types and location of primary care patients, visits, and types needed to be studied – and this study will attempt to do that.

1.5 DEFINITION OF CONCEPTS / KEY TERMS

1.5.1 STANDARD AND OPERATIONAL DEFINITIONS

- **“Census Tract Grouping”**

This term is operationally defined and used in this study. A Census Tract Grouping (CTG) in this study is a collection of several (usually between 11 and 20) census tracts or small areas, which analytically tend to cluster together when factors such as housing density, ethnic mix, access to community health facilities and community identity are analysed. CTGs are the units of analysis to be used in this study.

- **“Demand”**

  Demand is defined in general usage as a strong request for something (Merriam-Webster 2013). In economics, the term “demand” is used to Categories the quantity of a commodity or service wanted and purchasable at a specified price and time (Ecolab 2015). Hence, “demand” is implicitly defined by the total number of individuals in the population/area. Demand is operationally defined in this study as a quantitative concept representing the number of annual office-based primary care *visits* available. “Demand” is therefore synonymous with *actual visits made to primary care physicians* (Chandra et al 2013:1-18). It represents the number of “visits” to primary health care physicians (that is, "actual visits demanded") by the population as it seeks care to prevent, alleviate, treat or cure primary (basic) health problems or conditions. In this study, "demand" (or visits) is estimated (calculated) from composite indices (variables and indicators) obtained by using variables such as population (by age and income levels), local poverty rates and numbers, types and numbers (visits per physician) of primary care physicians existing in an identified, small community area (Snow 2010:1-15; Beaucage et al 2013:1-47; Vernon et al 1984:1-23).

- **District of Columbia Primary Care ("DCPC")**

This acronym is coined by this researcher and is used as a catch-all descriptive term to summarise the design, conduct and results of this study. When used in this study "DCPC" stands for "District of Columbia Primary Care". It is the summary descriptive and analytic study of primary care need and demand for the District of Columbia. It describes quantitative measures of primary care "need" (scores) and "demand" (visits). DCPC thus encompasses data, estimates, and methods for conceptualizing, analysing and presenting indices data by census tract and by Census Tract Groupings (CTG) for the District. The ratios, indices and indicators calculated may then be used to test the statistical significance of the six null hypotheses of the proposed study.

- **Health care system**

Health care system is an overarching conceptual framework that shows the interrelationships and dependencies between health problems, health services, health resources, and health status (NEHI 2009).

- **HPSA**

HPSA stands for Health Professional Shortage Area. It is defined by, and designated for US areas, by the US federal government's Bureau of Primary Health Care of the HRSA/DHHS. (ARF 2009). Designation as a HPSA or Medically Underserved Area (MUA) is based on the availability of health professional resources within a rational service area. HPSA is a type of Health Manpower Shortage Area (HMSA). They have the disadvantage of not having non-primary care facilities taken into account. Also, HPSA, unlike Census Tract Grouping (CTG) used in this study, may cross county boundary lines. Phillips (2013), for example, summarises the differences between the federal HPSA and MUA shortage area definitions and designation processes.

- **“Need”**

The dictionary definition of “need” is a “lack of something wanted or deemed necessary” (Webster 2011). For this study, “need” is a specific ad technical term which is synonymous with the term “Composite Need Score”, a numerical index or number which is meant to be a quantitative descriptor of what a local community “numerically” lacks in access to primary care. “Need” is developed from the following two (of the study’s three) objective measurement indices: (i) % population with incomes below the federal poverty level and (ii) percentage of births which are low birth-weight.

“Need” is used interchangeably with the term “Composite Need Score (CNS)”. Need (or CNS) is calculated by using the formula for the computation of Composite Need Score (CNS). See chapter 3: methods. Specifically, “need” as operationalised and used in this study refers to a numeric number. It ranges from a minimum of zero (0) to a maximum of 100. It is a calculated numerical summary indicator of health deprivation in a given small-area community. (Bradshaw 1972, Matthew 1971:27-46, Vernon et al 1984:3-10).

- **Primary Health Care**

The World Health Organisation WHO defines the ultimate goal of primary health care as better health for all in its classic work (WHO 1946). Primary health care is a general concept denoting all health services which exist at the health care “gateway” (initial entrance) level. It refers to all services at the primary level (private physicians, neighbourhood health centres, community health clinics, etc.) and some services at the secondary level (hospital out-patient department, ambulatory visits). All visits made to a neighbourhood/community health centre are classified as primary care visits except for some specialty services such as cardiology, podiatry, etc. Primary health care services are provided by or under the auspices of a primary care physician.

In the US, the National Academies Press (NAP) and the Institute of Medicine (IOM) wave defined primary care, classically, as the provision of:

> *"integrated, accessible health care services* by *clinicians* who are *accountable* for addressing a large *majority of personal health care needs,* developing a *sustained partnership* with *patients,* and practicing in the *context of family and community." (NAP IOM 1994).*

From a medical practice perspective, there are accepted standards of practice which define the domain of primary care. This includes disease screening, disease prevention and disease management (Esherick, Clark, Slater 2012; and Ross, Williams, Pavlock 1998:xxiii-xv*).*

- **Primary Care Physicians**

Two groups are operationally defined in this DCPC study – General Primary Care Physicians (GPC) and Specialist Primary Care Physicians (SPC). General Primary Care refers to all physicians who are licensed and practice in any of the following five specialties:

- GP – General Practice
- FP – Family Practice
- OB/GYN (or OBG) – Obstetrics/Gynaecology
- PED (or PD) – Paediatrics
- IM (or INT) – Internal Medicine.

- **Primary Care Physician Visits**

These are visits made to primary care physicians in the five primary care specialties (listed above) who work in any primary care setting including private practice (solo or group), physician office, neighbourhood health centre, hospital outpatient department, or HMO/Managed Care Clinic or other health centre.

- **Poverty status / poverty level / poverty thresholds**

These three terms are synonymous and are derived from the US federal government's census definitions. As used in this study, "poor" persons are defined as persons living below the *poverty threshold*. "Near poor" persons have incomes of 100 percent to less than 200 percent of poverty threshold. "Non-poor" persons have incomes of 200 percent or greater than the poverty threshold. As applied in this study, percent of persons at or below 100 percent of the US federal poverty level is used as the measure of *poverty* in a small area in the USA. These three terms are thus interchangeable. The standard definition of poverty is "the condition of having little or no money or means of support" or the condition of being poor. Synonyms include privation, neediness, destitution, indigence, pauperism (Webster: 2011). The *poverty thresholds* are the original limits defined in the federal US poverty programs. The poverty thresholds are updated each year by the federal US Census for use by US cities, counties and states. The thresholds are used mainly for statistical purposes - for instance, preparing estimates of the number of Americans in poverty each year. (DHHS: http://aspe.hhs.gov/poverty/08poverty.shtml (accessed 24 January 2015).

- **Primary Care Physicians**

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GPC General Primary Care refers to all physicians of the following five specialties

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- FP – Family Practice
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- PED (or PD) – Paediatrics
- IM (or INT) – Internal Medicine.

1.5.2 Abbreviations used in this study

- CT Census Tract
- CTG Census Tract Grouping(s)
- CNS Composite Need Score
- DC District of Columbia
- DCPC District of Columbia Primary Care
- DHHS Federal US Department of Health and Human Services
- HMSA Health Manpower Shortage Area (as defined by US federal government, DHHS)
- HPSA Health Professional Shortage Area
- LBW Percent of live births which are low birth-weight (< 2500 gm)
- MUA Medically Underserved Area
- NCHS National Centre for Health Statistics
- NHIS National Health Interview Survey

- PC Primary Care (as in PC Physicians, PC visits, etc)
- PCPS Primary Care Priority Score
- PCSA Primary Care Shortage Area
- POV Poverty rates; percent of population below federal poverty level
- PPPPP "The Five P's" – major stakeholders in issues and discussions of primary care planning, organisation, delivery and financing. They are:

  (i) planners (ii) policymakers (iii) primary care practitioners/physicians (iv) other providers, and (v) the public.

- PPACA Patient Protection and Affordable Care Act

1.6 FOUNDATIONS OF THE STUDY

1.6.1 Theoretical assumptions

Assumptions were made in this study about the primacy of the economics argument as a major driver for an area's physician distribution pattern. An urban area with few physicians is assumed to have an unmet (or unsatisfied) capacity for primary care physician "visits" relative to an area with plentiful physicians. This is especially true if the low-physician-count area also experiences severe socio-economic challenges including high poverty levels (Zerehi 2009: 1-3). The study relied on the social-inequities-cum-imperfect-market theoretical framework which states that poverty is a factor in diminished health outcomes (Singer, & Ryff 2001:100-224). The "health inequality fosters decreased outcomes" assumption is largely based on the work of researchers whose work have established veritable links between poverty and diminished poor health status for certain disenfranchised population segments. See Hart (2010:1-336) and Niewczyck & Lwebuga-Mukasa (2008:22-40).

Certain assumptions will be made in this study. They are listed here as points of departure for further argumentation. They include the following

- It is assumed that there is a relationship between the availability of health professionals and the health status of a specific community
- It is assumed that certain economic supply and demand factors are the impetus behind the primary care crisis and that they impact patients' ability to access needed primary care services. Support for this is provided in the work "The Primary Care Crisis and Health Care Reform" (Sherman, Moscou & Dang-Vu 2009: 944-950).
- It is assumed that in an environment free of access barriers, a population's need for care is expressed as demand for services which, when met by adequate supply, translates into appropriate care utilization (Snow 2010:1-15).

This study will also assume that community-oriented primary care (COPC) can improve the health of the population. As a concept, COPC was developed in the 1940s in a rural area of South Africa by family physicians Sidney Kark and Emily Kark (Gofin & Gofin 2005:757). Using the COPC model, other researchers have studied the relationship between lower travel time and proximity to physicians and how they enhance a community's access to health care (Fry, Light, Rodnick & Orton 1995:757).

1.6.1.2 Theoretical framework - Description of this study's "Iterative PRP-PPE Model"

The conceptual framework, the “Iterative PRP-PPE Model”, which this researcher followed in conducting this study, is an original framework. It postulates that in small-area health planning considerations, positive policy mechanisms (PPM) serve as pathways to positive policy effects (PPE) via primary care resource allocations. In this conceptual model, the six study hypotheses are possible research postulates (PRP) and may be related to health conditions and outcomes. This model posits linkages among Policy-Making Processes (PMP), Policy-Making Rules (PMR) and Policy Effects (PE). The mechanisms (inputs, rules and processes) may be reiterated until the desired product or “demand” is sufficient to deal with the community’s “need”. The paths from hypothesis (PRP) to outcome (PPE) are shown in Figure 1.2.1, an original derivation by this researcher.

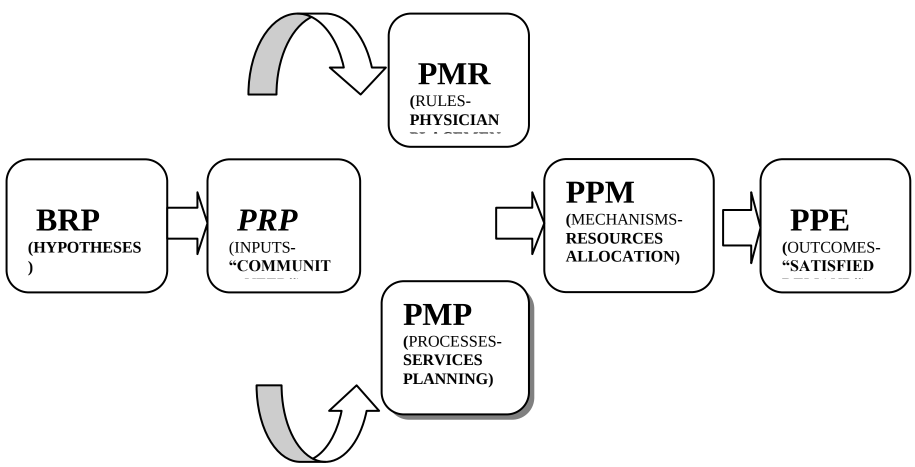

Figure 1.2.1: Iterative PRP-PPE Model. Source: Researcher’s own derivation

1.6.2 Theoretical framework – Why the study variables were chosen

The variables selected for analysis in this study are poverty%, low birth-weight%, physicians supply and location, and Census Tract Groupings (CTG). These variables as used in this study have a direct link to the aims of the study, the research methodologies, sampling and analysis methods (chapter 3) which will ultimately culminate in the findings (chapter 4) and conclusions (chapter 5). The rationale for selecting and using these specific variables in this study is grounded in generally accepted and grounded theories in public health and primary care. These assumptions and theories are elucidated in the literature review section (chapter 2) and are summarised here, as follows:

● there are proven interrelationships and dependencies between health problems (low birth-weight, poverty, preventable community health diseases) and health services, health resources, and health status (NEHI 2010);

● the social-inequities-cum-imperfect-market theoretical framework states that poverty is a factor in diminished health outcomes (Singer, & Ryff 2001:100-224);

●. The theory underlying the "health inequality fosters decreased outcomes" assumption is largely based on the work of researchers whose work have established veritable links between poverty and diminished poor health status for certain disenfranchised population segments. See Morgan (2011) and Niewczyck & Lwebuga-Mukasa (2008:22-40).

The original contribution of this study is that it will, for the very first time, use physician supply and location data, poverty data and low birth-weight data to generate quantitative estimates of *primary care need* and *primary care demand* for the District, by Census Tract Groupings (CTG).

1.7 RESEARCH DESIGN

The research design is a cross-sectional and epidemiological study of three periods which span the years from 1985 to 2004, twenty years of the District's history. The study will link the variables poverty%, low birth-weight% and physicians supply and location to newly-developed CTGs across newly-developed, linked but separate health, population and physicians location files. New databases will be developed using CTGs and the three variables. The new databases will be linked by the new CTGs for the following three periods: 1984-1985, 1990-1992 and 2004-2005. The study will develop primary care need and demand indices and will aggregate them by the new rational service areas (CTGs).

Validity and reliability are important considerations in this study. An integrated data collection and analysis approach will be used to enhance the validity and reliability of the findings quantitatively. Aspects of the study such as its logical flows and contextualization will enhance the researcher's description and interpretation of the methods and processes of data collection. To increase the study's validity and ensure greater reliability of its findings, multiple data collection methods - primary and secondary data collection activities – will be undertaken. Primary data collection, specifically, a survey of active physicians practising in the District to ascertain their specialties and locations, which are two of the study's important variables, will be undertaken. This primary survey data will help to validate the secondary data on physicians which will be collected from the District's private and authoritative governmental health professionals data sources.

Types of data to be used in this study include interval and categorical/nominal data. Motulsky (1995:37).describes these various data types. Variables to be used in this study are as follows: for dependent variable - primary care visits and primary care visits shortages (i.e. primary care visits gaps); for independent variables: interval data including CNS, PCSI and PCPS; for ordinal ordinal/categorical variables – Census tract Groupings (CTG). Univariate and multivariate data analysis will be performed on the dependent and independent variables.

Two Microsoft Windows-based personal computer software packages – IBM SPSS version 20 and Microsoft Excel 2010 – will be used in all phases of the data management and data analysis**.** The unit of analysis in this study will be the eleven (11) Census Tract Groupings obtained by aggregating small DC census tracts into larger CTGs. This aggregation of census tracts will be done separately for the District of Columbia for the years 1985 (using US 1980 census), for 1992 (using US 1990 census) and for 2005 (using US 2000 census). The results for the 1985 to 2005 data analysis will be compared to the survey results from the DC Board of Medicine for 2010-2013.

1.7.1 Hypotheses/Null Hypotheses

A hypothesis is an educated prediction that provides an explanation for an observed event (Veney, Kros, Rosenthal 2009:18). One hypothesis and six null hypotheses will be formulated for this study. The six null hypotheses (#H_{01} = 0 through #H_{06} = 0) will guide the design, implementation and conduct of the study. The research will determine whether there is statistical significance, at the 95 percent confidence level, to reject (or fail to accept) the null hypotheses.

The hypothesis for this study is as follows:

If the variables poverty, low birth-weight and physician location are linked by the new Census Tract Grouping (CTG), primary care indices can be calculated which in turn can be used to define and delineate primary care shortage areas for the District.

A null hypothesis is a hypothesis that there is no relationship or difference between two or more variables. In the hypothesis-testing approach a researcher attempts to demonstrate “the falsity of the null hypothesis, leaving one with the implication that the alternative, mutually exclusive, hypothesis is the acceptable one." (Reber 1985: 337)

The six null hypotheses for this study are as follows:

H_{01}: The distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia.

H_{02}: The primary care service index (PCSI) which is calculated from *study variables active physicians, poverty%* and is the ratio of primary care visits demanded by the population to the primary care visits satisfied, does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{03}: The unsatisfied visits (or "visits gap") in primary care, which is calculated *from study variables PCSI and CNS,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{04}: The quantitative measure of "need" for primary care - "composite need score (CNS)" - which is calculated the from *study variable low birth-weight%,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{05}: The primary care priority scores (PCPS) – which is calculated from *study variables PCSI and CNS* - when cross-tabulated by census tract or Census Tract Grouping, do not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care "visits gap" by census tract or Census Tract Grouping in the District of Columbia.

1.7.2.1 Original, newly-created study variables for the District

For this study of the District of Columbia, this researcher will create new databases containing actual, practicing physicians location and specialty aggregated by census tract, by Census Tract Grouping (CTG) and by practice category (general primary care (GPC), specialist primary care (SPC) or non-primary care (Non-PC). These databases have never existed before in the District. This is a significant and original contribution by this researcher to the literature and practice of primary care for the District of Columbia. This data will be created for this study for 1985, 1992 and 2004 and will serve as a template for creation of similar databases in future years by other researchers for the District.

1.7.2.2 Variables and data sources for calculating primary care indices

The variables poverty, low birth-weight and physician location variables will be used in addition to the variable Census Tract Grouping (CTG) to evaluate the hypotheses and achieve the study objectives. For the physicians' location variable, it must be noted that there is a difference between the numbers of licensed physicians and the numbers of active (practising) physicians in a specific area. In most epidemiological analysis, using the numbers of licensed physicians is not useful since licensed physicians reside inside and outside the boundaries of a given area and may be inactive/retired or not actively practising medicine. Also, published or electronic licensed physicians data for the District for 1985 to the present time only contain physicians' physical addresses (residential, office or lab) and do not have census tracts or Census Tract Grouping information. This study will create new databases of active physicians (GPC, SPC and non-PC) categorised by CTG thus making a significant contribution to the District's primary care literature and practice.

Physician availability (supply/location) variable i.e. # licensed physicians, # general primary care physicians and # specialist primary care physicians will be used to calculate composite indices for potential primary care physician visits (potential demand) and actual primary care physician visits (satisfied demand). This will be done by utilizing actual (i.e. existing) physician counts by CTG. The ratio of these two values (satisfied demand divided by potential demand) is the primary care service index (PCSI), which will be analysed in the second null hypothesis (#H_{02}).

To analyse the six null hypotheses (#H_{04}),, t*wo demographic and health/social services sentinel variables*, poverty rates and percentage low birth-weight births, will be used to calculate a composite index for the primary care need estimate, i.e. composite need score (CNS).

To analyse one of the null hypotheses (#H_{06}), in the analysis portion of the study (described in chapter 3 and presented in chapter 4) the researcher will cross-tabulate PCSI and CNS values to create three categories (values) for the primary care priority scores (PCPS) – low, moderate and high priority.

To analyse another one of the null hypotheses, the numerical difference between "potential demand" and "satisfied demand" will produce an estimates of primary care visits shortage (volume) for a given CTG.

1.8.1 Population and sample selection

The population *universe* for this study will be the total population of residents in the District of Columbia aggregated into the eleven Census Tract Groupings for each of the three study periods. The *study sample* is number of active primary care physicians – total primary care physicians consisting of general primary care physicians and specialist primary care physicians - who are licensed to practice medicine in the District of Columbia AND are active and actually do practice within the boundaries of the District of Columbia.

There will be no selection bias because ***all*** active, licensed physicians and ***all*** community resident populations in the District during the three cross-sectional study periods (1984-1985, 1990-1994 and 2004-2005), will be included in the study. Also, population data from the US census (age, income, poverty) for all residents in each of the 11 CTG areas will bed aggregated and used.

1.8.2 Data collection/data sources

The researcher will collect data from the following data sources: District of Columbia Department of Health State Centre for Health Statistics (DCDOH-SCHS), District of Columbia Department of Health's Health Professional Licensing Administration, the District Government's Office of Planning (DCOP) and the private-sector Washington Physicians Directory, Inc. The researcher will collect raw and unlinked variables from these data sources, as follows:

- licensed physicians data files (variable: PhysicianLocation) from the DOH-HPLA whose data files contains only physical location addresses but have no other geographic or census tract or CTG information;

- health status data files (variable: low birth-weight or lbw%) by census tracts from the DCDOH;

- population at or below poverty levels (variable: %poverty) by census tracts from the DCOP;

Physician data to be collected from the DOH-HPLA do not possess census tract or CTG information. Low birth-weight% and poverty% data to be collected from the DOH-SCHS and the DCOP have census tract information but no Census Tract Grouping (CTG) information or CTG information. Importantly, none of the data collected from any of these private or governmental data sources are linked to other variables across different domains.

The researcher will create the first-ever database of active, practising primary care physicians location data by census tract and CTG. The researcher will then compile the raw data variables from the DOH-HPLA, the DOH-SCHS and the DCOP, for the study periods 1984-1985, 1990-1992 and 2004-2005, so as to strategically link them across the different domains by census tract and by CTG. Researchers, planners, providers and policy-makers from the general public as well as these three authoritative, government sources (Departments/offices) of the District of Columbia Government - the SCHS, the HPLA and the DCOP – will potentially benefit greatly from the database creation work to be done by this researcher in this study.

1.8.3(i) Data analysis

In the data analysis phase of the study, the three primary care indices (PCSI, CNS and PCPS) and the primary care visits demanded, visits satisfied and visits shortages (or gaps) - which will all be created by mathematically combining the study variables: physician availability, percent below poverty and percent of low birth-weight births - will be aggregated, presented and analysed by the eleven new Census Tract Groupings (CTG). Univariate (descriptive) and multivariate (model estimation) approaches will be used. The six null hypotheses (#H_{01} to #H_{06}) listed above in section 1.7.1 of this study will be evaluated for rejection or non-rejection.

For univariate statistics, descriptive procedures (frequencies, cross-tabulations) will be used. For multivariate statistics, inferential procedures (ANOVA, linear and logistic regression) will be used. Parametric and non-parametric tests for samples and their associated statistics (means, median, modes, measures of central tendencies, range, and minimum and maximum values, Fisher's Test, Chi-Square and F-Test) and inferences at the 95% significance level, will be used in the analysis of the physician location and specialty data and the census-tract-based poverty and low birth-weight data. The six null hypotheses for this study will be tested separately. Differences between group (i.e. CTG) means will be calculated. Two multiple linear regression and log-linear regression models will be developed and tested and their associated tests of statistical significance will be presented. Overall, the data analysis will generate descriptive profiles for the District by CTG using the study variables %poverty, %low birth-weight, PCSI, CNS and PCPS, visits satisfied and visits demanded, primary care shortage areas and priorities for the District for the study period, 1985 to 2004.

1.8.3(ii) Census Tract Groupings (CTG)

The District is divided into eight Wards. These Wards are political and legislative boundaries. Because they are *not* rational health service areas for health planning purposes, Wards will not be used in this study. Census Tract Groupings (CTG) will be the unit of analysis used in this study. The eleven CTGs, each one being an aggregation of between 11 to 20 census tracts, will be defined, developed and used as the District's rational health service areas. The criteria for inclusion in a CTG – ethnic composition, community identity, housing density and access to health centres - serve as close approximations to the definition, provided by the federal DHHS-HRSA, of what constitute rational health service areas. The CTGs will be described in detail in the methods chapter of this study (chapter 3).

1.9 VALIDITY AND RELIABILITY

Issues of validity and reliability are of major importance to this study. This is because the issues of validity and reliability will be critical in arguing in favor of the rigor and credibility of this study. Validity and reliability maximisation will guide the assumptions to be made in this study in terms of adopting research paradigms, theories, measurement scales, indices and methodologies (Fos 2011: 16-17). The validity of the study will be determined by the extent to which it accurately achieves what it had originally intended to achieve – which is, to use physician location data, poverty data and low birth-weight data to generate quantitative estimates of *primary care need* and *primary care demand* for the District, by Census Tract Groupings (CTG).

This study will be valid because the variables to be selected for computing the three indices will be variables culled from authorised, government data sources which have been certified as measuring exactly what they are intended to measure. For example, poverty data will be guaranteed to represent persons living below the federal income poverty levels and low birth-weight births will be certified as mothers having live-births with birth-weight of 2500 grams or less. Also data collected on physicians will be valid because every physician data record to be maintained in the study database for each of the study years will represent a verified physician who has been properly and legitimately licensed to practice medicine by the Government of the District of Columbia, and actually practiced medicine within the District's of Columbia

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The data collection methods as well as the credibility of the data sources themselves, will have a big impact on the study's validity. Additionally, with careful attention to maximizing the study's validity and reliability, data collection for this study will follow the triangulation model. For cross-checking and maximum accuracy, study data will be collected from a primary data survey of District physicians, from governmental secondary data sources and from the trusted long-term private publications of Washington Physicians Directories, Inc.

Indices and indicators will be developed and used in this study. Reliability refers to whether or not one can trust the answers that respondents provide in a data collection activity or survey (Veney et al 2009; Fos 2011; Provost & Murray 2011). In this study, physicians' primary survey data responses will be compared and checked against the authoritative secondary data files of licensed physicians maintained by the District's Health Professional Licensing Administration (DOH-HPLA).

1.10 ETHICAL CONSIDERATIONS

This study created and used aggregate statistical indices and did not use any data with personal identifiers. Confidentiality was thus ensured for individuals, organisations and offices. For this proposed study, the researcher certified, via the grid below, that the four basic ethical principles of autonomy, justice, benevolence and non-maleficence were rigorously adhered to (as indicated by “X” in the chart below) with regards to the four study components - participants, institutions, researcher and ethics.

	Autonomy	Justice	Beneficence	Non-maleficence
Participants (1992 physicians survey)	X	X	X	X
Institutions (1985 to 2004: institutional and governmental data sources)	X	X	X	X
Researcher	X	X	X	X
Ethics pertinent to primary care data analysis	X	X	X	X

(X – satisfied/certified in the study)

Researcher’s own derivation

The ethical considerations undertaken in this study to maximise research integrity were assured as follows:

- protecting the rights of the participants: satisfied. *Reason:* poverty, low birth-weight and other aggregate socioeconomic and health census-based data used in this study were collected, completed and organised from official, publicly available datasets and are not subject to the collection and signing of individual consent forms.

- protecting the status of the institution: satisfied. *Reason:* the Health Professional Licensing Administration of the District’s Department of Health is authorised by statute to collect licensing and practice data from all physicians desiring to practice in the District. This data was aggregated in this study and no names or identifiers were used. Therefore the rights of hospitals, health centres and individual physicians are fully protected and will never be divulged in this study.

- scientific (researcher) integrity: satisfied. Reason: this study is the researcher's original work for an urban area in the US based on the modification and enhancement of existing health planning methodologies used for and by large US states such as New York, Connecticut, Maine and Arizona (Snow 2010:1-15; Vernon 1984:1-23). All sources referred to or used in this study were appropriately cited and credited. This study was conducted with the highest ethical standards for integrity, accuracy and scholarship.

1.11 SCOPE AND LIMITATIONS OF THE STUDY

Acknowledging the limitations of a study while providing information to interested persons and parties about the need to interpret and use the study findings with caution will add immensely to the credibility of the study. Two limitations are identified here for this study. Because the data to be collected and analysed is historical data, the study will therefore not be a reflection of current realities and situations. Although the researcher will collect and organise raw data variables from valid and reliable governmental sources and use them to create study indices and other measures, it will still be a study of past conditions and outcomes. This limitation of the study - a historical study of physician practices, resource configurations and population demographic and health conditions from 1985 to 2004 – is by design. It may be seen as a limitation only in the sense that current situations will not be profiled.

A second limitation of the data – which is actually by design - is that it will involved only a few selected variables – that is, population, %poverty, age, income, total births and low birth-weight births, and numbers and distribution of practising physicians for the District. This limitation will be necessary because only these few sentinel variables are needed in order to focus attention on achieving the study's objectives. The three aggregated primary care need and demand composite indices (PCSI, CNS and PCPS) will thus be created from historical, not current, data. This data limitation is necessary for simplicity and gives a narrow and specific focus to the research design.

1.13 CHAPTER SUMMARY/CONCLUSION

In this chapter, the research problem was identified, described and explained. The research problem was linked to the aims of the research, the research design, research methods, issues of validity and reliability, and ethical considerations relevant for this research. This chapter also addressed why it is important in this research to study primary care in the District of Columbia for the significant study period of 1985 to 2004.

This researcher hopes that the findings of this study will blaze new trails as well as provide some support for prior research which documented the existence of statistically significant relationships between health care indices and physician accessibility and availability. New methods which are being proposed in this study, such as analysis and presentation of primary care data by the new Census Tract Groupings (CTG), may prove beneficial to primary care's major stakeholders - planners, policymakers, practitioners/physicians, providers, and the public.

CHAPTER 2
REVIEW OF THE LITERATURE

2.1 INTRODUCTION

The literature review for this study focused on three areas essential to this study:

(i) literature that provide the conceptual and theoretical framework for studying need and demand indices and indicators as well as issues of poverty and low birth-weight and the roles they play in the planning and delivery of primary health care;

(ii) literature on the analytic methods used in this study and analytic tools available for use in primary care data analysis for urban and non-urban geographic areas or population sub-groups; and

(iii) literature on primary care in the District for the study periods of 1985 to 2004 and for comparison, literature on the District for the period 2005 to 2014.

The current and classical literature on quantitative methods for studying primary care was reviewed (Veney, Kros, Rosenthal 2009; Fos 2011; Provost, Murray 2011; & White, Fuchsberg, Haase, Wilson & Gleeson, NCHS 1968.). Important and topical primary care issues, both classical and contemporary, were reviewed (ACoS 2009; Staiger, Auerbach, Buerhaus 2010; Petterson, Liaw, Phillips, Rabin, Meyers & Bazemore 2012; & Roberts 1998). The paradoxical issue of abundant US physician supply in a defined area not necessarily leading to improved health outcomes (Starfield, Macinko 2005) is also investigated in this literature review. The literature review shows that some US states have worked on need-and-demand models for large geographic areas which, unlike this study, are not cities and are not predominantly urbanized. Examples of earlier models and processes studied in this literature review include models used for the mostly non-urban geographic areas (states) on the eastern seaboard of the United States such as New York State, Vermont, Connecticut, New Hampshire and Maine (Snow 2010:1-15; Beaucage et al 2013:1-47; Vernon et al 1984:1-23).

2.1.1 Introduction to literature review specific to the study period 1985-2004

Because this study covered the District of Columbia during the period 1984 to 2005, literature review was conducted on relevant literature of that twenty-year period. This review was then extended to include primary care literature and works covering years 2005 to 2014 in order to obtain more current information pertaining to primary care in general and primary care need and demand methodologies (for urban areas) in particular. For this study's literature review, national (and occasionally, international), regional (US states) and local (District) literature sources were compiled and reviewed for the period covered by this study (1985 to 2004) as well as for the ten-year post-study period (2005 to 2014).

According to CETL-AURS (2012:1), there are several reasons for conducting a literature review in a study. This study's literature review activity attempted to address the following:

1. To develop an explanation for the observed variations in behavior or characteristics or systems.
2. To find any potential correlation between concepts and to identify a possible hypothesis to research.
3. To understand how others measure and define concepts.
4. To find other data sources.
5. To develop alternative research designs.
6. To find out how the research project might relate to other works

2.1.2 Literature review specific to the study period of 1985 to 2004

The following sections of this chapter will present and discuss literature review conducted on published material specific to the study period of 1985 to 2004.

The terms “primary care need” and “primary care demand” are terms which are used in the public health planning and analysis literature and they have very specific meanings. In the literature as well as in this study, these two terms are used in the singular, not plural, sense as in “primary care need” and “primary care demand”. These terms were used, for example, by the New York State Department of Health/New York State Health Planning Commission’s seminal study entitled “NYS Primary Care Analysis Areas” (Vernon et al 1984:1-25). In addition to New York state, other US states including Connecticut, Arizona and Maine have produced similar primary care health planning documents (for mostly non-urban, larger geographical areas, unlike the urban focus of this study). These states used similar primary care “need” and “demand” terminology and lexicon (Bradshaw 1972, Matthew 1971:27-46; Vernon et al 1984:1-25).

A central theoretical tenet that is explored in the literature review for this study is why there is a necessity for primary care to be analysed, planned and configured. For example, the following question is addressed: “Why should primary care planners, practitioners and policymakers not leave the issue of the distribution of primary care physicians to the normal economic forces of supply and demand?” This review also explores why it is necessary to adopt and apply quantitative planning methods to assure that the number of primary care physicians and volume of visits are equitably distributed in an urban area especially one with significant pockets of medically indigent persons. Because primary care is deemed to be essential to the health, wellness and well-being of a community, shortages in primary care practitioners which lead to shortages in primary care visits can become very acute societal problems (Sargen, Hooker & Cooper 2011:991-9).

This District of Columbia primary care study, DCPC, is about primary care, primary care physicians and primary care visits in a local urban area. In the US, the National Library of Medicine (NLM) and the National Institutes of Health (NIH) define primary care physicians as physicians with specialties in General Practice, Family Practice, Internal Medicine, Paediatrics and Obstetrics/Gynaecology (MedlinePlus, NLM, NIH 1997-2014:1). From this basic definition, primary care visits, primary care analysis areas and primary care visits shortage areas are defined.

Practically, primary care *visits* shortages are expected to occur in local areas with primary care physician *manpower* shortages. In this DCPC study, primary care visits shortages are defined as potential primary care demand (that is, visits exceeding satisfied or actual primary care visits). According to the literature, primary care shortages may exist in local, regional and national areas. The Association of American Medical Colleges conducted a study entitled: "Recent Studies and Reports on Physician Shortages in the US" (AAMC 2012:1-22). This report found that since 2002 about 33 out of the 50 states in the US states have assessed their current or future physician workforce needs and in general, uncovered a situation where the under-served and elderly populations are the populations most likely to be affected by the shortages The study found that many of the state reports have found shortages in areas of primary care as well as in medical specialties including allergy and immunology, cardiology, child psychiatry, dermatology, endocrinology, neurosurgery, and psychiatry (AAMC 2012:1-22).

This situation is also true, in part, because increasingly more demographic shift data such as the one described in "Medicare beneficiaries, by race, Hispanic origin, and selected characteristics: United States, 1992-2009" show that the

US's elderly population and elderly medical/health care seekers, many of whom are in dire need and are not receiving easily accessible primary health care, are experiencing rapid growths in all areas of the US and across all racial/ethnic and income groups (Freid, Prager, MacKay & Xia 2003: 329-331).

This DCPC study presents a quantitative method for analysing primary care data It employs the terms "need" and "demand" for primary care more from a community-based, public health understanding than from a classical and theoretical economics sense. The basic theoretical construct and assumption used in this study is that population conditions (poverty and low birth-weight levels) create a certain level of need for primary care visits in a community – and presents one approach for determining the level of primary care need and demand. A significant portion of this primary care visits demand (potential demand) must be satisfied, or provided, or must exist in the community if the wellbeing and health status of the population is to be maintained. This is the "need-based" concept (Snow 2010:1-15; Beaucage et al 2013:1-47; Vernon et al 1984:1-25).

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The extent and available supply of primary care physicians (and hence primary care physician visits) describe the ***demanded*** or existing or available "demand" or satisfied primary care physician visits. It is not the same as the volume of primary care visits (potential visits or demand) ***needed*** by the population as per their demographic, economic and health status characteristics. One null hypothesis tested in this study and stated in chapter 1 (Hypothesis #H_{02}) is that for the District of Columbia or a given urban population, there is no significant difference, on a small area basis, between the population-based primary care physician "visits needed" and the primary care physician "visits demanded."

2.1.3 Background: Number of Physicians Per Capita in the U.S.

Primary care physician shortages and uneven distribution of resources and policy implementation challenges continue to exist even as health care reform efforts have moved forward in the US (Sherman 2009:944-950). In March 2010, the US Congress passed and President Barack Obama signed into law the history-making health care reform legislation entitled “Patient Protection and Affordable Care Act (PPACA)”. The PPACA “*put in place comprehensive health insurance reforms that will hold insurance companies more accountable, lower health care costs, guarantee more health care choices, and enhance the quality of health care for all Americans”* (DHHS 2010). Some supporters and critics contend that this reform effort may also usher in more uncertainty and a more stressed primary care system. This is because it is estimated that the PPACA will increase the numbers of uninsured and underinsured individuals eligible for Medicaid, from 100% of the federal poverty level to 133% of the poverty level. This may increase the numbers on the Medicaid rolls even though there may be fewer physicians available or willing to accept lower and inadequate payment to care for them (Marcy 2011:1). Such a crisis will affect the District and make the health and primary health care debate and divide even more acute.

The issue of geographic maldistribution of primary care physicians in the US is well-documented in the literature. In a study of this vexing phenomenon, Shipman (2011) states that the inequitable distribution of the US physician workforce is a long-standing problem, has received less attention and is especially the case, unfortunately, for children. The Shipman (2011) study laments that despite enhanced and continued growth of the primary care workforce for America’s children and adults, it is exasperating to researchers and policymakers to acknowledge the that millions of children continue to reside in areas in the US that are faced with insufficient local and accessible supplies of primary care physicians. The study therefore concludes that additional policies which target adequate geographic access to primary care are needed.

Research on the availability of U.S. physicians by small area, such as this study, is needed. Although on an aggregate (nationwide, statewide and even

Countywide) basis physicians may be in abundant supply, certain communities and small areas in urban America often have shortages of primary care physicians. Such inequitable physician distributions may exacerbate health status disparities and frustrate population-based remediation efforts. Also, abundant physician supply does not necessarily lead to improved health outcomes. For example, Starfield, Shi, and Macinko (2005) state that a greater number of primary care physicians does not necessarily mean that all people in the area have greater access to or receipt of primary care services. They then state that analyses considering people's relationships to or experiences with a primary care practitioner may be helpful to determine the association between primary care and health outcome (Starfield, Macinko 2005).

Primary care is significant in a discussion of the overall health care system. Available, accessible, affordable and high quality primary care is generally believed to be associated with better physical and mental health. According to the literature, the core foundations of primary care medicine - preventive care, care coordination for the chronically ill, and continuity of care - can lead to improved outcomes and reduction of costs. (Russell 2011:1; and O'Grady, Manning, Newhouse & Bork 1985:484-90).

For much of the period studied by this DCPC research, much of the US appeared to have enjoyed increases in total physician supply, as did the District of Columbia (DCBOM, 2010). Between 1991 and 2001, all US statewide non-metropolitan areas and 301 out of the 318 metropolitan areas gained physicians per 100,000 people. During the 1991 to 2001 period the average number of physicians per 100,000 people increased from 214 to 239 and the mix of generalists and specialists in the national physician workforce remained about one-third generalists and two-thirds specialists. The American Medical Association (AMA) also calculates physician-to-population ratios and found that this ratio increased by 98% from 1970 to 2010 (Heisler 2013:3).

Of the 17 US metropolitan areas that experienced declines in the number of physicians per 100,000 people, only 2 had fewer total physicians in 2001 than 1991. GAO researchers issued a report on the U.S. Physician Workforce to the Chairman of the Committee on Health, Education, Labor, and Pensions of the US Senate. The GAO study noted that through a variety of programs such as the Association of Clinicians For the Underserved (ACU) and the National Center for Primary Care (NCPC), the federal government supported the training of physicians and encouraged physicians to work in underserved areas or pursue primary care specialties (ACU 2011). GAO was asked to provide information on the physician supply and the generalist and specialist mix of that supply in the United States and the changes in and geographic distribution of physician supply in metropolitan and non-metropolitan areas. To address these objectives, GAO analysed data on physician supply and geographic distribution (Heisler 2013:1-24).

2.2 THEORETICAL FRAMEWORK

In the literature, certain noted health economists (Mwachofi & Al-Assar 2011:328-337; Roberts 1998:186-189) have variously stated that medicine ad primary care, as are most health care services and activities, exist in an imperfect economic market. To fully explore the economic concepts of need and demand for primary care, the theory underlying primary care and its relationship to classical economic theory was reviewed. In the area of theory, this study relied on John Robert’s theoretical framework for understanding and applying the terms need, demand in the context of the market for primary care. Roberts, a British health care economist and physician, published his theories in a series on Primary Care Core Values in the British Medical Journal. Roberts’ analysis of primary care in an imperfect market provides support for the use of the need-demand concept in this study. It provides a rationale for the application of analysis and planning methods as targeted interventions in order to ensure that physician distribution, access to primary care, and other aspects of health services are equitably distributed in a community or defined geographic area. Roberts states that the word "market" is not applicable to the work of physicians since in classical economics theory, a market is an encounter controlled by supply and demand. Importantly, the medical marketplace does not follow the classic rules of supply and demand since physicians are able to set the demand of the care they provide. Physicians artificially increase demand for the goods they supply, as highlighted by Roemer's law: "The supply of beds creates the demand for those beds." (Feinstein 1994:279-322).

Professor Olsen (2012:1-11) states that the marketplace cannot solve the problems of medicine nor diminish the existing tensions between primary care and specialist physicians because the two conditions necessary for a perfect market to exist in health, do not in fact, exist: A ‘perfect market’ is deemed perfect if:
1) Consumers get what they want – and if they are willing and able to pay, and if
2) Producers cannot exploit consumers because profits are eradicated in the ‘price war’.
In health care, it appears that these two conditions are utopian and often unrealistic and unattainable. Economist Roberts states that an imperfect market model to which primary care is subject cannot ensure highest quality medicine at the lowest costs. Roberts concludes that in considering primary care medicine and the marketplace, it may be helpful to analyse the failed reform effort proposed by former U.S. President Bill Clinton in the early 1990s.

In the US in 1993, President Clinton’s task force, while realizing that an imperfect market can never be made truly perfect, created the following five criteria for an optimal medical market:

- Universal medical insurance coverage
- Costs that are affordable to society and to patients
- Comprehensive medical benefits
- Freedom of patients to choose their own physicians
- Public accountability, both in cost and in quality of care.

Even though these five criteria are mutually exclusive in practice, they remain a goal for persons, authorities, organisations, countries and local areas which seek universal primary health care services. The literature states that efforts must continue to be directed at reforming the existing imperfect medical marketplaces. A certain level of altruism and non-economic behaviors, or modifications of imperfect economic market conditions, are assumed as theoretical foundations for analysing and planning primary care in urban centers due to the existence of high pockets of urban poverty. These high poverty areas often have disintegrating health status for much of the population. In medicine, the buyer-consumer is not necessarily knowledgeable about the goods purchased and does not frequently compare sellers' quality and prices. Also consumer-patients tend to avoid using medical services until it is medically late and the need for the service is most acute. On the other hand, seller-physicians can set up monopolies or oligopolies in which neither purchasers nor consumer-patients can shop or even easily negotiate services or prices. In the U.S. purchasers (insurers/payers) have more information on the market than do the physicians who deliver the services. The literature states that consumer-patients respond to market incentives which are often ill-incentivized (O'Grady & Manning 1985:484-90).

The above primary care perspective fits into the broader discussion of primary care need and demand estimation. It is generally accepted that primary care which is directly accessible 24 hours a day is usually the patient's first point of contact with the medical system and therefore the primary care physician (PCP) should be a guide, an advocate, and a coordinator of all appropriate services, primary, secondary or tertiary. The literature states that the PCP should provide long term, continuing, and comprehensive care and act acts as a health “broker” (Fry, J., Light, D., Rodnick, J., Orton, R., 1995:757). Community-oriented primary care (COPC) can improve the health of the population through helping to remedy social pathologies, providing planned health promotion, screening for risk factors, preventing disease, collecting reliable data on the condition of a community, and helping the community to decide on health priorities (Jarris, Martinez, & Tucson 2012:31).

Economist Roberts states that in the past 20 years capitated payments by managed health care plans and organisations have surpassed the fee-for-service system in primary care, with about 55% of Americans now in some sort of managed care arrangement. The literature states that in the US, managed care PCPs behave much like general practitioners in Britain: they serve as physicians of first resort for nearly all medical problems and act as gatekeepers for patients' access to specialists. This rise in managed care utilization has produced a parallel rise in the demand for primary care. Specialist physicians now find it difficult to find work in a nation oversupplied by physicians, while primary care physicians are still in increasing demand (Miller, Jonas, and Whitcomb 1996:708-712).

Another study found that the use of managed care has generated an opposition and a backlash against many forms of cost-cutting in health care. The study, using panel variation in the passage of state-specific regulations across US states and over time to investigate the effects of the backlash on health care cost Increases, found that the backlash increased the U.S. health care share of GDP by 2 percentage points (Pinkovskiy 2013:1-53).

Donald Light (1994:1-33) lauds the United Kingdom for its system of paying primary care physicians, because in his view, its three part system of paying capitation, operating costs, and bonuses for targets ensures that patients are neither over-treated (as in the U.S. fee-for-service system) or under-treated (a potential risk of the for-profit managed care systems in the U.S.). Unfortunately, the single payer system does not engender experimentation and entrepreneurship due to its often large and sometimes inefficient national bureaucracies.

2.3 QUANTITATIVE APPROACHES TO PRIMARY CARE

This study reviewed several sources in the literature pertaining to analytical methods used in primary care data analysis. In particular, contemporary sources on quantitative methods in health care research were reviewed (Veney, Kros, Rosenthal 2009; Fos 2011; Provost, Murray 2011; & White, Fuchsberg, Haase, Wilson). One classical and used published literature on physician productivity rates in the US (White, Fuchsberg, Haase, Wilson & Gleeson 1968) was of particular importance in this study. It provided the basis for the use of physician availability rates for the US by population density, age, sex, race and income. The literature review also showed that advances in the application of quantitative methods to physician volume modeling exist and are impressive. At Dartmouth University, “The PCSA Project” is one of the first of its kind to use internet-based geographic information systems to define primary care service areas throughout the United States using standardised methods (Dartmouth PCSA 2002:). The goal of Dartmouth’s Primary Care Service Area (PCSA) Project is to provide information about primary care resources and populations within small, standardised areas that reflect patient utilization patterns (Poage 2000: 287-309).

Various texts on quantitative research and epidemiological methods were consulted and studied for possible application to this DCPC study. One such text used extensively was “Epidemiology foundations–the science of public health’ (Fos 2011:-15). Also consulted, studied and used due to their advanced presentation of multivariate approaches for multi-dimensional data, were the following texts: “Statistics for health care professionals, 2nd edition” (Veney, Kros & Rosenthal 2009) and “The health care data guide – learning from data for improvement“ by Provost & Murray (2011).

Pinkovskiy (2013:1-53) from the Massachusetts Institute of Technology has pioneered a novel approach working with a colleague, Hausman, that avoids the bias of instrumental variables by estimating a transformed version of the lagged dependent variable with fixed effects via a nonlinear least squares procedure.

The researcher consulted several textbooks and journals dealing with quantitative methods for analysing health, economic, social and demographic data. Johnson and Reynolds (2008:111-118) provide a good treatise on the definition, conceptualization, development, measurement and analysis of multi-item measures, indexes and scales. The source provides a comprehensive description, and glossary of, terms, concepts and methods used in qualitative and quantitative analysis of multi-dimensional data as were employed in this DCPC study. Another source, Krishnakumar (2013:1-26) presents detailed work on the development of multi-dimensional and multi-categorical indices. Krishnakumar (2007:39-63) also has an econometric model to explain and estimate human and societal capabilities, locally, regionally, nationally or internationally. Regarding combined and complex indices Krishnakumar (2013) addresses multi-dimensional indexes and their capabilities and characteristics. This source states that a multi-dimensional index should possess one or more of the following characteristics – several of which are applicable to this DCPC study:

Many dimensions (this criterion is applicable to this DCPC study)
Multiple indicators within a dimension (applicable to this DCPC study)
Observations at the individual (micro) level
Aggregation over individuals
Aggregation over dimensions (applicable to this DCPC study)
Decomposability between groups (applicable to this DCPC study)
Comparability over time (applicable to this DCPC study)
Comparability across countries
Welfare interpretation (applicable to this DCPC study)
Inequality within a group/population (applicable to this DCPC study)
Inequality between groups (applicable to this DCPC study)
Inequality due to various factors (applicable to this DCPC study)

Additionally, quantitative methods which specifically cover geographic units of analysis, were also reviewed in the literature. One example is the researchers in a joint cooperative consortium involving Dartmouth and Virginia Commonwealth University (Goodman, Mick, Bott, Stukel, Chiang-hua, Marth, Poage, and

Carretta 2003: 287-309) who found that some geographic units are better suited for health and primary care analysis better than others. For example, they found that using US counties as a unit of analysis in primary and health care work may prove less beneficial to researchers and policymakers, a position adopted as foundational in this DCPC study. The Dartmouth & VCU researchers cited reasons including the following:

(i) using political jurisdictions for primary care analysis is often an arbitrary and imprecise activity,

(ii) bias is an issue since local conditions of very low and very high resources and utilization can be obscured within an overall county rate,

(iii) existing evaluation ratios have limitations, noting for example, that physician-to-population ratios are biased and unevenly affected by patients seeking services in adjacent counties, and

(iv) no uniform standards exist citing that the one method for area definition currently in use which defines rational service areas (RSAs) for Health Profession Shortage or Medically Underserved Areas (MUA) applications per federal rules - 42 CFR ch. 1, part 5.2 – are, by design, set up to be flexible to accommodate local circumstances; this lack of standardisation complicates an unbiased comparison of primary care capacity and utilization from one RSA to the next (U.S. General Accounting Office 1995),

(v) few states have yet undertaken the task of defining their unique and local RSAs that encompass their entire population. (Goodman, Mick, Bott, Stukel, Chang, Marth, Poage and Carretta 2000: 287-309).

Paradoxically, researchers, in “The Dartmouth Atlas 2010” state that adding more physicians may not necessarily make care better since the issue has always been quality, affordability and ease of patient access, not quantity. Dartmouth research has shown that patients in U.S. regions with a greater physician supply do not necessarily obtain better health and that in actuality, primary-care physicians in high-supply regions of the US reported having a harder time coordinating care than those in low-supply regions (Dartmouth Atlas 2010:1-35).

2.4 PRIMARY CARE IN THE NATIONAL (U.S.) CONTEXT

A general overview of significant and current primary care issues available in the literature for the study period of 1984 through 2005 – supplemented with updates and additions from 2008 through 2013 - is presented in this section.

Major changes are occurring in the health care system in the U.S. Factors that affect the usual sources of care for significant portions of the population invariably affect the need and demand for primary care. Changes in the usual sources of medical care between 1987 and 1992 have been studied. These changes are observed to have affected most Americans but significantly affected specific population groups (Moy, Bartman & Clancy 1998:126-139).

The literature shows that there are books and studies which have documented the relative efficacy, efficiency and effectiveness of a reliance on primary health care within the context of a comprehensive primary-to-tertiary health care system. One such book, a heralded academic work which was reviewed by the prestigious New England Journal of Medicine, critically reviews evidence that a system with effective primary care will more than likely provide an increased level of high quality care - decreased mortality, fewer emergency visits, lower rates of preventable hospital admissions, and more appropriate care – and, in addition, offer lower overall costs (Donaldson, Yordy, Lohr, and Vanselow (eds). 2001:27-51).

In a survey produced on behalf of The Physicians Foundation, America's physicians and their practice patterns and perspectives are examined including the professional morale, practice patterns, career plans, and healthcare perspectives of US physicians (Hawkins 2012:1-127). The report aggregates data by age, gender, primary care/specialists, and practice owners/employees and states. It states that each year, physicians in America conduct over 1.2 billion patient visits. The survey reports that physicians are seeing 16.6% fewer patients per day than they did in 2008, which could potentially precipitate a decline that could lead to tens of millions of fewer patients being seen per year.

An overview of the history and current practice patterns of general internists, family physicians, and combined medicine-pediatrics practitioners as well as speculations about the possible match between current training programs, future system needs, and opportunities, are presented in a publication by the federal Agency for Health Care Policy and Research (A.H.C.P.R.). (Clancy & Cooper 1998: 215-218).

Authors Lanier D., and Clancy, C. (1997:434-438) in their article "Primary Care Research: Current Challenges, Future Needs," examined challenges and trends in primary care and health services research and how they relate to the health care system. They discuss quality measurement in primary care, research on patient preferences, studies of provider competence, infrastructure of primary care research, and future funding for primary care research. They also examined referrals by primary care physicians, based on office visits of adult patients to primary care physicians reported in the NCHS National Ambulatory Care Survey. They made adjustments for patient, physician, and practice factors, which is an important analytic consideration in a population-based planning approach.

The role of managed care in primary care is also investigated in the literature. Citing the Sachs Group, one 1997 study states that if the nation's health care were to be completely controlled by managed care, the demand for primary care physicians would soar by nearly 25 percent while the demand for specialists would drop off. Specialists face their steepest potential decline in the northeast with a predicted drop of nearly 41 percent. The south represents the smallest potential drop in forecast demand for specialist of only 6.5 percent. When coupled with the largest increase in demand for primary care physicians, the south of the US becomes the largest net growth market for physicians (Duranarenas, Asfura & Mora 1991:643).

Health care reform efforts have also focused attention on the perceived proliferation and excessive use of medical specialists relative to primary care physicians. One study showed that these concerns about specialists have resulted in proposals to regulate medical education programs and impose caps on the number of entrants into specialty training programs. The study also noted that there is evidence that, independent of regulatory forces, market forces are leading to adjustments in the market for physicians. The incomes of primary care physicians rose most rapidly in states with higher managed care growth, while the income growth of hospital- based specialists was negatively associated with managed care growth (Wennberg, Freeman, & Culp 1987). The conclusion is drawn, then, that using the median income may understate the influence that managed care has on average physician income if the median physician in a state is not involved with managed care and managed care primarily affects average income through low payments to affiliated physicians. (Shih, YT & Konrad, TR. 2007:1-25).

2.5 ANALYTIC FRAMEWORK

The following section of the literature review for this study focused on literature on primary care need and visits estimations and analytic methods at federal, state and local levels. Several examples of primary care predictive models and analytic methods exist in the literature, mostly at the larger state and county levels (Snow 2010:1-15).

Overall the literature shows that there is a sizeable body of knowledge, practices and experiences on primary care in general and primary care needs assessment, primary care indicators, primary care profiles and primary care planning methodologies in particular. This is especially true at macro levels of description and analysis such as at the federal, state and county levels in the United States and nationwide or regionally in international health circles. The literature on pertinent primary care analysis and data which is readily available and accessible does not appear to be as abundant at local levels especially by small area. This is partially explained by the lack of resources available to small areas and the fact that many cities and local governments are operating under tight fiscal restraints. Public entities and authorities at many local levels are continually challenged to do more with less.

Much literature exists which discusses the use of geography and geographic units and divisions as a basis for analysis and evaluation of primary health care in the US. Much work in this area has been done on, by and for US counties. But that approach leaves a lot to be desired. This is because the building blocks of much of this approach were counties, which were and are arbitrary political jurisdictions, often arbitrarily and imprecisely drawn and much more likely to be large to serve as a meaningful proxy for the boundaries of where primary care is delivered (Zwanziger, Mukamel, and Indridason 2002:55-56).

Much of the analytic framework for this research comes from a review of two US state-based approaches: (i). “Primary Care Analysis Areas (P.C.A.A.)” planning document produced by the Primary Care Division of the New York State Department of Health and the Quantitative Analysis and Special Studies Unit (Q.U.A.S.S.) of the New York State Health Planning Commission in Albany, New York (Vernon, P. et. al, 1983:1-22); and (ii). “Assessment of Primary Care Capacity in Connecticut” published by the University of Connecticut, Center for Public Health and Health Policy (Benson & Eberle. CPHHP 2008:1-45).

The major difference in the New York Study is that it analysed data for an entire state while this study’s focus is to adapt and apply similar methods in order to create a new approach for the District of Columbia, an urban area with pockets of economically disadvantaged persons with relatively poor health status.

The New York state P.C.A.A. Project and document divided New York State into 384 primary care analysis areas and ranked the P.C.A.A.’s in terms of the severity of need for additional primary care physician services. In the circles of small area analysis for primary care this was a landmark study. Its adoption on a statewide basis for New York State by the New York State Legislature is testament to the methodological rigor and usefulness for local planning purposes of its underlying principles.

2.6.1 Federal (US) Sources

At the federal level, the National Center for Health Statistics (NCHS) has been a beacon of data and analysis on health status, resources, problems and trends. The NCHS is a good repository of data and analysis on Ambulatory Health Care. Its surveys and data systems include NHANES, NHCS, NHIS, NIS, NSFG, SLAITS and Vital Statistics (see chart below1). The NCHS is also responsible for planning and conducting several scientific national studies. Two of these national sampling studies of importance to primary care are the National Ambulatory Medical Care Study (N.A.M.C.S.) and the National health and Medical Care Study (N.H.A.M.C.S.). The N.A.M.C.S. and N.H.A.M.C.S. are part of the National Health Care Survey, which measures health care utilization across various types of providers. There is a separate report which combines N.A.M.C.S. and N.H.A.M.C.S. data to provide a comprehensive picture of ambulatory medical care utilization (Burt & Schappert 2002:1-66).

The literature review for the 1985 to 2004 period found the federal government's CDC and NCHS to be a trove of detailed data and information on primary care and primary care physicians at the national level and sometimes at the regional and local levels. This was the case for the study period of 1984 to 2004 and beyond. For example, Hing and Schappert (2012:1-66) of the Centers for Disease Control and Prevention's National centre for Health Statistics found in a 2012 study that:

- In 2009–2010, annual visits per generalist physician were 30% higher than visits per specialty physician. A similar pattern was observed in 1999–2000.

- In 2009–2010, generalist physicians were less likely to accept new Medicaid patients (65%) than were specialty physicians (71%).
- A greater percentage of generalist physicians (70%) than specialty physicians (61%) spent 31 hours or more per week providing direct patient care in 2009–2010.
- In 2009–2010, a greater percentage of generalist physicians (40%) worked evening and weekend hours than did specialty physicians (19%).
- Generalist physicians were more likely to set aside time for same-day appointments (82%) compared with specialty physicians (49%) in 2009–2010.

According to the literature, the Health Resources and Services Administration (HRSA) has had an active and leading role in national US efforts to design and plan for models that can aid in estimating capacities and supply for US national physician and primary care forecasts and projections. HRSA, for example, has supported research on physician workforce issues and maintains the Physician Supply Model (PSM) and Physician Requirements Model (PRM). HRSA produced a report which describes the various components of the PSM and PRM and presents findings from the literature and original research to provide the context for the data, assumptions and methods used to project the future supply of and demand for physicians (HRSA 2008:1-106). In this report, projections from the PSM and PRM are presented, and the adequacy of future physician supply is discussed (HRSA 2008:1-106).

To estimate the need for primary care physician visits, data on local conditions such as demographic and socioeconomic characteristics for District of Columbia residents are used in this study. To calculate estimates of primary care demand it is necessary to use normative rates for physician visit rates, available nationally and adjusted to local conditions. The visit rate is the number of visits divided by the appropriate age/sex/race group and then multiplied by 100 (to get a rate per 100 persons), by 1000 to get a rate per 1,000 persons, and by 100,000 to obtain rates per 100,000 population.

This study estimated the demand for primary care visits by adjusting the national physician visit rates to local conditions for the District of Columbia. In order to do this, visit rates are calculated and used for the non-poor and the poor (defined as persons at or below the poverty level as per the U.S. Bureau of the Census).

Primary care physician visit rates are central to the analysis used in this study. Local physician visit rates are estimates culled from the available national visit rates for primary care physicians published by authoritative institutions of the U.S. Department of Health and Human Services (D.H.H.S.). These rates are available from the Centers for Disease Control (C.D.C.P.) National Center for Health Statistics (N.C.H.S.), based in Hyattsville, Maryland.

One earlier, groundbreaking N.C.H.S. publication, a classic in the field, is entitled: "Volume of Physician Visits: United States" (NCHS 1967:), has data published in the National Health Survey, Series, 10, Number 49. It is of particularly critical importance in the derivation of the physician visit rates used and applied to local data in this study. These national physician rates from NCHS provided the basis for the adjusted physician visit rates for the poor and non-poor in the District of Columbia for the years 1985, 1992, and 2004. Another classic study provided a foundation for the conduct of this DCPC study. The relevant data of relevance to this DCPC study comes from Table A, page 3 entitled: "Number of physician visits and number of physician visits per person per year by selected characteristics: United States, July 1963-June 1964 and July 1966-June-1967" (DHEW/NHS 1967:3). Normative visit rates from this prior DHEW study provided the basis for adjusting and producing the estimated normative physician visits rates per person per year for the District of Columbia, for the study period of 1985 to 2004.

The landmark NCHS national study on physician visits presents detailed statistics on the volume of physician visits and number of visits per year by selected demographic characteristics. Additionally, it has statistics on the number of physician visits by place of visit, cost per visit of office and home visits, office visits by type of physician, and percentage distribution of persons by frequency of visits per year. It is based on data collected in health interviews during July 1966 and June 1967. In 1967, 831.1 million physician visits, or 4.3 visits per person per year, occurred among the civilian, non-institutional U.S. population (White, Fuchsberg, Haase, Wilson and Gleeson 1968:1-59).

A Centers for Disease Control and Prevention survey on doctor visits shows that there were about 824 million visits made in 2000. NCHS has updated its physician visits data for year 2000. Physician visit rates reached 823.5 million in 2000 down from 831.1 million in 1967. The number of doctor visits has been increasing over the past decade due to population growth and a larger senior population which visits the doctor at a higher rate.

- The U.S. Department of Health and Human Services and the University of Missouri-Columbia (UMC) predict that United States, by 2025, will experience a decrease of 35,000 to 44,000 adult care primary care physicians (Bodenheimer 2006:861-864). Others in the US have gone as far as to predict a possible collapse of primary care medicine and are worried about its implications for the future of the nation’s health care system (Zeiner MR, ACOP 2009:1). Another study on ambulatory medical care in America profiles doctor visits in 2006 and highlights changes that have occurred in physician office practices. C.D.C.'s National Center for Health Statistics conducted this annual survey of physician visits as part of its National Health Care Survey which also covers hospitals, nursing homes, hospices, and home health care (Cherry, DK. & Woodwell, DA 2008:1-40). This researcher wrote and published a study on patients awaiting alternate care placement after acute care stays to show disparities in prolonged non-acute lengths of hospital stays. (Andoh & Vernon:1984). Study was entitled: *Patients Awaiting Alternate Care Placement,* New York State, Health Planning Commission, NYS Department of Health, Albany, NY, 1983.

Literature review for the 1985 to 2004 study period uncovered additional pertinent issues as follows. Public health authorities at the Centres for Disease

Control and Prevention (CDC) state that study of physician visits is important since most Americans receive their health care in the doctor's office and such studies provide a way for planners, policymakers and practitioners to learn about Americans' health by studying the symptoms and diseases presented, the drugs provided, the prevention services offered, and the treatments received in the doctor's office. Other key findings of the study (Cherry & Woodwell 2003:3) – which cover the 1985 to 2004 DCPC study period - include the following:

- In 2000, US doctors spent an average of about 19 minutes with each patient, with most visits ranging from 6 to 30 minutes and varying by physician specialty.

- General medical examination was the most frequent reason for a visit to the doctor in 2000.

- In 2000, 823.5 million visits were made to physician offices—about 300.4 visits per 100 persons.

- There was an increasing trend in the proportion of office visits where a physician or physician group was the owner of the practice (74.3 percent in 1997 to 88.1 percent in 2000).
- The trend in the proportion of visits to physician offices owned by a hospital declined since 1997, from 7.6 percent to 2.7 percent.
- The visit rate for white persons (3.2 visits per person) was higher than for black persons (2.1 visits per person).
- Patients who had seen the physician before accounted for 86.2 percent of office visits.
- Patients were referred from another physician or health plan at 16.8 percent of visits.
- Approximately 30 percent of visits were by members of health maintenance organisations.
- Medicare or Medicaid was the expected source of payment at 28.3 percent of all visits.

- General medical examination was the most frequently mentioned reason for visit, accounting for 7.8 percent of all office visits.
- Complementary and alternative medical therapies were ordered or provided at 31.6 million physician office visits, representing 3.8 percent of all visits.
- Since 1997, there was an increase in the percent of office visits where a cardiovascular-renal drug (by 21%), hormone (by 25%), or metabolic/ nutrient drug (by 49%) was ordered, supplied, administered, or continued.

Federal primary care data sources are many, comprehensive and very detailed. They are available for local, statewide, regional and national data. Federal sources include the NAMCS, NHAMCS and NHIS which are all part of the DHHS Centers for Disease Control and Prevention. The federal HRSA and AHRQ are also valuable data sources.

For the study period of 1985 to 2004 and beyond, the National Ambulatory Medical Care Survey (N.A.M.C.S.) serves as a national probability survey of visits to office-based physicians. It is a survey which began in 1973 and collects data on the utilization of ambulatory medical care services provided by office-based physicians. The N.A.M.C.S. survey was conducted annually until 1981, repeated in 1985, and resumed on an annual schedule in 1989. The NAMCS is complemented by the National Hospital Ambulatory Medical Care Survey (N.H.A.M.C.S.), which was inaugurated in 1992 to expand the scope of data collection to the medical services provided by hospital outpatient and emergency departments (Niska, Bhuiya, & Xu 2010:1-31).

Taken together, NAMCS and NHAMCS data provide an important tool for tracking ambulatory care utilization in the United States. A third survey, the National Survey of Ambulatory Surgery, was conducted by N.C.H.S. from 1994 through 1996, to focus on the rapidly increasing use of ambulatory surgery centers that are not covered in the NAMCS or the NHAMCS.

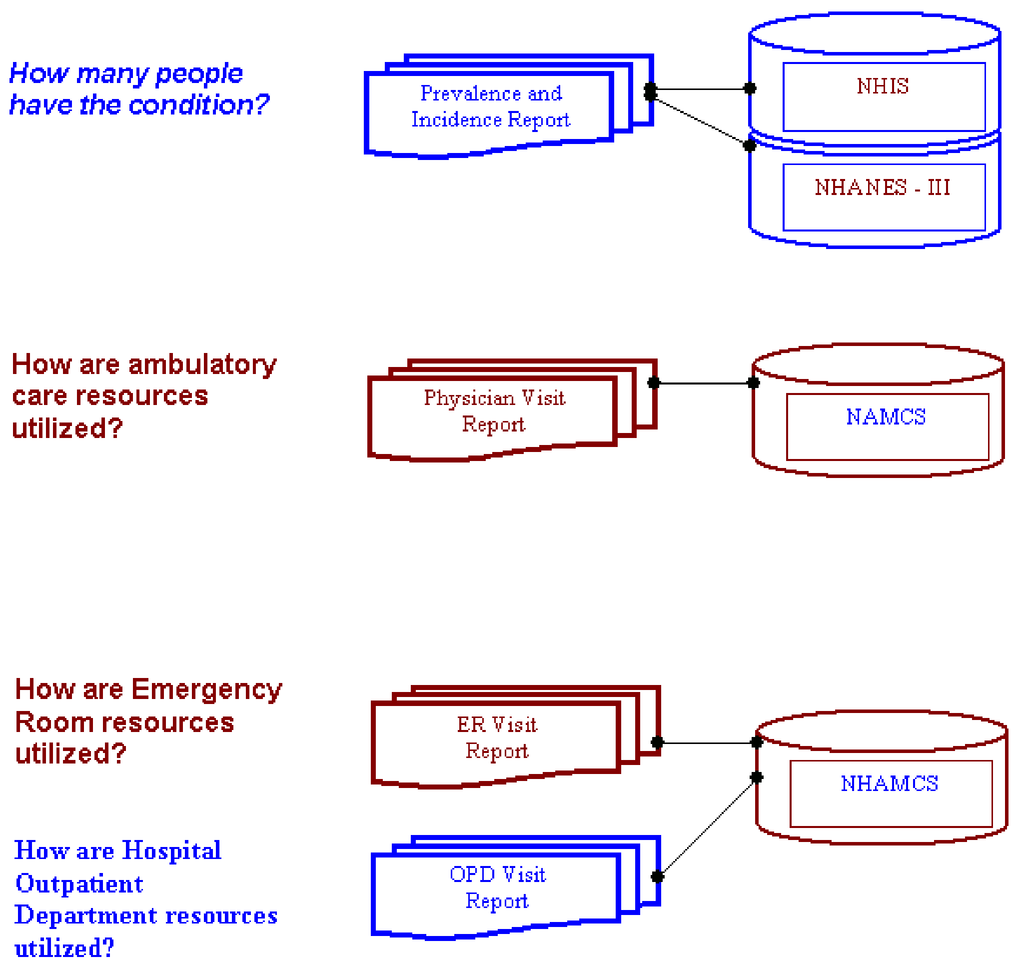
Of particular interest to the data and methods and assumptions used in this DCPC study, federal researchers Ly & McCaig (2002:) published the article entitled: “National Hospital Ambulatory Medical Care Survey: 2000 Outpatient Department Summary”. They found that during 2000, an estimated 83.3 million visits were made to hospital

Outpatient Departments (OPD) in the United States, constituting about 30.4 visits per 100 persons. The study also reported that approximately 61 percent of physician-supervised OPD visits were to general medical clinics.

A federal source, McCaig & Ly (2000:1-31) reports that about 80 percent of ambulatory care delivered by non-Federal physicians, as identified by the NAMCS and NHAMCS, is provided in office-based practices. Also of interest for comparability to the District is their finding that hospital ambulatory patients nationally are known to differ from office patients in certain demographic and medical characteristics. In addition to presenting national annual estimates of physician office visits for 2000, physician practice, patient, and visit characteristics are also described.

Data from NAMCS and NHAMCS were published in NCHS Advance Data reports are available by hardcopy and the internet. Visit rates to physician offices and other sources of health care are an important contribution of these national sample studies. At the time of publication of the NCHS Advance Data reports for 2002, population estimates from Census 2000 were not available for use in calculating visit rates. Three reports from the NCHS (AD 326, AD 327, and AD 328) presented rates for 2000 that were available from the U.S. Census Bureau. Since these were monthly post-censal estimates of the civilian non-institutional population of the United States based on the 1990 Decennial Census, they were adjusted for net under-enumeration. NCHS reports that population estimates based on Census 2000 are available and adjustments have been made to the NAMCS and NHAMCS visit rates data for 2000 visit rates to physician offices and hospital outpatient and emergency department data. Brown (2013:1-17) in an NCHS presentation titled “Changes to the National Health Care Surveys to Monitor the Impact of Health Care Policy” provides state-specific estimates of care provided in physician office and community health centers for 34 states (2012), 22 states (2013) and 17 states (2014). These changes are necessitated by the massive Affordable Care and Patient Protection Act passed by the US Congress in 2010.

Using NCHS databases which contain primary care data for research and analysis



The chart above (original source: www.healthcare-informatics.com accessed by this researcher in 2011 has since been moved and was not accessible as of 21 October 2014) is instructive for analytical purposes. It shows the various US national databases of relevance to primary care and ambulatory data analysis that are available from the U.S. National Center for Health Statistics. Current available U.S. data sets containing primary care data include National Ambulatory Medical Care Survey (NAMCS), National Health Interview Survey (NHIS), National Health and Nutrition Examination - Phase III (NHANES-III), National Hospital Discharge Survey (NHDS), National Hospital Ambulatory Medical Care Survey (NHAMCS), Medical Expenditure Panel Survey (MEPS) and more.

The federal government's Bureau of Primary Health Care (HRSA 2014) uses primary care data and analysis to designate areas within the US as Health Professional Shortage Areas (HPSA). The federal Health Professional Shortage Area (HPSA) designation identifies an area or population as having a shortage of dental, mental, and primary health care providers. HPSA designations are used to qualify for state and federal programs aimed at increasing primary care services to underserved areas and populations. A HPSA designation is based on three criteria, established by federal regulation:

The area to be designated must be a rational area for delivery of health services.

A specified population-to-provider ratio representing shortage must be exceeded within the area as evidenced by more than 3,500 persons for every one physician (or 3,000 persons per physician if the area has "high needs").

Health care resources in surrounding areas must be unavailable because of distance, over-utilization or access barriers.

It must be stated that the Government Accounting Office (GAO) – renamed to the Government Accountability Office – in an earlier study has reported reservations, skepticism and limitations of the usefulness of HPSA designations (GAO 1995). This provided another rationale for the development of CTG in this DCPC study.

2.6.2 State and Local (US) Sources

Outside of the literature sources available from the federal government, health departments in various US states have contributed significantly to analytic work in primary care. The work of the New York State Department of Health has already been cited. The Arizona Department of Health Services, Office of Health Systems Development has done major work on Primary Care Index (Arizona DHS 2014). Connecticut's work has been cited (Benson 2008).

According to the District of Columbia's Department of Health there is a great need to attract additional, accessible, localised health care services overall and clinic-based prevention and primary care services in particular, to help in improving the city's overall poor chronic health status (Indices 2009:19-46).

It has been known that significant problems have plagued the health and human services sectors in the District. Several shortcomings of the District's health care system and primary health care in particular have been documented. The city's Mayor convened the Health Care System Development Commission to recommend strategies for transforming the District's health care delivery system into one that "more effectively increases access to health services and emphasizes primary care". The Commission documented that the District has an abundance of primary, hospital, and specialty care providers even though they were not equitably distributed throughout the city. Many neighborhoods of the District were noted as continuing to be underserved for primary and preventive health care (HCSD 2000).

A large segment of the District's population exhibited great need for governmental health and social services. For example, segments of the District's 2008 population of 51,833 which relied on services and programs from the government's health and social service providers were substantial, as follows: 144,413 (24.4%) for Medicaid, 86,872 (14.7%) for Food Stamps and 39,859 (6.7%) for Temporary Assistance for Needy Families. The District's periodical statistical publication, Indices (2009:44) reports that for 2006, 2007 and 2008 respectively, there were 9,529, 8,929, and 8,731 licensed physicians and surgeons in the District. These physicians were licensed by the District but may or may not have their offices or practices based in the District (Indices 2009:222).

The Arizona 2001 Primary Care Index published by the Office of Health Systems Development has factors/indicators, value ranges, and points allocated to each factor. A primary care index is calculated for each of the primary care areas in Arizona. The designation of areas in Arizona as Arizona Medically Underserved Areas (MUAs) are based on the federal Health Professional Shortage Area (HPSA) designation or the application of the Arizona Primary Care Index. The index consists of a totaled score for each primary care area of 14 weighted items (Arizona DHS 2014:1). The following primary care index factors are included in their analytic approach:

-availability of providers
- geographic accessibility
- income/ability to pay
- ambulatory sensitive conditions
- natality
- mortality
- supplemental criteria

The Arizona Primary Care Area Program designates Arizona Medically Underserved Areas which can be made the focus of programs providing adequate access to health care for Arizonans. Additionally, by Arizona Statute, all federally designated Primary Care Health Professional Shortage Areas are considered Arizona Medically Underserved Areas.

One of the most comprehensive sources for health care (general and primary care) data and analytic methods in the US is the Dartmouth Atlas of Health Care published by the Center for Evaluative Clinical Sciences (CECS) at Dartmouth Medical School. The major goal of research at CECS is the accurate description of the health care "system" in the United States, and the pursuit of answers to such questions as: “What do variations in resources and utilization mean? Is more health care always better? What opportunities exist to reallocate excess capacity to other uses – to fund a Medicare pharmacy benefit, for example?

When do rationing and over-utilization occur?" (Wennberg, Freeman & Culp 1987:1185-1188).

The Dartmouth Atlas defines the concept of a Hospital Service Area (HSA). Clinically active physicians are assigned by the Atlas to the HSA of their primary place of practice or preferred professional address. Per the Dartmouth researchers (Dartmouth 2013), clinically active physicians are either clinically active non-federal physicians or clinically active federal physicians who serve populations counted by the US census, such as veterans, residents of Indian reservations, residents of medically underserved areas, and military personnel and their dependents. The Dartmouth Atlas used allocated physician rates that were adjusted for age and sex using the indirect method based on the 1995 U.S. population as a standard. The national age-sex specific physician workforce rates are estimated using outpatient age, sex, and specialty specific physician visit rates from the combined 1989-1994 National Ambulatory Care Survey (NAMCS 1994). These estimates were used to calculate the expected physician supply in each HSA. A similar approach is used in this study.

Another state level analysis of health status and socioeconomic conditions with an analytic approach similar to the one used in this study is provided by the Kansas Department of Health and environment (KDHE). KDHE had produced a State Needs Assessment (SNA) that has index summaries for each county in the state. The primary care index and other indices are part of the Kansas Joint State Needs Assessment (JSNA) County Index Summary. The JSNA includes the following calculated statistical indices:

- primary care index
- family planning index
- perinatal index

The JSNA primary care index includes indicators for demographics, socioeconomics, health risk/health status and access. For each indicator a value is calculated for each county. Each indicator has a value (number), rate or percent, indicator rank (by county), and indicator z-score. On the basis of the primary care index score and rank, a comparative level of need (low, medium, high) is determined.

The JSNA County Index Summary reports key county-level results to aid a given community in the state in evaluating its needs and planning program activities to meet those needs. KDHE encourages all counties and communities to use their index summary along with other information about the needs and services available in the county or community to address identified priorities.

There is much discussion in the literature on the issues of current and future physician supply shortages or surpluses. The California Health Policy Institute Roundtable has published a report “Assessing the status of California’s physician workforce: shortage or surplus?” and the National Health Foundation for the California Hospital Association published results and statistics for its survey of federally and state designated hospitals. The report explore estimates of California’s present and future physician supply, the issues that affect the state’s physician workforce, and approaches for ensuring an adequate number and mix of primary care and specialty physicians, as well as a balanced geographic and demographic distribution. The report correctly notes that while the supply of other health care personnel, including nurses, has been a focus of attention nationally and in California, additional attention needed to be focused on physician supply. This physician study uncovered several important facts about the state’s physician supply (Kun, Grigsby & Cameron 2009:1-27).

Physician data and its availability, validity and reliability as well as its comparability to other similar jurisdictions are central to this DCPC study. According to American Medical Association (AMA) data presented on the Kaiser Family Foundation’s State Health Facts Online (www.statehealthfacts.kff.org), there were 92,985 nonfederal physicians in California in 1999 (including all physicians, whether or not they are actively involved in direct patient care). This translated to 280 physicians per 100,000 Californians (compared to 285 per 100,000 people in the U.S. overall, and to a low of 179 in Idaho and a high of 454 in Massachusetts).

Studying and analysing primary health care must of necessity include a serious review of multi-dimensional aspects of the District's socio-economic and health care conditions. Detailed and up-to-date data on health status and health and socio-demographic indicators for the District of Columbia are also maintained and published by reputable public and private sources including the multi-dimensional, multi-categorical works of The Kaiser Family Foundation. One specific source reviewed by this researcher was data and analysis produced and published by the Kaiser family Foundation. For example, Kaiser (2014) presents data on the District which covers for the District, data on its:

Demographics and the Economy
Health Costs & Budgets
Health Coverage & Uninsured
Health Insurance & Managed Care
Health Reform
Health Status
HIV/AIDS
Medicaid & CHIP
Medicare
Minority Health
Providers & Service Use
Women's Health

In 2001, one-third of California's physicians were primary care physicians; the rest were in specialty care. However, these statewide totals mask significant variation in the geographic and demographic distribution of physicians, as well as regional differences in the need for primary versus specialty care. The ratio of physicians to 100,000 people te+nded to be higher in urban areas and lower in rural regions, although there also were underserved populations in low-income and inner city areas. Moreover, there were marked discrepancies between the gender, racial, and ethnic composition of California's physician population and the civilian population. The physician population was predominantly male (77 percent) and White (50 percent). And, while the White population was roughly proportional to the number of White physicians, there was a disproportionate number of Hispanics in the population compared to Hispanic physicians (31 percent versus 3 percent), and, to a lesser degree, more Black persons than Black physicians (6 percent versus 2 percent). These differences had potentially significant implications for Californians' access to care and the cultural and linguistic competency of medical care.

A similar analysis of physician supply in general and primary care physician supply in particular, has been done for the state of Virginia. For physician supply, a paper examined the supply of primary-care physicians at the state level (Olchanski, Marsland, Rossiter and Johnson 1998: 6(3):142-6.). It shows that

- the number of actively practicing physicians is considerably less than the number of licensed physicians;
- the age distribution of primary-care physicians has a bulge in the ages younger than 50, and this bulge may lead in the near future to an unexpected sudden increase in physician attrition due to retirement; and,
- at the state level, migration may be playing the dominant role in determining the total supply of primary-care physicians.

For primary care physician supply in the state of Virginia, two reports by a group of researchers show the outstanding importance of out-of-state migration for the state of Virginia: approximately two thirds of primary-care physicians are out-of-state medical graduates (Olchanski, Marsland, Rossiter, & Johnson 1998: 6(3):142-6.). These two reports state that the attrition of primary-care physicians will start to suddenly increase because of the upcoming prominent growth bulge in the physician age distribution. Similar bulges were observed in the age distributions for some other states. The report concludes that the method used appropriately reveals the underlying mechanisms and principles of physician work-force reproduction. It may show which goals are feasible, and it may be used in any state for the research necessary for rational policy formulation.

Although this study does not address the issue of physician availability in US rural areas, the literature in this area also predict a future decrease of rural primary care physicians, especially family practitioners (Kun, Grigsby & Cameron 2009; and Garner, Scheirger, Beasley, Macmillan-Rodney, Swee, Garrett, & Norman 1998:204).

The literature also analyses the urban-rural manpower needs for the years of this study. Although not a focus area fore this study, estimated current and future shortages of primary care personnel is not the purview of only underserved urban areas like the District of Columbia; some rural areas in the US are also at risk. At the national level, rural family practice physicians in the U.S. are declining, according to Bowman. The Bowman study (2010) states that:

- There is a rapid increase in the total number of US physicians, increasing faster than the US population growth. The numbers of FP and GP physicians seems to be closely related to the US non-metropolitan population.
- Decreases in the number of rural background students admitted to medical school have begun to result in decreases in the numbers of senior allopathic medical students interested in rural practice and also the number of rural FP physicians.

- The US has already begun a significant decrease in graduation of rural physicians for the nation. The data considers the three types of rural practices in the nation by RUCA coding. Urban and Urban focused is RUCA 1-3, Isolated rural is RUCA 10, Rural is RUCA 7 - 9, Large Rural is RUCA 4-6.

- Isolated Rural RUCA 10 communities across the nation, similar to certain disadvantaged urban communities, are in great need of physicians. Unlike urban areas, these rural areas have low population growth rates and are not connected to other areas that are likely to be able to help them with health care, economics, or other services.

- Rural RUCA 7, 8, and 9 communities need physicians. For example, in Nebraska these tend to be towns of 4 - 10,000 with about 5 - 8 FP physicians, occasionally an internist and maybe one or two other specialties, and no psychiatrists.

- Large Rural RUCA 4 - 6 communities usually have a wide variety of physicians and sometimes even have psychiatrists, although many are on foreign J-1 visas and the turnover is constant.

- Rural Areas of the nation depend upon Family Medicine. Of all non-metropolitan visits in the National Ambulatory care study, FP provided 37% and IM provided 24%. As the town size shrinks, the contribution of IM goes to zero rapidly and FP is the remaining provider. The isolated rural and rural portions involve 13% of the US population and this is the part not affected by increasing the numbers of physicians in a non-localized, haphazard fashion.

- The conclusion is that US production and importation of physicians is greatly exceeding population growth. This continues to be fueled by patient demand for more care and more expensive care. According to the work of Starfield and the lesson of businesses in the US and the managed care work, the nation may be on a collision course with financial hardship given the existing uncontrolled health care expenditures and little modification of such expenditures by more cost efficient approaches, such as family medicine.

There exists a documented link between primary care (or lack thereof) and hospital emergency care. Inadequate community-base primary health care access often lead to inefficient triage and utilization of costly hospital emergency rooms care. This researcher, previously, had conducted a Triage Accuracy Study and evaluation of ambulance transports for trauma and non-trauma patients for the New York City Emergency Medical Services (Andoh, J., Benjamin, L., MD 1982:1-65).

2.6.3 Local/District of Columbia sources

The problem of medically uninsured and underinsured persons in the District of Columbia is also significant (King 2005). In year 2000, there were about 80,000 uninsured persons out of a total population of about 572,000. In 2009 about 16.9 percent of the District's population was uninsured compared to 13.8 percent nationally (ARF 2009).

The District of Columbia has public and private entities that analyse primary care data and formulate policies to address the issues surrounding primary care physicians and services. The District of Columbia Primary Care Association is a private organisation which advocates for public primary care with both private and public entities. The District of Columbia Department of Health has several offices devoted to planning, analysis and health statistics per specific web pages from the Department of Health's Government website (http://doh.dc.gov/service/data-and-statistics and http://doh.dc.gov/page/center-policy-planning-and-evaluation, retrieved on 17 February 2015). The Department houses an Office of Primary Care, Planning, and Prevention which in turn, houses a Primary Care Administration (PCA). The Department of Health also has the State Health Planning and Development Agency (SHPDA), a state agency as well as the Office of Health Planning and Development (OHPD), a local agency. The Department also has the Office of Policy, Planning and Analysis which houses the State Centre for Health Statistics. The precursor to this office was the Office of Policy and Planning, Research and Statistics Division of the Department of Human services.

A review of the literature of local (District of Columbia) health care, health systems and health access issues was done. One study by District of Columbia researchers Kofie, Mitchell, Brown, Ndubuisi, Andoh, and Nzeribe (1994) on the Centers for Disease Control's Behavioural Risk Factor Surveillance System for the District showed that primary care has a major role to play in ameliorating some of the unhealthy behaviours of District residents. Another previous research on District residents' years of potential lives lost entitled "How Healthy Is The District of Columbia" by Andoh, Ndubuisi, Kelley, Saunders, Hester and Kofie (2000) has shown that the District does not enjoy high indices of "wellness" and "well-being" due in part to an inadequate focus on primary prevention and an inaccessible and under-capitalised District primary health care system.

Other literature from non-governmental District-based primary care entities were reviewed for this study. For example, according to its website the District's private non-profit organization, the DC Primary Care Association, states that its mission is:

> "to facilitate the development and sustainability of an effective, integrated health care system in the District of Columbia that guarantees access to primary health care and eliminates disparities in health outcomes". (http://www.dcpca.org/about/ accessed 17 February 2015).

Milestones have been set and some have been achieved by the District's DOH collaborations with public/private stakeholders such as the private DCPCA and other primary care-focused organisations. These public-private sector collaborations had the objective of increasing the number of primary care providers and determining the need for updated Health Professional Shortage Areas (HPSA) designations as well as identifying gaps in service delivery, developing primary care training sites, developing systems to monitor the quality of services provided at healthcare clinics and assisting in the physical improvement of clinical space to ease access and increase capacity to meet community needs (DCPCA 2014:1).

The Department of Health's State Center for Health Statistics Administration (SCHSA) is the officially-designated source of vital and health statistics data for the District of Columbia. The State Center for Health Statistics Administration

(SCHSA) was the source of some of the raw data on percentage of live-births that are low birth-weight by census tracts used in this study. An important report produced by the SCHSA that was useful for this study is "A Draft Briefing Paper on the 2000 Infant Mortality Rate for the District of Columbia," (Philips, Johnson-Clarke, Wilson and Manzur 2002:1-8). Previously, this researcher had researched and produced a study which highlighted the criticality of infant mortality as an indicator and measure of good or poor health status for nations, communities and areas (Andoh 1981:1-425).

The SCHSA provides birth, death, and mortality data for all residents of the District. For the period covered by this study, the SCHSA produced – and this DCPC study referred to - several research publications and data on the state of health and health status in the District of Columbia (SCHA 2000). For the study period of 1985 to 2004, the SCHSA listed the following important health statistical data reports for the District of Columbia for the periods 1980, 1990 and 2000:

- Abortions in the District of Columbia, 1998
- Prostate Cancer Mortality, 1994-98
- Reported Pregnancies and Pregnancy Rates, 1994-98
- Ten Leading Causes of Death, 1997-98
- Selected Birth Data by Ward, 1998
- Selected Death Data by Ward, 1998
- Vital Statistics Data Sheet, 1999
- Vital Statistics Data Sheet at a Glance, 1999
- Vital Statistics Data Sheet, 1995
- Draft Briefing Paper on the 2000 Infant Mortality Rates for DC
- 1999 Infant Mortality Rates for DC
- 1997 Infant Mortality Rates for DC
- 1997 Mortality Rates for DC
- 1996 Infant Mortality Rates for DC
- 1996 Mortality Rates for DC
- 1995 Mortality Rates for DC

Similar local (DC) vital statistics and health status data and reports for 2005 to 2014 - the period beyond the DCPC's 1985 to 2004 study horizon - are part of the published data and material available from the SCHSA.

SCHSA frequently collaborated with research and other staff in other offices within the District's government, Commission of Public Health and its successor Department of Health. This was done in order to produce health and health status publications covering the District. For example, researchers Ndubuisi, Kofie, Andoh and Schwartz (1995, 1998 and 2002) produced peer-reviewed and non peer reviewed research articles covering primary care, chronic care and rehabilitative care in the District of Columbia. Just as infant mortality rates and low birth-weight rates are often higher in the District of Columbia so are other chronic and behavioural conditions of District residents. High addictions rates and high cancer morbidity and mortality rates have also plagued the District for many years (Tuckson et al 1989). An example of a peer-reviewed work by District researchers which covered cancer is entitled "Black-white differences in stage at presentation of prostate cancer in the District of Columbia" (Ndubuisi 1995:46:771-777) and it showed the important relationship between cancer prevention, primary care and a prevention-focused health improvement program plan for the city's cancer-ravaged population.

For the study period of 1985 to 2004, the District of Columbia Office of Planning (DCOP) is another important source of literature and data on the health, economic, and social trends for District residents and the District as a whole. The DCOP is the source of raw and unlinked data on the District by age, sex, race, and census tract for use in this study. The District's Office of Planning operates the DC State Data Center. The State Data Center is the District of Columbia's official link to the US Census Bureau. The Center is a part of the Planning and Design Information Division of the Office of Planning. Its website provides a variety of demographic data for the District by ward and census tract.

The literature review revealed that the private and public entities and organisations in the District often worked together on health systems and public health initiatives especially those with primary care reform potential. For example, the District of Columbia Department of Health has an ongoing relationship and partnership with the private sector's DC Primary Care Association which is a private organisation with mutually-inclusive primary care goals. DC Primary Care Association oversees and coordinates the Health Disparities Project in the District whose goals are to:

• Improve the health of underserved populations and document those improvements

• Educate health practitioners on the best ways to achieve improved results

• Develop infrastructure, expertise, and leadership that improves the health of patients, increases the chances of a medically vulnerable person getting care, and reduces costs of providing care.

2.7.1 Literature review for the period: 2005-2014

Literature review on the District of Columbia's primary care system was conducted for the post-study period of 2005 to 2014. This literature review conducted for the post-study period of 2005 to 2014 showed, for example, that in 2011, the District of Columbia had fewer than 3,000 active doctors (Sun 2011:1). In 2013, this same source reported that according to a 2013 study, there was a shortage of primary care doctors in the District of Columbia (Sun 2013:1).

Additionally for the District, a 2013 report entitled “A State Medical Board’s Assessment of its Physician Workforce Capacity: Purpose, Process, Perspective and Lessons Learned” affirmed some of the assumptions, findings and conclusions presented by this 1985 to 2004 study, including the fact that physicians were, in 2011 and 2013, in plentiful supply in the District while the numbers of primary care physicians lagged significantly behind (Watson & Soyer 2013:10-19).
A second report on the District of Columbia entitled “Physician & Physician Assistant Workforce Capacity Report 2.0” substantiated and supplemented the findings of the 2013 study cited above previously (DC BOM 2013:1-173).

2.7.2 Literature review on trends of primary care issues, facilities and services in the District of Columbia, 2000 to 2014

For the purpose of obtaining background information, an exhaustive literature review was conducted on the recent chronological history of primary care in the District of Columbia covering the pre-study, study and post-study periods surrounding 1985 to 2004. This historical literature review encompassed the District’s primary care thorny issues, facilities, demand, supply, costs and adequacy, availability and quality. It was uncovered that in 2001, the primary care services and facilities organisation **,** Unity Health Care, joined the DC Health Care Alliance, a collaborative of a variety of local health care providers to provide wrap-around services to those most in need in the District of Columbia.

In 2014 there were 29 health care centers - public and/or public-private primary care facilities in the District – which are operated directly or contractually by the Unity Health Care Organisation for or through full or partial funding by the DC Department of Health (Unity 2014:1). However, in 2011, the DC Healthcare Alliance’s enrollment locations (which formerly were owned, operated and managed by the local government’s DC Commission of Public Health/AHCA Neighborhood Health Centers) were folded into the then quasi-publicly-funded and administered DC General Hospital-based Public Benefits Corporation (PBC).

DC General Health Campus 1900 Massachusetts Avenue, SE Washington, DC 20003 (202) 548-5110	**Southwest Health Center** 850 Delaware Avenue, SW Washington, DC 20024 (202) 548-4520
Hunt Place Clinic 4130 Hunt Place, NE Washington, DC 20019 (202) 388-8160	**United Medical Center** 1310 Southern Avenue, SE Washington, DC 20032 (202) 574-6873
Woodridge Health Center 2146 24th Place, NE Washington, DC 20018 (202) 281-1160	**Congress Heights Health Center** 3720 Martin Luther King, Jr. Avenue, SE Washington, DC 20032 (202) 279-1800
Anacostia Health Center 1328 W Street, SE Washington, DC 20020 (202) 610-7160	**Walker-Jones Health Center** 40 Patterson Street, NE Washington, DC 20002 (202) 354-1120

From 2005 to 2014, post the DCPC study period of 1985 to 2004, the RAND Corporation did extensive work on health care and health systems in the District of Columbia. In 2013, the RAND Corporation and the *District of Columbia Healthy* Communities Collaborative (DCHCC) produced a study which examined and ranked, for 2007 to 2011, conditions for inpatient and Emergency Department discharges from the District's hospitals (RAND 2013). This RAND/DCHCC study also analysed the top 20 primary conditions for inpatient and emergency department discharges. An updated RAND study (RAND 2013) was entitled District of Columbia Community Health Needs Assessment and provided a look of primary care conditions, facilities and priorities (Chandra, Blanchard & Ruder 2013:1).

In 2008, RAND produced a Working Paper for the Executive Office of the Mayor of the District of Columbia entitled "Assessing Health and Health Care in the District of Columbia" (Lurie, Gresenz, Blanchard, Ruder, Chandra, Ghosh-Bastidar & Price 2008:1-57). RAND Research and the DC Healthy Communities Collaborative (DCHCC) also highlights the primary prevention and primary care issues prevalent in the District of Columbia (DCHCC 2013:1-22).

Specific RAND studies have provided analytical and methodological support and corroboration for quantitative approaches used in this DCPC study to count physicians and estimates physician supply in the District. The RAND Corporation has thus also contributed to the development of applicable health systems and primary care needs assessment methodologies in the post-DCPC study period. RAND analyses primary and specialty care supply factors, similar to DCPC use methodology by estimating specific methods, as is the case in RAND's and George Washingt:1-22on University's (GWU) study (2008:1-62) entitled "Assessing Health and Health Care in the District of Columbia - Phase 2 Report/Working Paper".

- developed estimates and mapped the supply of primary and specialty care providers in the District by, similar to this DCPC study, using data from the District of Columbia Health Practitioner Licensing Administration (HPLA) database of allopathic (MDs) and osteopathic (DOs) physicians with active licenses in the District. RAND and GWU also checked and modified the data in several ways, for example, by using only those providers who reported a practice or business address within the District of Columbia.

-Similar to this DCPC study, the RAND and GWU study checked the HPLA electronic file against the book, the Washington Providers Directory (WPD), to clarify subspecialties for internal medicine and to supplement specialties when faced with incomplete or missing specialties fields in the provider file.

Some studies using data from the post-DCPC study period provide support and corroboration for major findings of the DCPC 1985 to 2004 study. Becker

Hospital Review (2013) reports from a District of Columbia Board of Medicine study that, similar to the DCPC 1985 to 2004 study's finding, only roughly 6 percent of Washington, D.C.'s physicians are primary care physicians who spend more than 20 hours a week treating patients. Also, D.C. in 2003 has more than 8,000 total physicians but only 453 of them practice primary care. In 2010, that number was 918. The source of the data, the DC Board of Medicine is credible. To determine these numbers, the Board of Medicine sent surveys to 8,466 physicians in D.C. who renewed their licenses last year and received responses from 4,790 of them (DCBOM 2013).

Brookings Institution and the Rockefeller Foundation report that there is an imbalance in resources devoted to health across the District of Columbia's various geographic locations thereby creating disparities in health access and health outcomes. Racial and ethnic disparities in access to care and health status continue to pose key challenges to meaningful system's reforms in the District (Meyer, Bovbjerg, Ormond & Lagomarsino 2010). The report also states, in support of the DCPC 1985 to 2004 study finding, that:

"…. the District is generally segregated along lines of income and race; health status correlates with both. The southeastern quadrant has the most concentrated populations of low-income and black residents, especially in Wards 7 and 8 east of the Anacostia River. The northwestern quadrant has the highest share of upper-income and white persons. The northeastern quadrant is home to many higher-income black residents."

Also reported is the assertion, specifically made by the DCPC 1985 to 2004 study, that:

" ….. Overall, the District was and remains very well endowed with health care service capacity. However, providers are disproportionately located in Northwest (DC), rather than spread throughout the city. The supply of physicians, hospital beds and registered nurses per thousand population all far exceed national averages, although some of this excess serves the many nonresidents who work in D.C. or travel in to access care."

A detailed and useful history of primary care facilities in the District is provided in reports, websites and blogs operated by *DCWatch* and, independently, by the DC Health Systems Study Consortium (DCWatch 2001, 2002). According to DCWatch, in 2001 the District had a network of public health centers affiliated with DC General Hospital and run by the PBC. In addition to the public health centers, the District had a group of primarily independent, private, not-for-profit health centers, and hospital-operated primary care centers that served as medical homes for many lower-income people and high-risk groups, including the homeless, immigrants, children in poverty, and people with AIDS. According to data from the DC Primary Care Association, the PBC at the time provided about one-third of all primary care visits to the uninsured in the District, and the private health centers handled the remaining two-thirds. The District, however, lacked at that time a mechanism for certifying that its public and private health centers met community-need related care accessibility and quality standards. A process for ensuring that these health centers are integrated within the larger health care safety net was therefore recommended.

In 2001, the DC General Hospital's Ambulatory Care Center and the PBC clinics were operated by Unity Health Care. In 1999–2009, D.C. shifted from providing direct services to subsidizing individuals while focusing attention on its own continuing challenges in promoting health. A report by the Greater Washington Research Council/Brookings Institution and the Rockefeller Foundation also delineated and described the shift from a Public Hospital & satellite clinics to Public Insurance Coverage through the DC Healthcare Alliance (and later, to Unity Health Care).

As of 2014, the District Government's Department of Health provided support for the former DC General Hospital Ambulatory Care Center (ACC) and the former Public Benefit Corporation's (PBC) clinic sites that used to be a part of DC General Hospital to ensure that District residents have ongoing access to specialty and primary care in the public sector. The former Public Benefit Corporation (PBC) health centers (and DC General Hospital's Ambulatory Care Center (ACC) are operated by the Unity HealthCare Organisation and administered by the Department of Health (DOH). Programmatically and administratively, the Department of Health (DOH) covers the facility's fixed costs and, through a cooperative financial grant to the Unity Health Care Organisation, a portion of the operational costs for a total of four ambulatory health care sites. The sites that DOH sponsored included the following centers and locations:

The Ambulatory Care Center (ACC) located at 1900 Massachusetts Avenue
is operated by Unity Health Care at the grounds of the former DC General Hospital. The former Public Benefit Corporation Clinics included: Congress Heights Health Center located at 3720 Martin Luther King, Jr. Avenue, SE, the.Hunt Place Health Center located at 4130 Hunt Place, NE and the Southwest Health Center located at 850 Delaware Avenue, SW. As of 2014 Unity Health Care operated all of the above sites and provided comprehensive primary care to patients regardless of their ability to pay. Going back in history, in 1997, the DCG Hospital and the community health centers were transformed into an independent, quasi-public Public Benefit Corporation (PBC), an arrangement that lasted just over three years. Unity took responsibility for managing the six formerly public PBC clinic facilities. The historical and administrative progression is as follows:

Literature review on the District's health care system of a study conducted in 2010 provided support and corroboration for this study's rationale for studying the District from 1984 to 2005. This is because the Brookings 2010 study stated that for the District of Columbia:

"…Health outcomes are still poor. The District's health care system is still struggling to improve health outcomes by focusing on chronic diseases, increasing primary care usage and reducing reliance on emergency departments and other hospital-based care."

"…Moreover, health system redesign does not address the social determinants of health, such as personal behavior, income, education and environmental factors."

This 2010 report (Brookings 2011) then concluded with the following specific points and facts, which are studied and presented in this study of primary care for 1985 to 2004:

"The key lessons for privatization and coverage expansion alike are that changes in health care financing cannot succeed to their fullest without supportive changes in delivery of care and complementary efforts in public health and other areas that greatly affect health status."

"There is progress on creating a more integrated health system with less emphasis on hospitals and more on prevention and primary care, but there is a long way to go."

The conclusion from the above pertinent historical analysis and literature review of the District's history of primary care services-provision and policy-making definitively show that this DCPC study of the District's primary care need and demand estimates stood on solid, reasonable grounds. This DCPC study's objective, to deliver analyse factors, criteria and demand/supply indices that influence primary care delivery and to provide primary health care in programs, facilities and services close to where people live, are all well-grounded and based on real community needs. These studies reviewed as part of this DCPC study thus help to affirm the concept and rationale for the development of Census Tract Groupings (CTG) to assist in the identification and planning for primary care shortage areas in the District. Ostensibly, past (historical) primary care issues and problems identified by the DCPC study of 1985 to 2004 appear to continue to exist – to some extent – several years removed from the period of the study.

2.8 CONCLUSION / CHAPTER SUMMARY

Review of the literature conducted as part of this study served as a guide to provide the theoretical groundings, methodological framework and understanding of the prevailing issues of importance in the District's primary care system. It also provided guideposts about newer ways of thinking about and solving primary care problems.

This chapter has presented, discussed and summarised the variety of literature which was reviewed as part of this study. The literature review encapsulated the study period years of 1985 to 2004 but it also included reviews of earlier research and primary care classics as well as more recent literature (2005 to 2014) on local and national primary care methods, issues and trends. The literature review helped to refine the research method for the study which is presented in the next chapter on Methods.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 INTRODUCTION

The research paradigm (epidemiological, quantitative study), research design (non-experimental, correlational, model-testing, descriptive, comparative descriptive) and research dimensions (empirical, cross-sectional analysis) for this study are presented in this chapter. For this quantitative study, the data files, quantitative tools and analytic methods - statistical procedures, tests and comparisons - used in this study of primary care need and demand estimations for the District of Columbia, are described in this chapter. The main purpose of this study was to use study variables to describe and conduct a study for the development of quantitative primary care need and demand indices for the District of Columbia. This chapter discusses in detail the technical aspects of this District of Columbia Primary Care (DCPC) study. It also describes the techniques used to collect, organise, and analyse the study variables (poverty%, low birth-weight%, specialties and locations of physicians) and how the study variables were used to develop primary care need and demand indices and Census Tract Groupings (CTGs) for the District. The methods used and activities conducted by this researcher in order to produce the study findings on physicians, physician specialties, primary care visits, socioeconomic characteristics of primary care recipients and the primary care shortage areas, are described in the following sections.

This research analysed data for the District for the period 1985 to 2004 and made relevant comparisons to data for the District for years 2005, 2010 and 2013. For example, the study examined data for 2005 from the District's high-poverty public assistance and Medicaid populations who received services from the District of Columbia Government's Department of Human Services. Additionally this DCPC study compared findings from a 2010, 2013 study of District physicians conducted by the DC Board of Medicine.

Two windows-based personal computer software packages – IBM SPSS version 20 and Microsoft Excel 2010 were used in all phases of the data management and data analysis. The major terms and concepts used in this study are defined and explained in this chapter. These terms were also listed in detail in the "Definition and Explanation of Terms" section in Chapter 1.

The descriptions of the study's methods and approaches in this chapter are presented in a manner that facilitated the evaluation of the following six null hypotheses for this study:

H_{01}: The distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia.

H_{02}: The primary care service index (PCSI) which is calculated from *study variables active physicians, poverty%* and is the ratio of primary care visits demanded by the population to the primary care visits satisfied, does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{03}: The unsatisfied visits (or "visits gap") in primary care, which is calculated *from study variables PCSI and CNS,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{04}: The quantitative measure of "need" for primary care - "composite need score (CNS)" - which is calculated the from *study variable low birth-weight%,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{05}: The primary care priority scores (PCPS) – which is calculated from *study variables PCSI and CNS* - when cross-tabulated by census tract or Census Tract Grouping, do not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care "visits gap" by census tract or Census Tract Grouping in the District of Columbia.

In addition to describing the overall methods used to achieve the study's objectives, specific steps are described in the following sections to address the whys and hows of analysing and evaluating each of the above six research hypothesis. research paradigm, namely qualitative or quantitative research.

Overall, this chapter will describe the following aspects of the study:

- the research paradigm employed – which is quantitative, epidemiological research,
- the research design used – which is a quantitative design using non-experimental, correlational, comparative descriptive approaches, and
- the dimensions of the research, which covers empirical, cross-sectional data analysis of three study periods, 1984-1985, 1990-1992 and 2004-2004.

3.1.1 RATIONALE

This section will present the context of the methods chosen as well as the rationale underlying the study's methods. This study was developed by this researcher as an analytical cross-sectional study spanning three discrete study periods for the District of Columbia: 1984-85, 1990-1992 and 2004-2005. The rationale for the researcher choosing the period of 1984 to 2004 for this research was because it was a period of great significance for primary health care services organisation, delivery, operation and administration in the District of Columbia. This was the case, in large part, because during this period all of the publicly-financed primary health care clinics (Neighbourhood Health Centres) in the District, organisationally, structurally and functionally progressed, successively, *from complete public and governmental control*, financing and management (by the DC Commission of Public Health's Ambulatory Health Care Administration, CPH/AHCA in 1985) to a *brief period of quasi-public-private control*, financing and management (by the District's DC General Hospital Public Benefits Corporation, PBC in 1992) to a period of *private-sector control*, operations and management (via contractual and cooperative agreements between the private Unity Health Care (UHC) organisation, the District Government's Department of Health, and the DC Healthcare Alliance insurance and health finance arrangement in 2005. It is clear that valuable lessons could be learned and used - for the betterment of primary care planning activities in the District - by researching this twenty-year period in the District's history with primary care. The researcher strongly felt that a major contribution could be made to the literature and the discipline by studying the District primary health care system during this period of great change and significance.

Issues of research and data validity, reliability and ethics are described in this chapter. This chapter also discusses adherence to sound ethical and intellectual research practices and addresses the issue of why it is important to adhere to ethical processes in order to assure that the study is conducted with the highest standards of professional integrity and standards. In the literature, some authorities on research ethics have stated that the inclusion of research ethics is viewed as facilitating a procedural, rather than a quality assurance prerogative (Babbie & Mouton, 2001). However, in this research effort, maximum and continuous attention was paid to the paramount issues of ethics and intellectual and scientific rigor in order to ensure that the research process and the data collection and analysis undertakings would result in enhanced credibility and acceptance.

3.1.2 STUDY ASSUMPTIONS

This study is based on four main assumptions, as follows:

(i) primary care is, or should be most effectively organised, delivered and presented, at and to a well-defined local, small area or community by primary care and other health care providers (physicians/nurses/extenders) in private medical offices, group practices, clinics/health centers, ER/outpatient departments, hospitals)

(ii) factor analysis (principal components) can be used to define and delineate small area communities which are rational health care planning areas in an urban area or city. These rational health analysis areas - Census Tract Groupings (or CTGs) – are a product and contribution, of this study,

(iii) physicians, who practice in a city which has significant, economically disadvantaged communities, are often differentially distributed according to geography and specialty (See Hypothesis #1); and

(iv) Primary care potential visits (visits needed), actual or satisfied visits (visits demanded) and primary care visits shortages (visits needed *minus* visits demanded) can be calculated, compared, and prioritized for each census tract or Census Tract Grouping using data on physician distributions, community demographic characteristic (poverty) and community health status (low birth-weight%). See Hypothesis #2.

3.2 Logic and steps for calculating the three primary care indices

Figures and diagrams are presented below in this section to describe how the study was conducted and how the three primary care indices were calculated.

Three explanatory diagrams (Vernon et al: 1984:1-23) on the context, logic and steps for calculating the three primary care indices (PCSI, CNS and PCSI) are provided on the following pages:

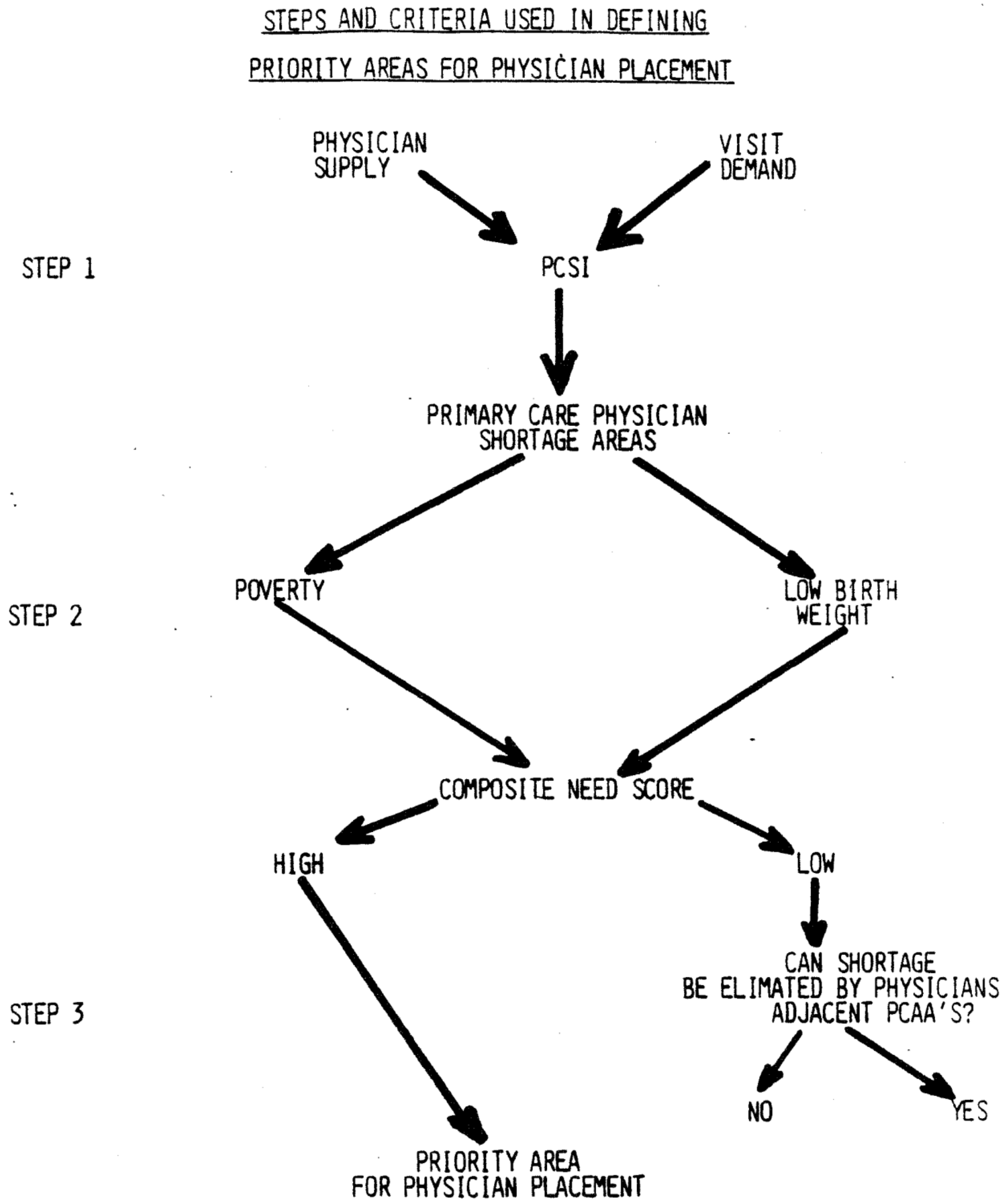
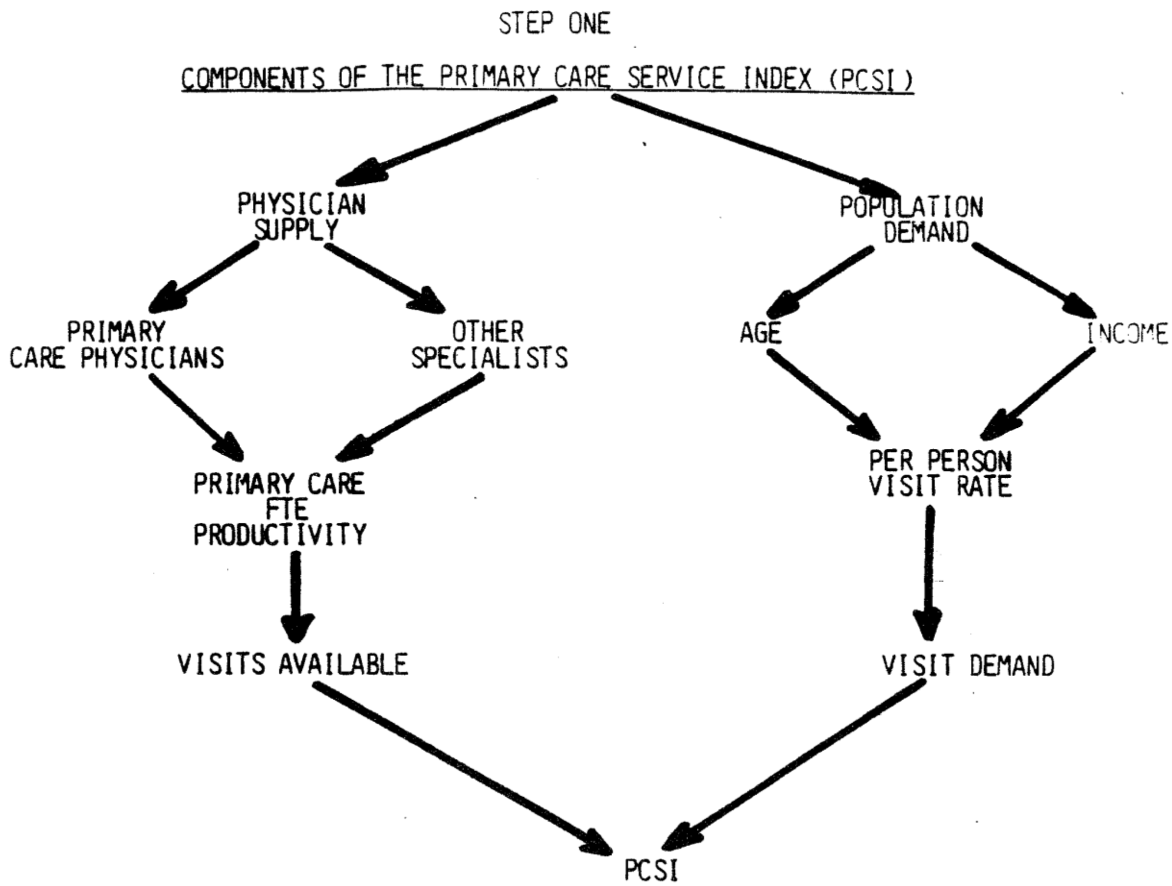


Figure 3.1: Steps and criteria used in defining primary care indices (Vernon et al: 1984)



SOURCE: PRIMARY CARE PROFILE,
NEW YORK STATE HEALTH PLANNING COMMISSION, JANUARY 1984

Figure 3.2: Components of the Primary Care Service Index (Vernon et al: 1984)

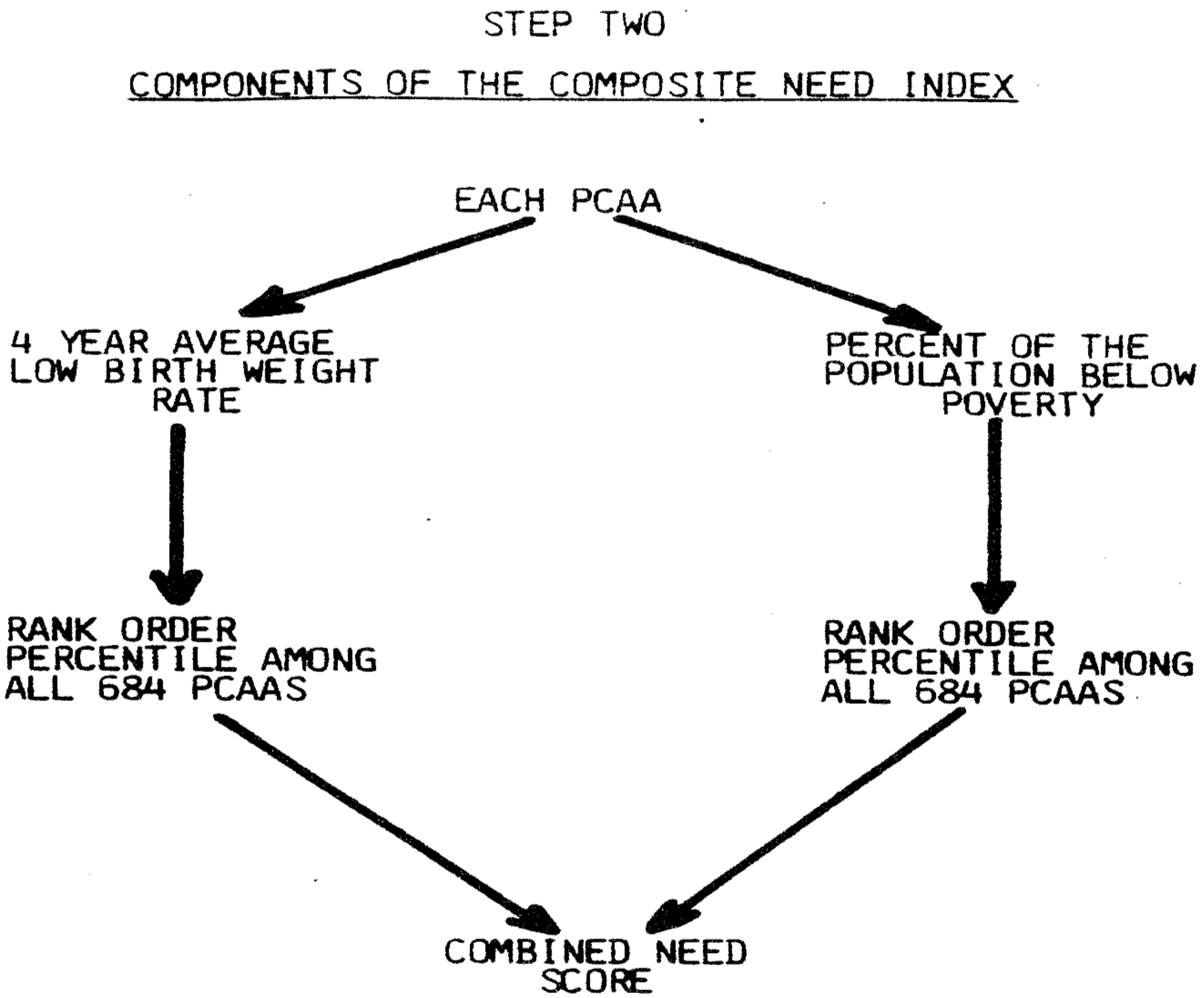


Figure 3.3: Components of the Composite Need Score (Vernon et al: 1984)

3.3 GENERAL OVERVIEW OF METHODOLOGY

Based on the three figures above, the overview of the general steps used to collect and link the study variables in order to calculate the three composite primary care indices, provided in the section below. This study analysed data and provided quantitative approaches for addressing three problems in the District of

Columbia: (i) the lack of composite *urban primary care planning indices*, (ii) the absence of *rational health service areas* for geographically analysing and presenting the indices, and (iii) the lack of adoption of a formal quantitative process for identifying *primary care visits shortage areas* for health planning in the District of Columbia (the District).

A brief overview of the methodology employed follows:

I: Physicians – data on physicians were collected, linked and analysed, by year. The analytical process encompassed the following technical, bulleted steps:

- **Primary Care Physicians** – To evaluate research hypothesis #1 concerning physicians, counts of the District's active physicians were developed. Research hypothesis #1 states the following:

H_{01}: The distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia.

To analyse this hypothesis, three groups of Primary Care Physicians (PCP) were defined for this study as follows:

1. General Primary Care Physicians (GPC);
2. Specialist Primary Care Physicians (SPC) and
3. Specialists (S)

- The term "General Primary Care (GPC) in this study refers to all physicians who practised medicine in the following five specialties:

GP –	General Practice
FP –	Family Practice
OB/GYN -	Obstetrics/Gynaecology
PED -	Paediatrics
IM -	Internal Medicine.

- The objectives of this study included the following:

1. To measure the level of physician counts geographically available to satisfy physician visits needed and demanded by District residents

2. To determine if available services were adequate to meet needs and demands of District residents for the given year of the study, and
3. To provide baseline data that can be used in the future for evaluating and planning for primary care resources and services in the District.

- The study's three statistical indices (or indexes) are as follows:

1. PCSI – primary care service index: measure of access to physicians for residents of a small area (census tract)

2. CNS – composite need score: measure of population-based need, derived from data on populations with incomes below the federal poverty level (POV) and low birth-weight (LBW)

3. PCPS – primary care priority score: Numerical PCSI and CNS values are mathematically combined to create a new index, priority score, which provided an objective basis for need/demand assessment and primary care resource allocation

The data management/data analysis steps were as follows:

- Researcher aggregated the 180 (in 1980), 188 (in 1990) and 182 (in 2010) US census tracts in the District to aggregate and create **eleven new Census Tract Groupings (CTGs)** which are rational health service areas, for the District.

- Researcher determined **counts of active practicing primary care and non-primary care physicians** for each CTG for study years 1985, 1992 and 2004.

- For a given study year, researcher determined DC population by CTG; multiplied physician counts in each CTG by a normative (US) standard value for physician productivity (visits made per 100,000 population) in order to obtain **satisfied visits** (that is, actual visits made to physicians in the small area community):

Table 3.1 presents the estimates of nationwide physician productivity, that is, total number of visits per year made to a physician based on the physician's specialty and the location of the physician's practice. These estimates were used in this study to calculate estimates of physician productivity for the District based on primary care specialty and density of population of where the physician's practice was located.

TABLE 3.1: CALCULATING ESTIMATES OF PHYSICIAN PRODUCTIVITY: VISITS PER YEAR FOR AREAS WITH DIFFERENT PHYSICIAN DENSITY LEVELS

	PHYSICIAN DENSITY		
	LOW	**MEDIUM**	**HIGH**
Physician (Visits/Year):			
Primary Care Physicians	8,226	5,795	4,714
Other Physicians	5,153	4,301	3,757
FTEs:			
Primary Care Fraction of Practice:			
Primary Care Physicians	1.0	1.0	1.0
Other Physicians	0.5	0.3	0.1

Source: NHIS; NCHS; NYS HPC, 1984

- Total visits a physician can handle per year were calculated: For a given year (or period) researcher determined the **potential (maximum possible) visits** that can be made by poor and non-poor residents in the small area community or CTG.

This was done by using the above (Table 3.1) national statistical visits norms for population-based visits per year to a physician by age group (number of visits per year made by "poor" and "non-poor" residents in a small area) as published by the federal National Center for Health Statistics (NCHS), shown in Table 3.2 below:

- Total visits a person can make per year to a physician, on average, based on the person's age and income were calculated by using the US visits norms shown in Table 3.2 below:

TABLE 3.2: NUMBER OF VISITS ONE RESIDENT CAN MAKE: ESTIMATED PRIMARY CARE PHYSICIAN VISITS PER PERSON PER YEAR FOR POOR AND NON-POOR PERSONS, BY AGE GROUP

	AGE: Under 15	**15-44**	**45-64**	**65+**
Primary Care Visits Per Person per Year:				
Non-Poor	3.3	3.4	4.0	5.1
Poor (Adjusted)	4.2	6.0	11.1	8.1

Source: NHIS; NCHS; NYS HPC, 1984

- **Calculated the number of primary care visits shortage** for each CTG (visits shortage = potential visits minus satisfied visits)

- Calculated **composite need score** for each CTG standardised to 100 (CNS = Rank (% population with incomes below the federal poverty level (POV) + Rank (% low birth-weight (LBW)).

- Calculated **primary care service index** (PCSI = actual visits divided by potential visits) for each CTG. See Figure 3.4 below.

II: PCSI

To evaluate research hypothesis #2 concerning the index, primary care service index (PCSI), values of PCSI by CTG for the District had to be calculated. Research hypothesis #2 states the following:

H_{02}: The primary care service index (PCSI) which is calculated from *study variables active physicians, poverty%* and is the ratio of primary care visits demanded by the population to the primary care visits satisfied, does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

The calculation of the primary care service index (PCSI) by census tract and by Census Tract Grouping (CTG) was done by using the formula as defined and described in Figure 3.4 below:

Formula for:

PCSI – primary care service index: measure of access to physicians for residents of a small area (census tract)

$$\text{PCSI} = \frac{\text{Satisfied Visits}}{\text{Total Potential ("poor" and "nonpoor") Visits}}$$

FIGURE 3.4: DESCRIPTION OF FORMULAFOR CALCULATING PRIMARY CARE SERVICE INDEX (PCSI)

Source: Researcher’s own derivation as based on Vernon et al (1984)

IV: CNS

To evaluate research hypothesis #4 concerning the index, composite need score (CNS), values of CNS by CTG for the District had to be calculated. Research hypothesis #4 states the following:

H_{04}: The quantitative measure of “need” for primary care - “composite need score (CNS)” - which is calculated the from *study variable low birth-weight%,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

The calculation of the composite need score (CNS) by census tract and by Census Tract Grouping (CTG) was done by using the formula for CNS as defined and described in Figure 3.5 below:

CNS composite need score, standardized to 100

CNS score = Rank (% population with incomes below the federal poverty level (POV))
+
Rank (% low birthweight (LBW))

Low CNS score (e.g.1) indicates high need
High CNS score (e.g. 100) indicates low need, relative to other census tracts (or Census Tract Groupings).

FIGURE 3.5: DESCRIPTION OF COMPOSITE NEED SCORE (CNS)

Source: Researcher’s own derivation as based on Vernon et al (1984)

V: PCPS

To evaluate research hypothesis #5 concerning the index, primary care priority score (PCPS), values of PCPS by CTG for the District had to be calculated. Research hypothesis #5 states the following:

H_{05}: The primary care priority scores (PCPS) – which is calculated from *study variables PCSI and CNS* - when cross-tabulated by census tract or Census Tract Grouping, do not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

- Calculate **PCPS, a number (=1 or 2 or 3)** obtained by cross-tabulating PCSI and CNS values for a small area (CTG) where

  PCSI = 1 high need for primary care resources

  PCSI = 2 moderate need / PCSI = 3 low need

  The calculation of the primary care priority score (PCPS) index variable by census tract and by Census Tract Grouping (CTG) was done by using the formula for PCPS as defined and described in Figure 3.6:

PCPS Primary Care Priority Score:

PCPS is a number (=1 or 2 or 3) **obtained by cross-tabulating PCSI and CNS values** for a small area (CT or CTG)

- **PCSI = 1 high need for primary care resources**
- = 2 moderate need
- = 3 low need

- *The primary care priority score provides an objective basis for making primary care resource allocation decisions.*

FIGURE 3.6: MEANING OF PRIMARY CARE PRIORITY SCORE

Source: Researcher's own derivation as based on Vernon et al (1984)

In conjunction with Figure 3.6 above, Figure 3.7 below illustrates how a 2-way cross-tabulation was used to categorise the PCPS values (1, 2 or 3) obtained from the calculations of the primary care priority scores.

	PCSI				
	1 (very low satisfied visits)	2 (low satisfied visits)	3 (med satisfied visits)	4 (med high satisfied visits)	5 (high satisfied visits)
CNS					
1 (high need)	1-HIGH	1-HIGH	2-MED	2-MED	2-MED
2 (med high)	1-HIGH	1-HIGH	2-MED	2-MED	2-MED
3 (med low)	2-MED	2-MED	2-MED	3-LOW	3-LOW
4 (low need)	2-MED	2-MED	2-MED	3-LOW	3-LOW

FIGURE 3.7: CROSS-TABULATING PCSI AND CNS VALUES TO OBTAIN PRIORITY SCORES. Source: Researcher's own derivation as based on Vernon et al (1984)

III: primary care visits gap

To evaluate research hypothesis #3 concerning the visits gap, the difference between the visits demanded and the visits actually available had to be calculated. Research hypothesis #3 states the following:

H_{03}: The unsatisfied visits (or "visits gap") in primary care, which is calculated *from study variables PCSI and CNS,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

In this study, by definition, **the numerical difference between the two calculated quantities (potential visits and actual visits) represent an estimate of the *primary care visits shortage* for the District** – which is one of the objectives for the conduct of this study.

Analysing and evaluating the six research hypotheses:

- To evaluate relevance and applicability of the methodology presented in the section above, the researcher analysed the resulting calculated primary care need and demand values (PCSI, CNS, PCPS, shortage areas) by CTG for the period 1985 through 2005 and compared these DCPC study values (for example, for physician counts) to other independently-produced data on active, licensed, practicing physicians as well as to physician counts obtained from designated federal Health Professional Shortage Areas (HPSA) for the District. See updated designations (HRSA 2013).
- Researcher tested all of the six (6) study hypothesis to determine if they should be rejected or not rejected. The section below provides details of the study methods.

3.4 DETAILED DESCRIPTION OF THE DCPC METHODOLOGY

Table 3.3 and Table 3.4 below provide data underlining the major assumptions in this study, using data from national primary care visit rates per physician per year. Table 3.3 below has estimates based on NCHS survey data, 1984. Table 3.4 has data on the expected visit rates for poor and non-poor persons:

TABLE 3.3 ESTIMATES OF VARYING PHYSICIAN PRODUCTIVITY (VISITS PER YEAR) FOR AREAS WITH DIFFERENT PHYSICIAN DENSITY LEVELS

	PHYSICIAN DENSITY

	LOW	MEDIUM	HIGH
Productivity (Visits/Year):			
Primary Care Physicians	8,226	5,795	4,714
Other Physicians	5,153	4,301	3,757
Primary Care Fraction of Practice:			
Primary Care Physicians	1.0	1.0	1.0
Other Physicians	0.5	0.3	0.1

Source: Primary Care Profiles, New York State Health Planning Commission, New York State Department of Health, 1984.

TABLE 3.4 PRIMARY CARE PHYSICIAN VISIT RATES PER PERSON PER YEAR FOR POOR AND NON-POOR PERSONS

	Under 15	15-44	45-64	65+
Primary Care Visits Per Person Per Year:				
Non-Poor	3.3	3.4	4.0	5.1
Poor (Adjusted)	4.2	6.0	11.1	8.1

Source: Data from the National Health Interview Survey, NCHS; Primary Care Profiles, New York State Health Planning Commission, NYS DOH, 1984.

Table 3.4 above shows the national estimates of physician productivity from NCHS data that were applied to the District's physician counts in order to produce estimates of (satisfied) physician visits for the District of Columbia.

This table, Table 3.4 above, provides the primary care visit rates per person per year, for poor and non-poor, as estimated from US national NCHS data by the New York State Health Planning Commission in its study, "Primary Care Profiles."

In this study, values from the two tables above (Table 3.3 and Table 3.4) were used in the calculation of estimated potential primary care physician visits (potential demand) and primary care physician visits based on actual physician counts by census tracts or Census Tract Groupings (satisfied demand). By definition, **the numerical difference**

between these two calculated quantities (potential visits and actual visits) represent an estimate of the *primary care visits shortage* for the District – which is one of the objectives for the conduct of this study.

In this DCPC study, the nationally estimated data shown in Table 3.3 and Table 3.4 above were applied locally to the District using the following rationale and procedures:

In a city such as the District of Columbia with a relatively large number of practicing physicians, ideally one full-time equivalent (FTE) primary care physician in a year is estimated to be able to provide about 4,714 visits while one FTE other non-primary care-physician is estimated to be able to provide about 3,757 visits a year (Table 3.3). Thus if a given community had 100 FTE primary care physicians, it is expected that they would produce a total of 471,400 (4,714 X 100) primary care visits in a year. This number (471,000 in this example) which is derived from the actual number of physicians located and practicing in the city, is the "satisfied visits" or actual visits.

The "potential visits" or "potential demand" is derived from two sources: By adding:

(i) the total number of "poor" persons in the city's (community-specific) population multiplied by the expected "poor" visit rate per person per year (e.g. 6.0 visits per person for residents aged 15-44, Table 3), and

(ii) the total number of "non-poor" persons in the city's population multiplied by the expected "non-poor" visit rate per person per year (e.g. 3.4 visits per person for residents aged 15-44, Table 3). The calculated ratio (satisfied demand divided by potential demand) is the Primary Care Service Index (PCSI, see Hypothesis #2, chapter 1), an indicator of the gap between potential demand and satisfied demand.

3.4.1 Data aggregation: Unit of analysis: CTG

Data was collected and organised by CTG by the researcher on the study variables poverty%, low birth-weight percent and counts of District physicians. Poverty data came from the census data for the District. Low birth-weight data came from the Department of Health's office which handles vital statistics (births, deaths, marriages and divorces) and other health systems data. Physicians data was collected by the researcher from three sources: The Government's Health Professional Licensing Administration (HPLA), the Washington Physicians Directory and finally, from a primary survey of active District physicians which was designed and conducted by the researcher working with the District's health Planning Agency and Office of Consumer and regulatory Affairs, now HPLA.

The unit of analysis in this study was Census Tract Groupings (CTG) which are aggregations of US census tracts for the District. There were 182 census tracts in the District of Columbia in 1980, 192 census tracts in the 1990 census, and 188 census tracts in the 2000 census. The person-level physicians data were aggregated by census tract then coalesced into Census Tract Groupings. Data aggregation diagram is shown below:

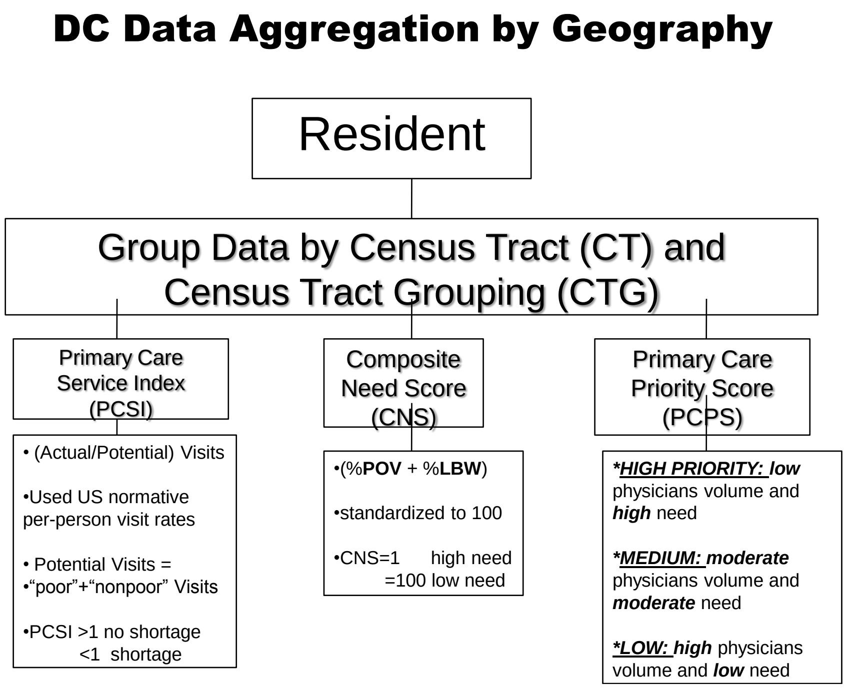


FIGURE 3.8: AGGREGATION OF POPULATION DATA (RESIDENTS) INTO SMALL AREA CTGS

Source: Researcher's own derivation

3.4.2 Physicians data

In 2004, there were a total of 9,694 physicians licensed to practice medicine in the District. Of this number, 3,179 or approximately a third (32.8 percent) had active practices within the District of Columbia. These 3,179 physicians constituted the study sample for this research in 2004, and 3,864 and 2,512 actively practicing physicians in the District constituted the sample for 1990 and 1985 respectively.

3.4.3 "Potential" and "Actual" or "Satisfied" primary care (physician) visits

Numbers of available full-time equivalent physicians (primary care and specialists) by census tracts were used to describe physician location and distribution in the District of Columbia. These actual numbers of available physicians was then be used to estimate the primary care physicians visits (satisfied demand). The difference between this satisfied demand and potential (total) demand constituted the "gap" or unmet demand for primary care visits.

The methodology described above was designed to produce two major products for this survey.

- The first product is sentinel-variables-linked, community-specific, primary care health status, physicians availability and visits data, of specific importance to the District of Columbia.

- The second product is an analytic process and approach which can be of general importance to health planners in the District of Columbia and in other cities in the United States with similar demographic and socioeconomic characteristics (Benbow 2007).

3.4.3.1 Data collection, data validity and reliability:
How data was assembled in order to apply the study methodology

In this study's Appendix is a copy of the combined data collection form designed and used by the researcher to collect data for this study from the five data collection sources used: the three governmental sources, the private physicians' directory source and the primary survey designed by the researcher. Validity of the data and the data collection process were both critically important to ensuring the integrity, comprehensiveness and accuracy of the study. The researcher used a data collection/data triangulation process to ensure maximum data validity and data reliability. The researcher collected data using three different methods: The three data collection methods included:

- Data collection from three valid and authorised governmental sources,
- Data from a credible private-sector physicians directory data source, and
- Data from the researcher's own primary survey data collection activity.

The three governmental data sources were the District's Department of Health HPLA, The Department of Health State Center for Health Statistics (SCHS) and the District's Office of Planning (DCOP). The actual sources of the physician data were the Health Professional Licensing Administration (HPLA), the Washington Physicians Directory and the survey of active District Physicians (see Appendix). The low birth-weight% data were collected from the State Centre for Health Statistics (SCHS) Vital Statistics Division. Both of these Departmental sources of study data are within the District Department of Health. The population data of District residents by age, gender, income and poverty level were collected from the District Office of Planning (DCOP), the repository of census data for the District.

First, data files on numbers of licensed, active and practicing primary care physicians and health and socioeconomic characteristics in the District of Columbia by census tract and Census Tract Grouping were collected by the researcher and organised, and linked to the other study variables, poverty% and low birth-weight%. These data files were used to facilitate the estimation of the following quantitative measures for the District of Columbia - primary care need, demand, and community-based primary care visits shortage areas which may be designated as priority areas for planning intervention. Second, after assembling data for the research from multiple sources, this study developed, tested and presented quantitative methods by *using a logical and systematic process* for analysing primary care data in an urban area such as the District of Columbia. This study covered the approximately twenty-year period from 1985 to 2004. Data was collected and analysed for three discrete time periods in this study: for 1985, 1992, and 2004.

3.4.4 Research design, data collection and data analysis methods

The research design used was a quantitative epidemiological study of cross-sectional data covering the study periods 1985, 1992 and 2004. The statistical methods used included univariate and multivariate analysis of the variables of the study data. Descriptive statistical procedures (frequencies, cross-tabulations, means, median, modes, measures of central tendencies, range, and minimum and maximum values) and inferential statistical tests on physician distribution and primary care visits (differences between group means, tests of statistical significance) and linear multiple regression modeling, are used in the study. The data gathering method consisted of assembling data from authoritative governmental and private, non-governmental sources. A primary data collection effort using a citywide physician survey was included and used as a tool for the modification and enhancement of manual and electronic physician data files.

3.4.5 Types of data and data files used

The types of data files collected and used in this study were as follows:

- 1. Physician Data:

The use of the term “raw data” in this section pertains to physician records which hat contained physical location addresses but no census tract information. Raw data file of active physicians licensed to practice medicine in the District of Columbia were obtained by the researcher for 1984, 1992 and 2004 from government files, from a primary survey effort and from a private-sector physicians’ directory source. This raw data was collected from the Health Professional Licensing Administration (HPLA) of the District of Columbia Department of Health. The data file as maintained by HPLA has one record per physician. Each record in this data file contained a business or medical practice address (location) for the licensed physician but did not contain census tract designations as per the U.S. Census bureau. For 1992, raw data from a survey conducted by the researcher working with the official government Office of Consumer and Regulatory Affairs was used.

Manually interactive and batch computer data entry was performed by the researcher in order to convert each address for each physician in the three, raw physician data files, to (a) US census tract for the District. The census tract data was then aggregated and linked by researcher and assigned to one of the eleven (b) Census Tract Groupings derived by this study. This conversion was necessary to allow for data organisation, sorting, maintenance and analysis by Census Tract Grouping.

The physician counts variable was calculated by the researcher using the newly-created, linked physician data files (with variables and values for census tracts, CTG and primary specialties). They were used to calculate estimates of primary care physician visits demand (potential visits, actual or satisfied visits) for each census tract and Census Tract Grouping in the District of Columbia.

The researcher's data collection survey instrument for collecting physician data (see Appendix) contained the following variables:

- Unique ID#/medical license number of physician
- specialty of primary practice
- specialty of secondary practice (if any)
- business address or location of primary practice
- business address or location of secondary practice (if any)
- number of hours worked at primary practice location
- number of hours per week worked at secondary practice location (if any)

The response rate for the physicians survey was quite high (over 90 percent) because almost all physicians desired to renew their medical licenses and thus took the time to complete and return the survey forms with their license renewal information.

To increase study data validity via data triangulation and cross-checking, physician data was also collected by the researcher from raw information in the annual publication: “Washington Physicians Directory” for the study years. These physician directories contained un-coded practice location/address and non-coded medical specialty physicians in the greater Washington metropolitan area, including the District of Columbia. The researcher cross-checked the three different physician data sources in order to compile a linked database of active, non-retired, practising physicians in the District. Researcher converted each practice address or location into a DC census tract, and then aggregated the census tract data into one of the eleven new DC Census Tract Groupings (CTG).

- 2. Poverty and Population Data

Data on population and poverty levels in the District for study years were obtained by this researcher by census tract from the DC Office of Planning, a US census data subsidiary office. Mean values for poverty levels were calculated for each Census Tract Grouping. In every decennial census, the U.S. Bureau of the Census collects data for each urban, suburban or rural area of the United States, on the number and percentage of persons who are at or below the poverty level, as defined using federal guidelines. The variable poverty% (percentage below poverty level) is one of the large number of variables collected by the US census in each decennial census on socioeconomic and demographic conditions for a given area in the United States. The District of Columbia Office of Planning is the official Census bureau liaison for census data on the District of Columbia. Mathematical methods were used to aggregate, then calculate, average values of percentage of persons at or below poverty levels for each Census Tract Grouping, for each of the study years. The procedure for generating the new Census Tract Groupings for the District of Columbia is described later in this chapter.

- 3. Low Birth-weight Data:

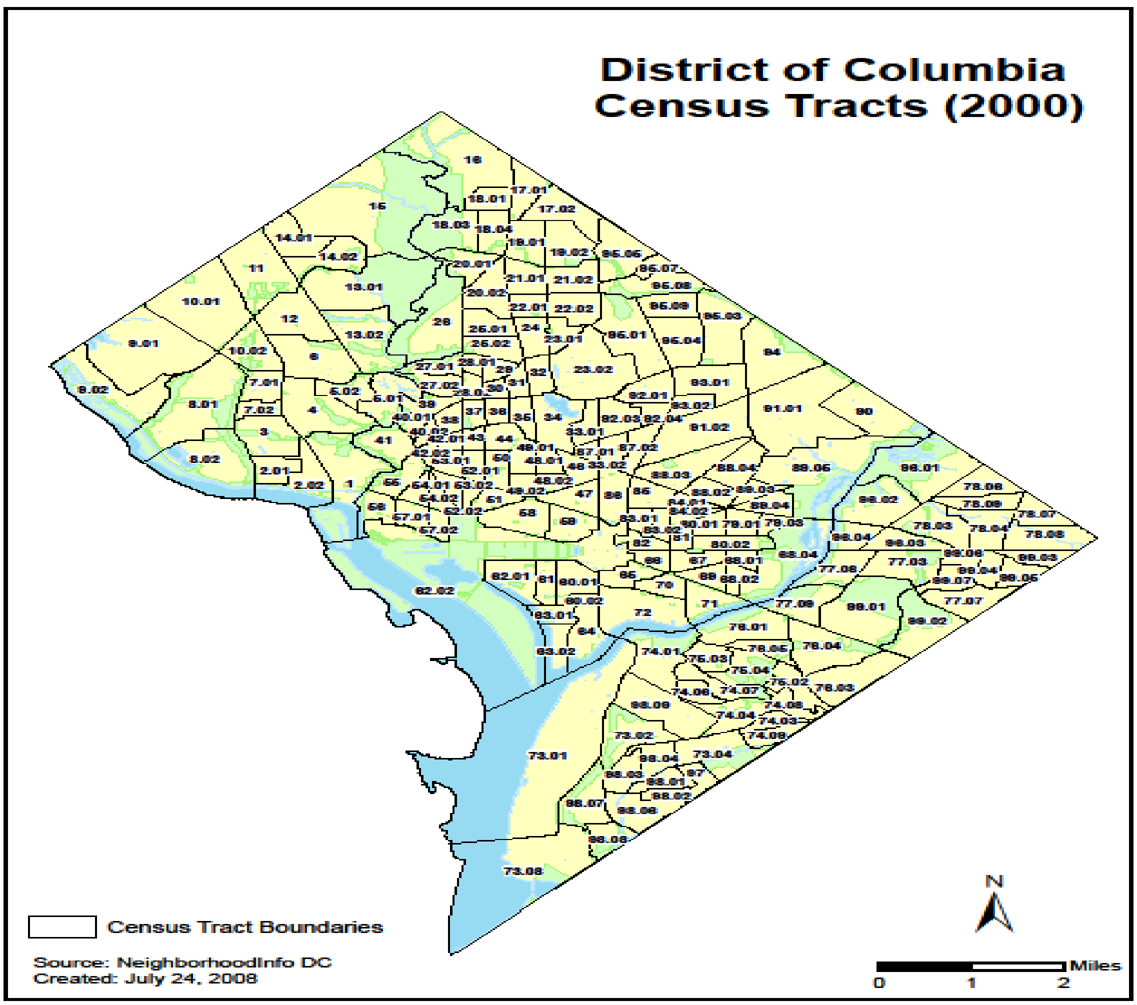
This data variable (low birth-weight%) by census tract was collected by researcher from the Department of Health's Center for Health Statistics, Vital Statistics Division. At least three years' worth of values of the variable for each census tract was collected, aggregated and averaged by researcher in order to obtain mean values for the periods 1980-1985, 1990-1992 and 2000-2004.

The study variable, percentage of live births that are of low birth-weight, is of critical importance and of great epidemiological interest. Taken together with data on infant mortality rates and other perinatal conditions, the overall health status of a given population, subpopulation or area can be described and compared. In this study, researcher obtained and aggregated data on the percentage of live births of low birth-weight by census tract for the District of Columbia, then generated aggregated, mean values by CTG.

Because of the need to overcome issues of statistical data instability for certain birth events, several years' worth of data were collected in order to obtain statistically stable rates for a given period, for events such as percentage low birth-weight births, and infant mortality rates. Thus the obtained percentages of low birth-weight live births for the District of Columbia for the three study periods (1985, 1992, 2004) were more stable and more reliable for statistical purposes.

3.4.6 Geographic Divisions of the District of Columbia

The District of Columbia, like most areas of the U.S., is broken down into small areas called census tracts by the U.S. Census Bureau for the purposes of conducting the decennial census enumerations of the population. Figure 3.9 below shows a map of the District of Columbia by census tracts as defined by the US decennial Census for the year 2000. These are the census tracts which were aggregated by this researcher into the eleven new Census Tract Grouping (CTG) areas:



Census tracts are useful for conducting small area analysis in a variety of settings including health and social services, business and commerce, etc. However, in conducting health services research in a city with the population and size of the District of Columbia, using 188 census tracts (in 2004), 192 (in 1990) and 182 (in 1985) could have led to a situation where, for certain sentinel health care events (like infant mortality or low birth-weight live births) the number of such events in a census tract could conceivably be too small (too few) and thus statistically unstable. Also, in health services planning and research the concept of rational service area is important, especially in primary care. In the District of Columbia, a close approximation to rational service areas are the eleven new Census Tract Groupings (CTG) developed in this study.

Rational service areas (RSA) is a concept used by the federal Health Resources and Services Administration (HRSA) and other state and local health planning entities in their application for and management of Health Professional Shortage Area (HPSA) & Medically Underserved Area (MUA) designations. Health professional shortage areas (HPSAs) and medically underserved areas (MUAs), established under the U.S. Public Health Service Act, are federal designations of a geographic area (usually a county or a collection of townships or census tracts) which meet the criteria as needing additional primary health care services. Designation as a HPSA or MUA is based on the availability of health professional resources within a rational service area.

The definition of a rational service area is usually based on a thirty-minute travel time, which can be useful in health care analysis and planning. Other factors considered in the federal HPSA designation process are the availability of primary care resources in contiguous areas and the presence of unusually high need, such as high infant mortality rate or high poverty rate. HPSA designations usually apply to geographic areas, but may apply to population groups and facilities. The Division of Shortage Designation, Bureau of Primary Care, Health Resources and Services Administration, Department of Health and Human Services is responsible for the designation process. The use of HPSA rational health service areas have certain limitations which this study's use of Census Tract Groupings as units of analysis sought to overcome.

3.4.8 Census Tract Groupings (CTG)

In this study of the District of Columbia, eleven Census Tract Grouping (CTG) areas were developed by this researcher and used to serve as rational units of analysis for the District. CTGs are close approximations to the federal government's criteria and definition of rational health service areas for health services planning and analysis.

For the years 1985, 1990, and 2000, the 182, 192, 188 census tracts respectively, in the District of Columbia, were logically grouped by this researcher into eleven (11) Census Tract Groupings based on clustering on four factor analysis variables conceptualized earlier by staff from DC Commission of Public Health's OHPD and OMCH offices and contractor, Koba Associates, Inc. Four factor analysis variables were used to create the 11 Census Tract Groupings for the District of Columbia. These four variables were obtained by using the statistical procedure, cluster analysis, on a large number of demographic and socioeconomic variables from the U.S. Census for all of the 182 census tracts in the District. The final four variables used to define the 11 Census Tract Groupings were:

- Housing density
- Ethnic mix
- Access to community health facilities, and
- Identity (of the community)

On the basis of these four variables it was observed that a collection of several small-area census tracts, generally between 11 and 20 census tracts, often clustered together identically. The following chart (Figure 3.10) summarises the eleven (11) new Census Tract Grouping for the District of Columbia:

DC: Census Tract Groupings (CTG) developed for the DCPC study

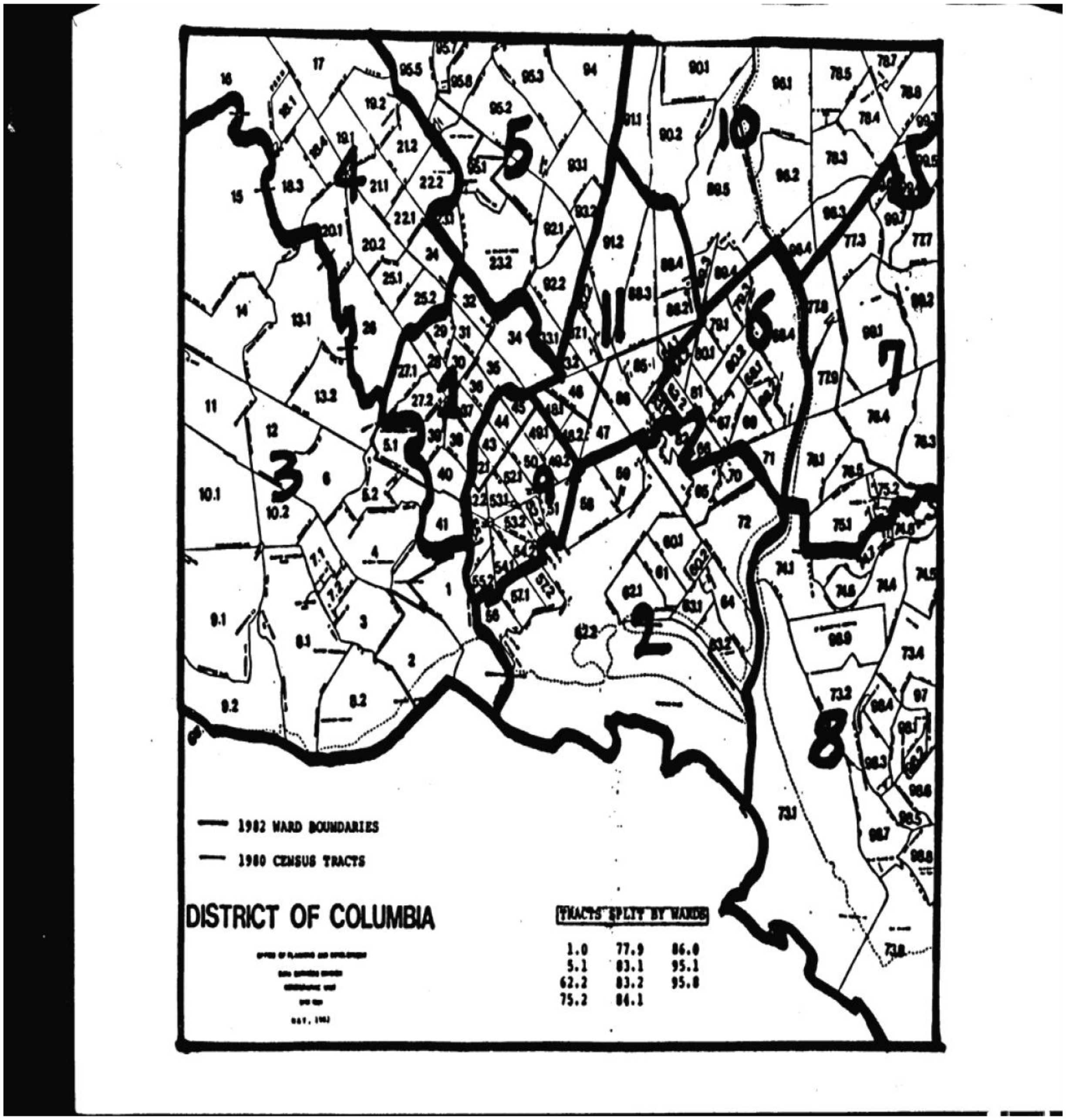


FIGURE 3.10: DISTRICT OF COLUMBIA CENSUS TRACTS GROUPINGS.

Source: Researcher's own derivation; DC CPH/OHPD, Koba Associates and DC CPH/OMCH criteria.

In Table 3.5 below, the four composite variables used to define the 11 CTG areas and the resulting eleven CTG areas, are shown:

TABLE 3.5: DERIVATION OF THE CENSUS TRACT GROUPINGS (CTG) USED IN THIS STUDY

CTG	HOUSING DENSITY	ETHNIC MIX	ACCESS TO NEIGHBOURHOOD HEALTH CENTERS (CPH / DCGH / PBC; & UNITY HEALTH CARE 2005)	COMMUNITY DENTITY
1	HIGH	HISPANIC & OTHER	ADAMS MORGAN NHC	ADAMS MORGAN, WARD1
2	HIGH BUT PRIMARILY MIDDLE TO UPPER CLASS	MIXED	SOUTHWEST NHC	SOUTHWEST & ADJACENT URBAN RENEWAL AREAS
3	LOW	MAJORITY WHITE	NONE	WARD 3
4	LOW	MIXED	NONE	WARD 4
5	LOW-TO-MODERATE	BLACK, AGING	WOODRIDGE NHC	BROOKLAND/MICHIGAN PARK/ FORT TOTTEN
	TOWNHOUSES	MIXED, BUT PREDOMINANTLY BLACK	CENTER 17, ARTHUR CAPPER NHC	CAPITOL HILL, WARD 6
7	MODERATE	BLACK	BENNING ROAD, EAST-OF-THE-RIVER 330 CLINIC	EAST-OF-THE-RIVER
8	HIGH	BLACK	ANACOSTIA NHC, CONGRESS HEIGHTS NHC	WARD 8/ANACOSTIA
9	HIGH	MIXED	“R” STREET NHC	DUPONT CIRCLE / SHAW
10	MEDIUM	BLACK	HUNT PLACE NHC, BENNING ROAD NHC	UPPER WARD 7, FAR NORTHEAST
11	HIGH	BLACK	WALKER JONES NHC	AREA CONSISTS OF THE LOWEST-INCOME PORTIONS OF WARD 2 & WARD 5

Source: DCPC Primary Care Study, Washington, DC, 2015; Commission of Public Health, OHPD Data Center, 1985; Maternal & Child Health Block Grant Plan & Grant federal submission; Koba Associates, Inc., 1984.

For the District of Columbia, the development and use of Census Tract Groupings (CTGs) in this study is potentially useful and significant.

3.4.8.1 Limitations in the applicability of Rational Service Areas (RSAs) and Health Professional Shortage Areas (HPSAs)

Certain limitations have been cited in the in the literature (General Accounting Office, T-HEHS-95-200, 1995) on the availability and use of geographical area definitions in efforts to increase the availability and allocation primary care resources to HPSA areas. CTGs can therefore be used in an attempt to overcome all or some of these limitations, in an urban setting.

To be designated a primary care HPSA, an area must be a rational service area and have a population-to-physician ratio of at least 3,500 to 1. HHS designates primary care HPSAs in one of three ways: (1) a general shortage of providers within a geographic area; (2) a shortage of providers willing to treat a specific population group, such as poor people or migrant farm-workers, within a defined area; or (3) a shortage of providers for a public or nonprofit facility, such as a prison or a hospital.

3.4.9 Using the data to calculate the three indices of primary care

A major contribution of this study to community health planning in the District of Columbia is the development, dissemination and potential mainstreaming of the analytical process and method for primary care need and demand estimations by small area as conducted by this researcher. Encouraging planners, policy-makers, and practitioners - to widely test and apply these data analysis methods to synthesize data on the need and demand for primary care in the District of Columbia – is a possibility. The analytic methods involved determining physician distributions by census tracts, estimating values for potential and satisfied primary care physician visits, calculating and comparing values for primary care service index, composite need scores, and primary care priority scores.

As discussed in the review of the literature in chapter 2, estimates of the demand for primary care were based upon the following:

- (a) quantification and comparison of the volume of primary care visits that exists or is "satisfied" in a given period (satisfied demand) in a small area of a community, and

- (b) calculation of estimates of the total or "potential" primary care visits that could or should exist in the same population.

In this study, the above two quantitative measures for primary care visits ("potential visits demanded" and "satisfied or actual visits" demanded) are used by this researcher, in the form of a mathematical ratio, to calculate the Primary Care Service Index (PCSI) for a census tract or Census Tract Grouping (CTG).

3.4.9.1 Primary Care service index (PCSI)

The four PCSI calculation formulas and steps (I to IV) and their relationship to the first three of the six (6) study hypotheses are shown in Figure 3.11 below:

Hypothesis # (H_):

I. Sum of (Population-based Primary Care Visits, For Poor, Non-Poor) = Total Population Demand for Primary Care Visits (Potential Demand)

II. (H_1): Total FTE Primary Care Physicians X Expected Productivity Visits Per Physician = Satisfied Demand (Visits)

III. (H_2): Primary Care Service Index (PCSI) = Satisfied Demand (B) / Potential Demand (A)

$$\text{Primary Care Service Index (PCSI)} = \frac{\text{Satisfied Demand (B)}}{\text{Potential Demand (A)}}$$

IV. (H_3): Potential Demand (A) – Satisfied Demand (B) = Unsatisfied Visits, or "Visits Gap" or "Unmet" Visits

= PRIMARY CARE VISITS SHORTAGE

FIGURE 3.11: FOUR STEPS (FORMULAS) FOR DERIVING THE PRIMARY CARE SERVICE INDEX (PCSI); (NOTE: PRIMARY CARE VISIT RATES ARE PER PERSON PER YEAR)

Source: Researcher's own derivation

In this study, it is important to note that the Primary Care Service Index (PCSI) values, by definition, have logical and intuitive meanings, as follows:

Low PCSI values mean that the supply of physicians is low in the community.
High PCSI values imply that a high volume of physicians exist in that community.

PCSI values mathematically range from a low of 0.0 to a maximum of 1.0 (or higher).

PCSI values are Categorised as follows, in Figure 3.12 below:

PCSI value (range)	PCSI designation (description)
0.0 – 0.24	Very low
0.25 – 0.49	Low
0.50 – 0.74	Medium
0.75 – 0.99	Medium high
1.00+	High

FIGURE 3.12: CATEGORISING PCSI VALUES

3.4.9.2 Composite Need Score (CNS)

In this study, Composite Need Score (CNS) is a calculated numerical value for a given small area and it has two components using socio-demographic and health status data:

1. Poverty/income variable (POV) using federal guidelines (e.g. as used in US census 2000), and

2. Low Birth-weight variable (LBW) calculated for a census tract or Census Tract Grouping by using 3-year or 5-year averages to ensure data stability.

The raw value for CNS was calculated by adding together the numerical poverty and low birth-weight values, obtained from the DC Office of Planning, the US Census Bureau and the D.C. Department of Health, respectively. These raw values were then standardised (from a raw summed value of 200 to a possible maximum score of 100.0). The standardised CNS scores were thus calculated by converting the raw CNS values to a scale of 1 to 100 percent.

The procedure for calculating the Composite Need Score (CNS) required that a value be calculated for each census tract for poverty (POV) and then for low birth-weight (LBW). Both rankings were then aggregated into Census Tract Groupings in order to obtain the CNS score for each CTG by adding the poverty percentage (POV) to the low birth-weight percentage (LBW) and then standardising the raw values. All of the census tracts were ranked on the basis of the standardised CNS scores from a low of rank 1 to a high of rank 188 (in 2004, for example, since for that year there were 188 census tracts in the District of Columbia).

The ranking of POV and LBW values by census tracts was done in descending order (of POV and LBW values). Each ranking thus indicated the relative ranking or position or importance of poverty and low birth-weight as a need factor for a census tract or Census Tract Grouping.

Figure 5 below illustrates the method used to calculate the Composite Need Scores.

CNS values must be interpreted with caution:

The CNS values have reverse meanings, thus a low CNS value means that a high need exists, and a high CNS value means that a low need exists in the respective community.

This is because standardised Composite Need Scores (CNS) were calculated on a percentage basis, ranging in values from 1 to 100. CNS values are obtained by adding up raw poverty values and low birth-weight values and standardising them to a maximum of 100. High poverty values (e.g. 88.5%) and high low birth-weight values (e.g. 70%) will both be in the first percentile. When standardised, the low percentile values will yield a low CNS value.

Thus a low CNS value implies a very high need in a small area community.

The CNS values are Categorised and classified in this study, as follows, in Figure 3.13 below:

CNS value (range)	**CNS designation (description)**
1.0 – 24.9	Very high (community) need
25.0 – 49.9	High need
50.0 – 74.9	Medium need
75.0 – 99.9	Low need

FIGURE 3.13 CATEGORISING RANGE VALUES OF COMPOSITE NEED SCORES (CNS)

PCSI values were also ranked and standardised.

An example of the processes in step 1 used for ranking and standardising the PCSI values are described in Figure 3.14 below:

Step 1:

Sample PCSI percentile calculations:

(used in derivation of PCSI)

(Numbers below are for illustrative purposes only)

CENSUS TRACT (N=182)	**% POVERTY**	**PCSI RANK**	**PCSI STANDARDISED**	**PCSI PERCENTILE**
X.XX	85.3 (very severe!)	1	1/182 = 0.005	= 1ST PCTL
Y.YY	83.9	2	2/182 = 0.005	= 1ST PCTL
Z.ZZ	80.2	3	3/182 = 0.016	= 1ST PCTL
A.AA	77.5	4	4/182 = 0.02	= 2ND PCTL
B.BB	70	5	5/182 = 0.027	= 3RD PCTL

etc ….

etc …. (perform the above steps for all 182 DC census tracts)

FIGURE 3.14: EXAMPLE: CALCULATING PERCENTILES FOR POVERTY AND LOW BIRTH-WEIGHT BY CENSUS TRACT WHICH WERE THEN USED AS STEP #1 IN CALCULATING VALUES FOR COMPOSITE NEED SCORE (CNS)

Source: Researcher's own derivation

After completing the calculations in Step 1 above, the next step (Step 2: Determining Percentiles for Low Birth-weight) was done similarly by converting the low birth-weight percentages to percentiles (for example, for the 188 census tracts in the District of Columbia in 2004).

The results of Steps 1 and 2 (percentiles for poverty and low birth-weight) were then used to calculate the Composite Need Scores, as shown in Figure 3.15 below:

Step 2:

Calculating CNS values by Combining Poverty and Low Birth-Weight Percentiles

(PCTL=Percentile; STND=Standardised)

(Numbers below are for illustrative purposes only)

CENSUS TRACT	**POVERTY (PCTL)**		**LBW (PCTL)**		**CNS RAW SCORES**	**CNS STND SCORE (TO 100%)**
A.AA	1.0 PCTL	+	12.0 PCTL	=	13.0	13/200 =6.5%
B.BB	2.5 PCTL	+	2.2	=	4.7	4.7/200=2.8%
C.CC	5.4 PCTL	+	95.0	=	100.4	100.4/200= 50.2%

etc …. (repeat the above calculations for all 182 DC census tracts)

FIGURE 3.15: EXAMPLE: CALCULATING THE VALUES FOR COMPOSITE NEED SCORE (CNS), BY CENSUS TRACT, BY COMBINING VALUES OF PERCENTILES FOR POV AND LBW (Source: Researcher's own derivation)

3.4.10 Primary Care Priority Score (PCPS)

Primary Care Priority Scores (PCPS) were produced in two steps:

(i)Cross-tabulating values of Composite Need Scores (CNS) for all census tracts or Census Tract Groupings with corresponding values of Primary Care Service Index (PCSI); and

(ii)Using the obtained cross-tabulation table to determine which census tracts or Census Tract Groupings have three levels of priorities, as follows:

- *high priority:*

low PCSI and high CNS (i.e. ***low*** physicians volume and ***high*** community need)

- *medium priority:*

  moderate PCSI and moderate CNS(i.e. ***moderate*** physicians volume and ***moderate*** community need)

- *low priority:*

  high PCSI and low CNS (i.e. ***high*** physicians volume and ***low*** community need)

3.4.11 How to interpret the primary care priority scores

	PCSI				
CNS	**1**	**2**	**3**	**4**	**5**
1	**HIGH**	**HIGH**	**MED**	**MED**	**MED**
2	**HIGH**	**HIGH**	**MED**	**MED**	**MED**
3	**MED**	**MED**	**MED**	**LOW**	**LOW**
4	**MED**	**MED**	**MED**	**LOW**	**LOW**

FIGURE 3.16 USING CROSS-TABULATION OF CNS AND PCSI VALUES TO DETERMINE AND TO CLASSIFY OF PRIMARY CARE PRIORITY SCORES - Source: Researcher's own derivation

From Figure 3.16 above, the following interpretations of the primary care priority scores can be noted:

CNS standardised values:

low values = high need;

high value = low need

PCSI standardised values:

low value = low physicians = high need

high value = high physicians = low need; therefore:

CNS categorical values 1, 2 and PCSI categorical values 1, 2

= **HIGH** primary care priority score

(PCSI=1=HIGH priority), and

CNS values 4, 5 and PCSI values 4, 5

= **LOW** primary care priority score

(PCPS = 3 = low priority).

PCPS value **2=medium** or moderate primary care priority.

3.4.12.1 Data analysis

The following software packages were used: IBM SPSS version 20 and Microsoft Excel 2010. Univariate and multivariate (inferential) statistics and methods were used in the analysis of the data.

3.4.12.2 How the six research hypotheses were tested

The six hypotheses (H_1 to H_6) of the research and how they were tested are presented in this section.

The six null hypotheses ($\#H_{01} = 0$ through $\#H_{06} = 0$) which guided the design, implementation and conduct of the study are listed below. This section describes how the hypotheses were evaluated and their results presented for each one of them. The research determined whether there was statistical significance, at the 95 percent confidence level, to reject (or fail to accept) the following null hypotheses:

H_{01}: The distributions of active physicians by specialty type and by census tract and Census Tract Grouping in the District of Columbia do not vary significantly.

One-Way Analysis of Variance (ANOVA) was the statistical test used to test the first hypothesis, H_{01}. In Chapter 1 of this study, six (6) research hypotheses were stated for this study. Figure 3.11 above links the analytic methods to the testing of the first three of the six study hypotheses. Referring to Figure 3, Hypothesis #1 (physician distributions and visit distributions do not differ significantly) was tested and the determination made whether to reject or not reject H_{01}, by calculating and examining values of potential (visits) demand and satisfied (visits) demand by census tract or Census Tract Grouping. Hypothesis #1 was tested by using equations (A) and (B) in Figure 3.11 above.

H_{02}: The primary care service index (PCSI) which is the ratio of primary care visits demanded ("potential demand") by the population to the primary care visits satisfied or available ("satisfied demand") does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Similarly, Hypothesis #2 (H_{02}) which was stated in chapter 1 is linked to Figure 3.11 above. Hypothesis #2 - ($H_{02:}$ the distribution of primary care service index, (PCSI) does not differ significantly within communities in the District) - was tested and the result was applied (to reject or not reject), the hypothesis. This was accomplished by using equation III in Figure 3.11 above.

H_{03}: The unsatisfied visits or "visits gap" in primary care does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Hypothesis #3 states that the unsatisfied visits or "gap" in primary care does not differ significantly by census tract/Census Tract Grouping in the District of Columbia. Subtracting primary care satisfied demand (equation II) from the primary care potential demand (equation I) produces values for the unsatisfied visits (or visits gap or unmet demand). Thus hypothesis #3 was tested – and the results used to reject or not reject it – by using equation IV in Figure 3.11 above.

Note: The remaining three hypotheses of the study (H_{04}, H_{05}, and H_{06}) were tested and the results were used to reject or not reject the hypotheses, as shown below:
H_{04}: The quantitative measure of "need" for primary care - "composite need score" – does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Hypothesis #4 states thus: 'The quantitative measure of need for primary care used in this study, "composite need score," does not differ significantly by census tract/Census Tract Grouping in the District of Columbia.' This hypothesis was tested by an examination of Composite Need Scores as shown in Figure 3.11above, for census tracts and Census Tract Groupings in the District, for 1985, 1990, and 2004.

H_{05}: There are no statistically significant differences among the values of the primary care priority scores (PCPS) calculated by census tract or Census Tract Grouping in the District of Columbia.

Hypothesis #5 states that: "There are no statistically significant differences in the values of the primary care priority score (PCPS) calculated by census tract or Census Tract Grouping in the District of Columbia." This hypothesis was tested by an examination of PCPS scores as described in the PCPS sections (3.4.11 and 3.4.12 above), for census tracts and Census Tract Groupings in the District, for 1985, 1990, and 2004.

H_{06}: The variables - primary care physician distribution, primary care service index, and composite need scores - acting alone or in combination, do not significantly predict the existence of a primary care "visits gap" by census tract or Census Tract Grouping in the District of Columbia.

Hypothesis #6 has two forms. The null hypothesis states that: "There are no identifiable variables used alone or in combination that can predict the existence of a primary care "gap" by census tract or Census Tract Grouping in the District of Columbia. The alternate hypothesis states that "using small areas in an urban setting, a multivariate predictive model can be developed using the variables primary care physician distribution, primary care service index, and composite need scores that can either act singly or in combination to significantly explain variations that exist in primary care visits "gap" in communities in the District of Columbia."

The above hypotheses (null and alternate forms) were tested for 2000-2005 by developing and testing alternative forms of at least two multiple linear regression equations. The dependent variables was primary care visits "gap" as calculated and tested in Hypothesis #3 above. The independent variables used were number of primary care physicians by census tract, percent of population below the poverty level, percentage of low birth-weights live births, and other variables. The proportion of variation of the visits gap that is explained by the independent variables in the equations was reported and their statistical significance was noted.

3.4.13: Analysis of the research objectives

The objectives of the research and the finding of this study as they relate to each one of the study objectives, were analysed. The research objectives analysed are listed together with the findings/determination:

1. To *identify critical variables* which impact on need and demand of primary care in the District:

   This objective was analysed via the three primary care indices – PCSI, CNS and PCPS. These indices were defined and calculated using the study data for 1984 to 2004.

2. To *develop an appropriate and rational geographical unit of analysis (CTG)* for describing the need and demand for primary care in the District which can assist planners in more effectively designing appropriate and cost-effective interventions for reducing primary care shortage areas.

This objective was evaluated via the aggregation of several DC census tracts into one of the eleven Census Tract Groupings (CTG) defined and used in this study. Data and results of DC primary care need and demand estimates were presented in this study by using the Census Tract Groupings the District for 1984 to 2004.

3 To *develop composite indices* for primary care data for the District using the selected sentinel variables and basing them on newly-conceptualized, newly-developed, rational geographic units of urban data analysis (CTG), which can be used to determine primary care need and demand estimates

This objective was analysed by examining the sentinel variables for the District – physician distributions, poverty rates and percent low birth-weights – and thus using them in the derivation of the three primary care indices (PCSI, CNS, PCPS) for the District for 1984 to 2004.

4 To *identify and delineate primary care shortage areas* for the District

This objective was analysed by examining the primary care shortage areas in the District that were identified in this study. This was accomplished by subtracting the calculated value of primary care visits available (due to presence of a certain number of physicians who provided primary care services to residents of that community) from the total (potential) primary care visits demanded by a small community (as determined by its need for services based on prevailing poverty and low birthweight percentages). The difference between potential demand (visits) and satisfied demand (visits) provided values for primary care visits shortages (or excess, as the case may be) for a given CTG.

5 To design a practical model for quantitatively analysing and describing primary care resources and outcomes in the District

This objective was analysed. The study provided new and expanded data, methods for analysing the data and practical geographic units of analysis (CTG) that can serve as a model for quantitatively analysing and describing primary care resources and outcomes in the District.

Findings related to the research questions are presented in Chapter 4 of this study.

3.5.1 Validity of the Data

In this as in most studies, validity is essential because it is the basis of drawing conclusions from the study. In a study with low validity, one cannot easily trust the conclusions of the research effort. Of particular concern is the fact that an investigation that has no external validity cannot be generalised to a wider population, as the results may have been produced merely by the circumstances of the research, the timing, the study sample or a confounding variable that produced the results. Internal validity is especially important, because without it a study's findings would be of little to no consequence. The researcher paid particular attention to efforts to improve the validity of this study.

Lincoln and Guba (1985) discourage the use of one source of data in an analytic or qualitative study. These authors recommend triangulation as a crucial element in this type of research. This study utilized data and data sources triangulation by using other sources or methods of gathering data to validate information collected from any one study source. This process served to check reliability of data collected. For example, the 1992 citywide physician survey used in this study compared the database of active physicians (available from OCRA and HPLA) to the physician survey responses obtained from the physician survey questionnaires and also to the listing of physicians collected from the publication "Washington Physicians Directory, 1992". This data triangulation and cross-checking process helped this researcher to demonstrate the existence of data validity for the study's physician data. Using a singular data source was avoided because it has the potential to introduce bias into a researcher's interpretation of information gathered. In addition, by using contrasting data sources, additional supports may be garnered to buttress a researcher's findings. This helped to develop confidence within the researcher as documented by Cohen and Manion, 1980.

Interpretation and analysis of data gained through triangulation are more reliable than that gathered from a single source.

The validity of this study's data was attested to since all the data was obtained from manual and online governmental authorities and sources that are officially published, publicly-available and are subject to secondary and independent data verification processes. As previously stated, the physicians, poverty and health status data were gathered from authoritative and official governmental sources: the Department of Health/Health Professional Licensing Administration (HPLA physician data), the State Centre for Health Statistics Administration CSHSA (percent low birth-weight data), and the District of Columbia Office of Planning's State Data Center DCOP (census population data and poverty data by census tract).

3.5.2 Originality of the Data

The data files created and used by this researcher for this study were original data file containing variables such as CTG that had never existed before prior to this study. Researcher's data also had CTG-linked community health indices-physicians-LBW%-poverty variables that, for the District, had not been linked across domains (health-demographic-physicians-geography) prior to this study. The researcher assembled raw, unlinked data then linked them by census tract and CTG then and verified the linked data by using secondary data sources. For example, the physician data file manually culled from "The Washington Physicians Directory was cross-checked with entries of physicians in the yellow pages of the Washington, D.C. telephone directory. Also, data on physicians and their primary and secondary practice locations, collected via the survey data collection effort (using the DC Physician Licensing survey questionnaire/data instrument) was cross-checked and validated using physician licensure data records from the Health Professionals Licensing Administration (HPLA).

The linked physicians, CNS, PCSI and priority score data files assembled and linked by census tract and CTG in this study were new, original files. The reasons are as follows:

(i) the 1985 and 1990 census-tract-based physician data files did not exist prior to this study.

(ii) the raw, unlinked HPLA physician data files for year 2004 were linked by researcher to census tracts and CTGs using valid and proven tools published by the U. S. Census Bureau. For example, the medical practice/business location addresses of District-licensed physicians obtained from the HPLA were converted by this researcher to census tract designations using a reliable and tested census tract conversion algorithm developed and published by the U.S. Census Bureau. This interactive and technological tool is called "Street Locator" and is located via the US Government's Census Bureau American Fact-Finder website, published for use by researchers and planners.

The technological tool used by this researcher to convert DC physicians' practice addresses into census tracts (and thence, into the eleven new CTGs) was the "Address Search: Find Census data by entering a street address" online tool which is located at: http//factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?ref=addr&refresh=t (available as of latest researcher access on 25 January 2015).

The US Census Bureau's interactive "Street address" tool, above, was used in conjunction with another more powerful, computerized, batch file processing tool available from a web/cloud-based application made available to the public and to researchers by the DC Office of The Chief Technology Officer (OCTO). This tool is called "MAR Geocoder".

Used together, these two tools enabled the researcher to geocode all of the addresses of all physicians who practiced medicine in communities in the District.

3.5.3 Limitations of the Data

This study has certain limitations.

The development of the census tract-based active physician data files for the District for 1985, 1992 and 2004, in this study, was a first of its kind. A resultant limitation is that there are no physician data files organised by Census Tract Grouping that can be used as a basis for comparison. The files developed for this study were original, first-of-its-kind. By using the research methods ad approaches described above, the researcher, in this study, has created innovative tools to facilitate then development of new health planning indices, PCSI, CNS and PCPS, which are updateable, useful and practical.

Due to the inordinate amounts of time needed to convert thousands of individual street addresses to census tracts (using batch as well as one-by-one single, interactive address data entry and data conversion algorithm available via the U.S. Census Bureau's "American Factfinder" tool) few to no researchers in the District other than this researcher have been willing or able to create similar, time-consuming, CTG-based physician location-low birth-weight%-and poverty% community-specific data files. This researcher has thus made an original and valuable contribution to primary care planning and analysis in the District of Columbia.

A second limitation of the data was that it involved, by design, only a few sentinel data variables (physician distributions, poverty levels, low birth-weight live-births). This was necessary for simplicity and to give a specific focus to the research design – thus should not be viewed strictly as a data limitation. Although there are other variables that are available to increase the power of the predictive models and to increase the proportion of variation in the dependent variable (primary care visits "gap") that is explained by the independent variables (physician distribution, medical specialty, percent poverty, and percent low birth-weight births), the researcher chose to narrow the study focus by selecting a limited number of few study variables (primary care indices, physician counts, poverty%, low birth-weight% and CTG).

Decreasing the potential impacts of study limitations and maximizing ethics and integrity of the study was a paramount concern. Particular emphasis was placed on ethical considerations. This researcher adhered to strict ethical study guidelines:

- by protecting the rights of the participants,
- by protecting the rights of participating departments and agencies, and
- adhering to published scientific research integrity standards and guidelines.

3.6 CHAPTER SUMMARY

This chapter described and provided details about the research paradigm (epidemiological, quantitative study), research design (non-experimental, correlational, model-testing, descriptive, comparative descriptive) and research dimensions (empirical, cross-sectional analysis) for this study. The data files, quantitative tools and analytic methods - statistical procedures, tests and comparisons - used in this study of primary care need and demand estimations for the District of Columbia, were described and an approach was presented for the analysis and evaluation of the study’s six research hypotheses. The data, data sources and data collection methods to drive the primary care need and demand estimation methods were outlined. Issues of data and study validity and reliability were addressed and steps to maximum data validity, reliability and accuracy were stated. The original contribution to primary care literature and practice made by this study was elaborated upon. The benefits of this research for the District of Columbia’s “Five P’s” - policymakers, planners, physicians, practitioners, and the public – were enunciated.

This chapter described how and why organising and analysing data by Census Tract Groupings, as defined in this study, is systematic, logical, practical and useful. The methods and analytic tools used in this research have provided a framework for future data analysis and further study on more complex issues concerning the District's primary care system. This chapter has elaborated upon why planning for, and attainment of, health care equity in urban areas like the District of Columbia that have large segments of indigent and economically disadvantaged persons living on the margins with barely adequate health status, is possible using the data, tools and methods presented here. Detailed findings of the study are presented in the next chapter (Chapter 4).

CHAPTER 4

ANALYSIS, PRESENTATION AND DESCRIPTION OF THE RESEARCH FINDINGS

I 4.1 INTRODUCTION

The previous chapter (chapter 3) addressed the research design and methods employed in the study. The current chapter addresses the analysis, presentation and description of the research findings using detailed data tables and figures. In this chapter, the data analysis conducted - detailed univariate, bivariate, trend analysis as well as multivariate statistical analyses, procedures, and methods - and their results (statistical and interpreted) are presented on primary care for the District of Columbia for the periods 1984-1985, 1990-1992, and 2000-2004. The data analyses were conducted by the researcher using the following two personal computer windows-based software packages: Microsoft Excel 2010 and IBM SPSS, version 20. *The goal for this study was to attempt to answer the question: for the District, can the variables - percent of residents at or below the federal poverty level, percent of births which are of low birth-weight, and specialties, types and location of District physicians, be organised by new Census Tract Groupings (CTG) - which are original contributions of this study - in order to create new primary care indices and delineate primary care visits shortage areas?* This chapter will present data and findings which relate the goal of the study to the study variables and to the research objectives. It will also address the six study hypothesis as originally stated in chapter 1.

In addition to presenting research results for the District for the period 1985 to 2004, this chapter will also compare and contrast study findings with other studies such as the District of Columbia Board of Medicine's finding that there appeared to be a plentiful supply of physicians in the District and shortages of primary care practitioners (DC BOM 2013:1-5). In this chapter, data and findings are presented by citywide (DC) totals and means as well as by CTG totals and means for the linked study variables (poverty%, low birth-weight%, physicians and visits) – the study variables used to derive the primary care indices (PCSI, CNS and PCPS). The tables and figures presented in this chapter were introduced and explained in detail in the Methods chapter (chapter 3).

The following sections will present Tables and Figures for the following:

- Results from using multivariate models (multiple linear regression) as described in chapter 3 (Methods) to estimate significant and non-significant predictors of primary care need and demand (visits) for the District of Columbia for the study period 1985 to 2004
- Total and primary care physicians, citywide and by CTG
- Profiles of poverty and low birth-weight, citywide and by CTG
- Values and scores of the primary care indices – PCSI, CNS and PCPS
- Visits demanded, visits satisfied and primary care visit shortages by CTG
- Physician profiles and distribution in the District by CTG
- Trends in physician distribution and primary care indices over the study period
- Primary care visits shortages and priorities in the District during the study period.

In order to provide an audit trail for the analysis of the study data for the District for 1985 to 2004, relevant copies of the statistical program (IBM SPSS) outputs obtained from the analytical procedures are provided in the Appendix to this study.

4.1.1 Overall, major findings (total physicians and primary care physicians available)

Data and findings for this study will be presented to align with the six research hypotheses which were stated in chapter 1. The research hypothesis H_{01} for this study concerned making a determination as to whether the calculated active total physicians counts and active primary care physician counts differed significantly by CTG for the District. This section provides findings of the study by physicians and CTG. To evaluate Hypothesis H_{01}, values of active physicians by CTG for the District were calculated and compared for study periods 1984-1985, 1990-1992 and 2004-2005. Hypothesis H_{01} states the following:

H_{01}: The distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia.

Finding: Overall, a major finding of this study is that from 1985 to 2004, primary care physicians represented a *declining* proportion of all physicians who practiced in the District. From 1985 to 2004, the District's total physicians rate per 100,000 population by Census Tract Grouping (CTG) was found to be statistically significant (Sig.=0.023, df=10). Total physician counts increased in the District from 1985 to 2004 even as the percent of primary care physicians declined. Thus, one finding is that the District of Columbia appears to continue to be a city with an abundant supply of total physicians who practice medicine within its boundaries although their distributions differ by CTG.

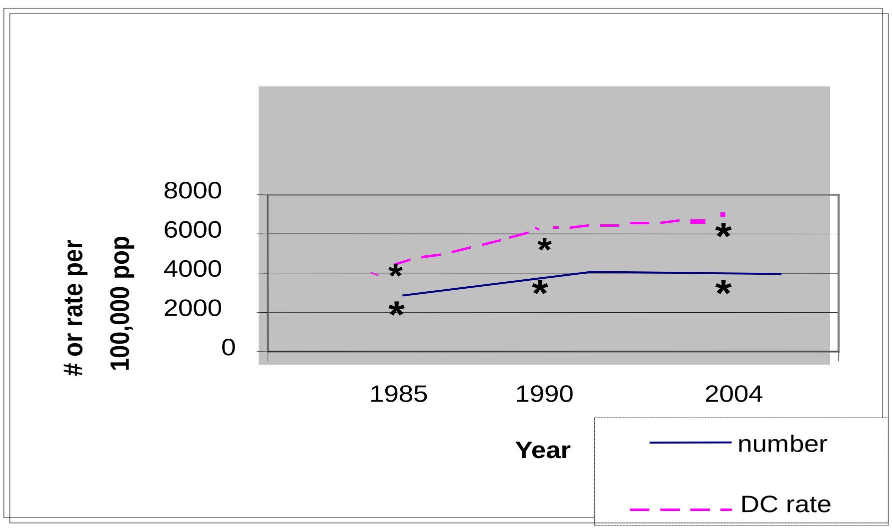


Figure 4.1: Number of active DC Physicians and rate per 100,000 population, Washington, DC, 1985 to 2004

The rationale for analysing physician distributions by CTG was to garner evidence to reject or not to reject null hypothesis H_{01} that the distributions of physicians by CTG did not differ significantly from city means. Frequency distributions and cross-tabulations were performed on study variable DC physicians in order to compare DC non-primary-care physicians and DC primary care physicians from 1985 to 1992 to 2004. Figure 4.1 above shows that the ratio of physicians per 100,000 population for the District of Columbia increased from 3.98 (in 1985) to 6.19 (1990) and to 6.74 (2004). The study found that on a citywide basis, there were increasingly more *total physicians* available to the District for every 100,000 population residents during each of the three study periods.

Comparisons of DC physicians per 100,000 ratios were also done for the eleven newly-created CTG areas. The study found that physicians were heavily concentrated in three sections of the District – in CTG 11, 3 and 5 respectively. Figure 4.2 below shows that, for 2004, the ratio of physicians per 100,000 population for the District were highest, in decreasing order, for CTG areas 11, 3, 5 and 9 and lowest, also in decreasing order, for CTG areas 2, 4, 1, 10, 8 and 7. For the year 1985, the ratio of physicians per 100,000 population for the District were highest, again in decreasing order, for CTG 9, 2, 5, 3 and 1.

As is shown in Figure 4.2 below, four of the eleven new Census Tract Groupings in the District of Columbia experienced substantial increases in the number of physicians per 1,000 population between 1985 and 2004, the study period. These were CTG 3 (from 6.42 to 58.5 per 1,000 population), CTG 5 (from 6.77 to 44.4 per 1,000 population), CTG 9 (from 17.1 to 31.2 per 1,000 population), and CTG 11 (from 0.32 to 79.8 per 1,000 population).

Thus, a finding of this study is that the District's ratio of physician availability when cross-tabulated by CTG, differed significantly from the overall city means, by CTG and by year, for the study period 1985 to 2004.

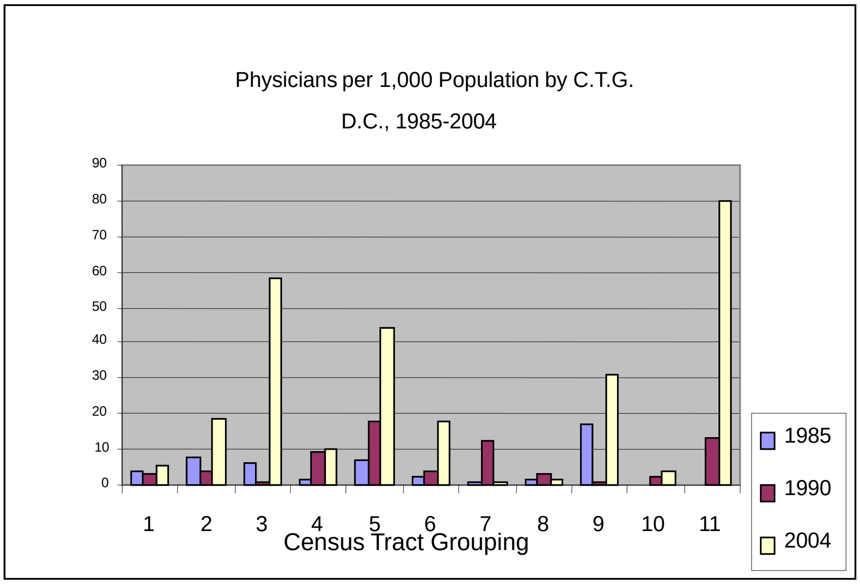


Figure 4.2: Physicians per 1,000 Population by CTG, Washington, D.C., 1985 to 2004

In summary, the above analysis of study hypothesis H_{01} provided sufficient evidence to reject null hypothesis H_{01} that total active physician counts and primary care physician counts did not differ significantly by CTG for the District of Columbia. This study thus leads the researcher to assert that the distributions of the *study variable, active physicians*, by specialty type differ significantly by census tract and Census Tract Grouping in the District of Columbia for the study period 1985 to 2004.

4.2 PRESENTATION OF FINDINGS BY CENSUS TRACT GROUPINGS

The researcher, in this study, created and used eleven new units of analysis called Census Tract Groupings (CTG) for the District, something which has not been done before. These newly-created CTGs for the District were used in all phases of the data analysis for this study and to analyse all of the six hypotheses of the study. The use of Census Tract Groupings (CTG) as units of analysis for primary care data for the District of Columbia was feasible and yielded useful planning and analysis information. CTGs were developed by the researcher specifically for his study and are a new contribution to the literature and practice of primary care in the District of Columbia. As discussed in the Methods section (chapter 3), in this study, each DC Census Tract Grouping was constituted to contain an amalgamation of between 11 and 18 smaller US census tract areas. This aggregation created CTGs with larger population of residents than the constituent individual census tracts. This study is the first time, according to a review of the existing literature, that data analysis findings for the District have been presented by Census Tract Groupings (CTG). As can be seen from a review of the literature on the District, most or all of previous research and data analysis conducted by and for the District aggregated and compared data by DC Wards or Neighborhood Advisory Councils (ANCs) or other legislative or administrative boundaries, which are political and judicial boundaries and are not rational service areas as defined by the US DHHS/HRSA.

Almost all the findings in this chapter are presented by the researcher using Census Tract Groupings (CTG) and on some occasions, by census tracts. One objective of this study was to facilitate and promote the use of the Census Tract Groupings for analysis and planning, as a useful alternative to the political Ward boundaries. This study achieved that objective. The following questions are answered by reference to the study findings:

What are the D.C. Census Tract Groupings (CTGs) and how were they constructed? As shown in the Methods section (chapter 3), Figure 4.3 below summarises the development and rationale for the eleven Census Tract Groupings for the District of Columbia. The definitions and derivation of the eleven CTGs were based on factor analysis and clustering of the following geographic variables:

- housing density,
- ethnic mix,
- access to neighbourhood health centres, and
- community identity.

Figure 4.3 below shows the eleven, new CTGs for the District of Columbia based on the above four aggregation criteria:

CTG NO.	**HOUSING DENSITY**	**ETHNIC MIX**	**ACCESS TO NEIGHBORHOOD HEALTH CENTERS**	**COMMUNITY IDENTITY**
1	HIGH	HISPANIC & OTHER	ADAMS MORGAN NHC	ADAMS MORGAN, WARD1
2	HIGH BUT PRIMARILY MIDDLE TO UPPER CLASS	MIXED	SOUTHWEST NHC	SOUTHWEST & ADJACENT URBAN RENEWAL AREAS
3	LOW	MAJORITY WHITE	NONE	WARD 3
4	LOW	MIXED	NONE	WARD 4
5	LOW-TO-MODERATE	BLACK, AGING	WOODRIDGE NHC	BROOKLAND/MICHIGAN PARK/ FORT TOTTEN
6	TOWNHOUSES	MIXED, BUT PREDOMINANTLY BLACK	CENTER 17, ARTHUR CAPPER NHC	CAPITOL HILL, WARD 6
7	MODERATE	BLACK	BENNING ROAD, EAST-OF-THE-RIVER 330 CLINIC	EAST-OF-THE-RIVER
8	HIGH	BLACK	ANACOSTIA NHC, CONGRESS HEIGHTS NHC	WARD 8/ANACOSTIA
9	HIGH	MIXED	“R” STREET NHC	DUPONT CIRCLE / SHAW
10	MEDIUM	BLACK	HUNT PLACE NHC, BENNING ROAD NHC	UPPER WARD 7, FAR NORTHEAST
11	HIGH	BLACK	WALKER JONES NHC	AREA CONSISTS OF THE LOWEST-INCOME PORTIONS OF WARD 2 & WARD 5

Figure 4.3: Criteria for Census Tract Groupings (CTG) used in this study.

The census tracts compositions of the eleven *new* CTGs are shown in Figure 4.4 below. Figure 4.4 showed that for the District of Columbia, aggregation of smaller census tracts into larger Census tract Groupings (CTGs) on the basis of the four geographic clustering variables - housing density, ethnic mix, access to neighbourhood health centres, and community identity - was possible thus resulting in the creation of *new* rational service areas for the District.

CTG	Component D.C. Census Tracts
1	29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 41, 27.01, 27.02, 28.01, 28.02, 40.01, 40.02
2	56, 58, 59, 61, 64, 65, 70, 72, 82, 57.01, 60.01, 60.02, 62.01, 63.01, 63.02
3	1, 3, 4, 6, 11, 12, 15, 2.01, 2.02, 5.01, 5.02, 7.01, 7.02, 8.01, 8.02, 9.01, 9.02, 10.01, 10.02, 13.01, 13.02, 14.01, 14.02
4	16, 24, 26, 17.01, 17.02, 18.01, 18.02, 18.04, 19.01, 19.02, 20.01, 20.02, 21.01, 21.02, 22.01, 22.02, 25.01, 25.02
5	94, 23.01, 23.02, 33.01, 92.01, 92.03, 92.04, 93.01, 93.02, 95.01, 95.03, 95.04, 95.05, 95.07, 95.08, 95.09
6	66, 67, 69, 71, 81, 84.01, 68.01, 68.02, 68.04, 79.01, 79.03, 80.01, 80.02, 83.02
7	75.02, 75.03, 75.04, 76.01, 76.03, 76.04, 76.05, 77.03, 77.07, 77.08, 77.09, 99.01, 99.02, 99.05, 99.06, 99.07
8	97, 73.01, 73.02, 73.04, 73.08, 74.01, 74.03, 74.04, 74.05, 74.06, 74.07, 74.09, 98.01, 98.02, 98.03, 98.04, 98.06, 98.07, 98.08, 98.09
9	43, 44, 50, 51, 55, 42.01, 42.02, 49.01, 49.02, 52.01, 52.02, 53.01, 53.02, 54.01
10	90, 78.03, 78.04, 78.06, 78.07, 78.08. 78.09, 89.03, 89.04, 91.01, 96.01, 96.02, 96.03, 96.04, 99.03, 99.04
11	46, 47, 85, 86, 33.02, 48.01, 48.02, 83.01, 84.02, 87.01, 87.02, 88.02, 88.03, 88.04, 91.02

Figure 4.4: Component census tracts for each of the eleven DC Census Tract Groupings (CTGs) used in this DCPC Study for the District of Columbia, 1985, 1992, 2004

4.3: WARDS – POLITICAL, GEOGRAPHIC DIVISIONS IN THE DISTRICT OF COLUMBIA

To determine whether or not to reject research hypothesis H_{01} - whether total active physician counts and primary care physician counts in the District differed by geographic area - comparisons could be made by DC Wards or by CTGs. In this study, CTGs (rational health service areas) were used and DC Wards (political boundaries) were not used. This study was designed to make a new contribution to the literature of community health planning in the District of Columbia by encouraging the use of the concept of Census Tract Groupings, not DC Wards, as rational health and social services service areas, for community-based planning and analysis activities. Hence, data and findings by DC Wards, the more commonly used unit of analysis, were not presented in this study. Many reports and studies published by the District of Columbia government and others provide data by DC *"Wards."* These "W*ards*" (there are eight of them, named Ward 1 to Ward 8) are political divisions of the District of Columbia for voting and legislative purposes. Six of the District's eight wards are not "rational" health service areas;

To present a visual aid to complement the presentation of study findings in this chapter, maps of the District overlaying DC Census Tract Groupings and DC Wards are shown below. The maps of the District shown below are: map of the District of Columbia by Ward showing major thoroughfares, map by Ward showing component census tracts, map by census tracts only, and map by Census Tract Groupings showing component census tracts. These maps are shown below (see Figures 4.5(i), 4.5(ii), 4.5(iii) and 4.6 below). It is worth mentioning that two of the eight DC Wards approximately align to CTGs as rational service areas (Ward 3 aligns to CTG 3 and Ward 8 aligns to CTG 8).
Data and trend analysis findings over the twenty year period from 1985 to 2004 are presented in the following sections. Results are presented for the District of Columbia as a whole, then for the newly-created, eleven Census Tract Groupings (CTGs) (and occasionally by the smaller census tracts) in the District. One of the aims – and original contribution - of this study, CTGs, is illustrated in Figure 4.6. This map shows the eleven new Census Tract Groupings (CTG) and their component census tracts. These CTGs are rational service areas for health data analysis and planning, especially for discussions involving primary health care. The maps shown below are as follows:

Figure 4.5(i):	Map of DC by Wards (political boundaries) showing major thoroughfares
Figure 4.5(ii):	Map of DC by Wards (political boundaries) and census tracts
Figure 4.5(iii):	Map of DC by census tracts only, 2000
Figure 4.6:	Map of DC by Census Tract Groupings (rational health service areas) and census tracts

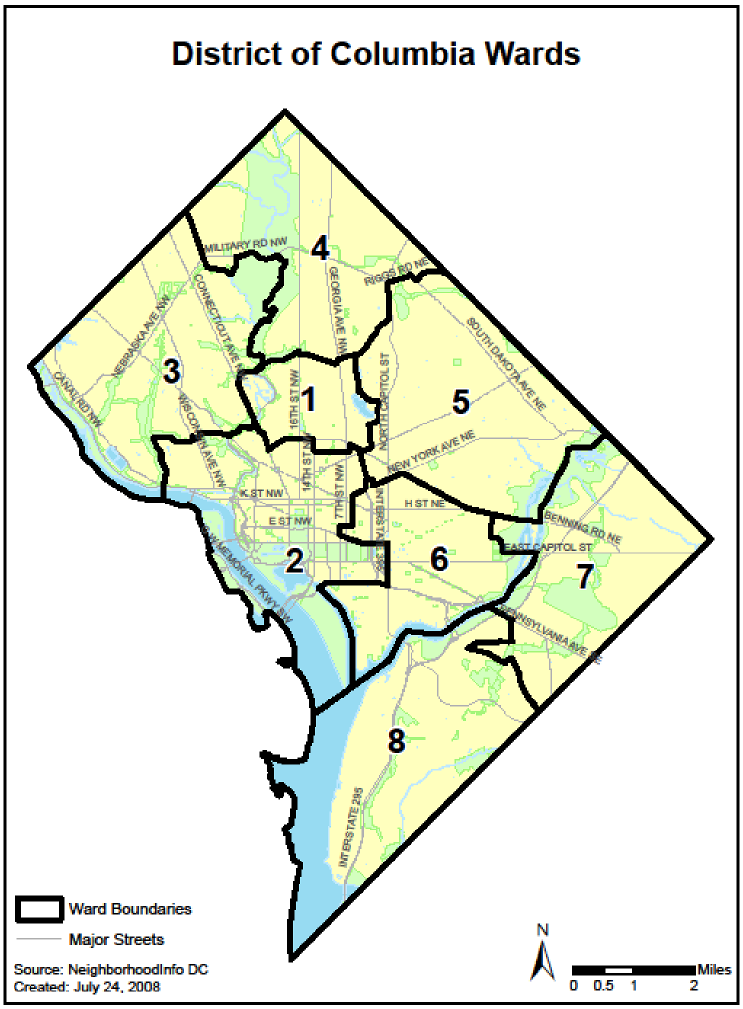


Figure 4.5(i): Map of DC by Wards (political boundaries) showing major thoroughfares

Source: NeighbourhoodDC, 2008

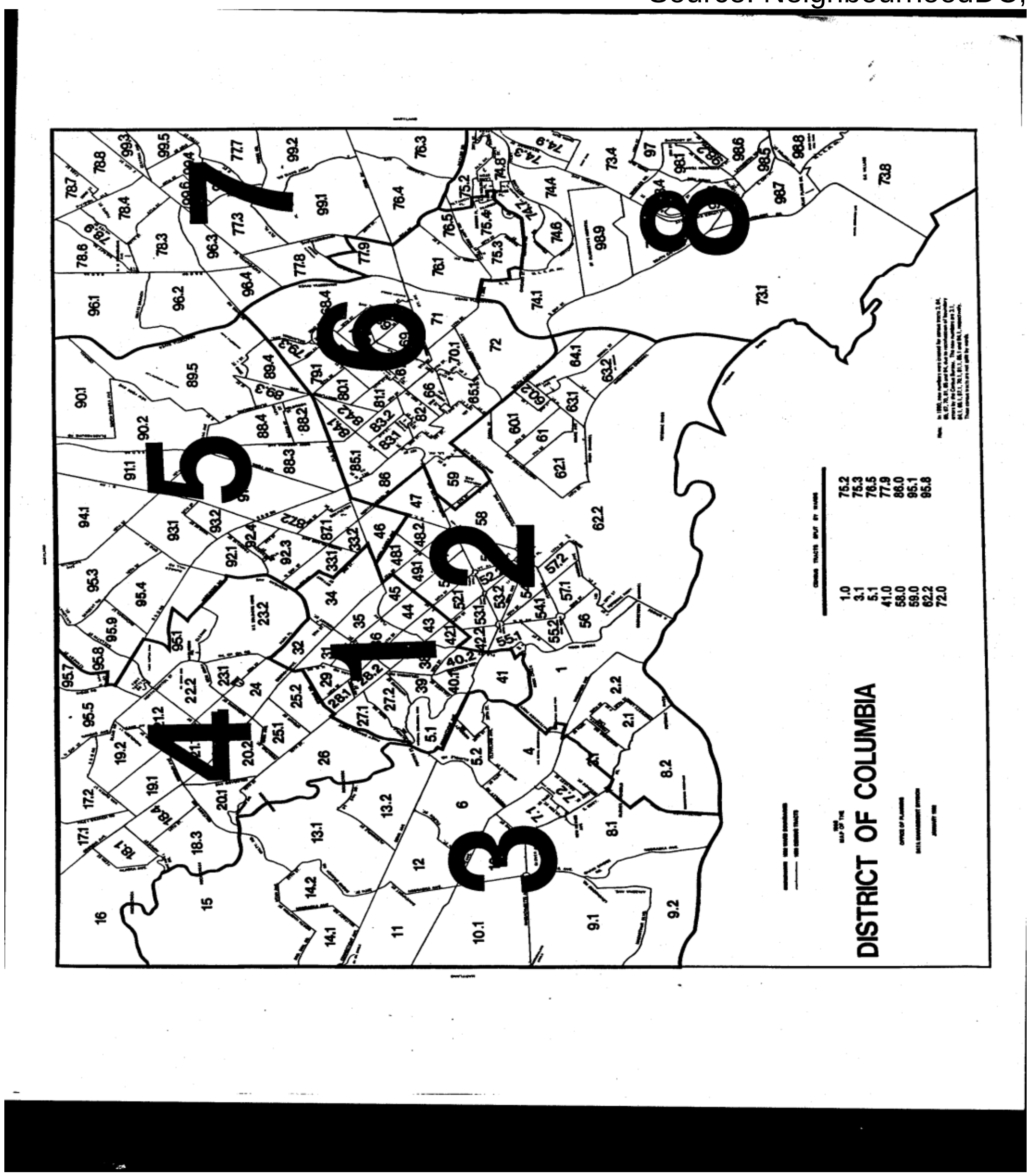
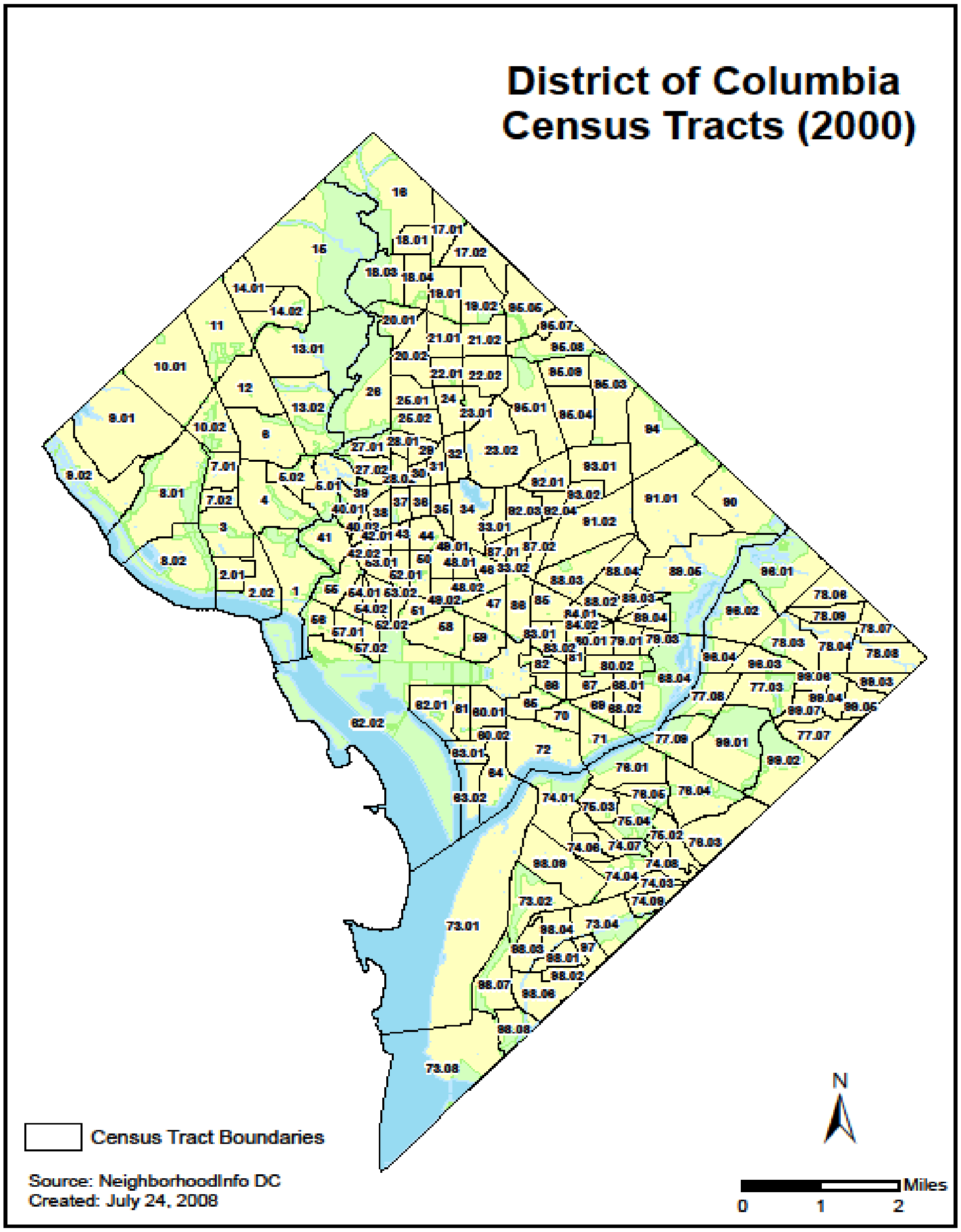


Figure 4.5(ii): Map of DC by Wards (political boundaries) and census tracts, 2000


District of Columbia
Census Tracts (2000)
Census Tract Boundaries
Source: NeighborhoodInfo DC
Created: July 24, 2008
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Miles
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1
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(above) **Figure 4.5(iii): Map of DC by Wards (political boundaries) and census tracts, 2000**

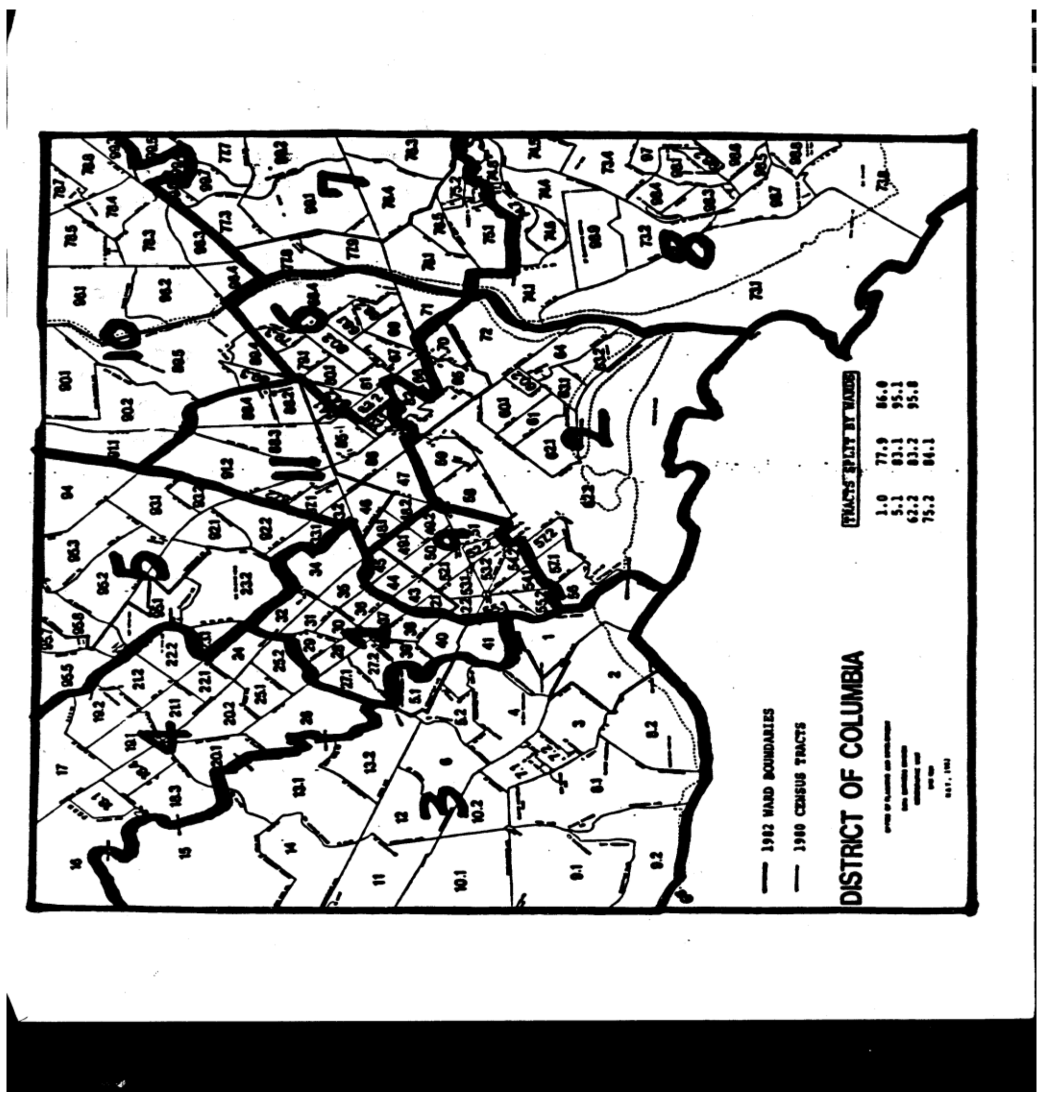


Figure 4.6: Map of DC by Census Tract Groupings (rational health service areas) and census tracts

Source: DCPC Primary Care Study, 1985-2004.

4.4 FINDINGS: MULTIVARIATE ANALYSIS - USING MULTIVARIATE MODELS TO ESTIMATE SIGNIFICANT AND NON-SIGNIFICANT PREDICTORS OF PRIMARY CARE VISITS NEEDED

4.4.1 Multiple Linear Regression Modeling:

Introduction

The researcher performed multiple linear regression using study variables in order to evaluate the following study hypothesis:

> H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care “visits gap” by census tract or Census Tract Grouping in the District of Columbia.

Multiple regression analysis was conducted to attempt to predict dependent variable visits needed using all of the 64 independent variables of this study, with a view to eliciting how the sentinel study variables – poverty%, low birth-weight%, physicians supply and location, and the new Census Tract Groupings (CTG) – would fare . Three new composite primary care indices (PCSI, CNS and PCPS) were developed by this researcher using the study variables (poverty%, low birth-weight%, physicians supply and location, physician visits and location). As described and explained in detail in chapter 3 (Methods), the 3 indices were then used to calculate the number of primary care visits shortages and variable: *visneed,* the *additional* primary care visits needed to serve residents. In this section, the *new variables* generated by the researcher (CTG, PCSI, CNS and PCPS) and *the original raw data variables:* poverty%, low birth-weight%, physicians supply and location - which were collected by the researcher from governmental sources using the researcher’s data collection instruments (see Appendix) - are analysed for the District of Columbia using multiple linear regression.

The researcher developed and tested several multiple linear regression models for predicting dependent variable (*visneed* or visits needed). Per the results of the multiple regression analysis (see SPSS outputs in Appendix), the two regression models which were statistically significant are presented below. The two models were analysed using two separate sets of independent variables. The first model shown below, labeled as Model #1, had significant F statistic (F change=9.390, Sig. F change=0.000). The R^2 value of 0.191 is shown below in Table 4.1. The dependent variable, *visneed*, was used for both regression models. Variable *visneed* is the number of additional primary care visits that would be needed to adequately serve the residents of a particular census tract. This dependent variable, *visneed,* is calculated using the study's 3 indices by subtracting the available, satisfied primary care visits demanded (variable: *pcsatdem*) from the total potential visits demand for each given small area (variable: *tvisdem*).

There were 64 possible independent or predictor variables present in the linked study database but only seven of them which showed little or no multi-collinearity effects from partial correlation analysis, were used in the two multiple regression models. One-tailed or 2-tailed significance=.000 was the norm or guide which was used to identify high correlation between independent variables that could be due to effects multi-collinearity. (See SPSS outputs, partial corr. in Appendix). These seven independent or predictor variables were therefore included in the multiple linear regression models.

The independent (predictor) variables selected for stepwise inclusion were the three original study variables (poverty%, low birth-weight% and physician supply) and the newly-developed CTGs. These variables, both the original and the new, form the centrality of the aim and objectives of this study. These seven predictor (independent) variables are as follows:

- percent of persons below 100 percent of the federal *poverty level* (poverty% or povp), an interval variable
- 3-year average of percent of live births that were *low birth-weight*, (low birth-weight% or lbwp) an interval variable
- Active primary care *physicians per 100,000 population,* an interval variable
- Census Tract Grouping or *CTG* (a categorical variable)

- percent of population less than 17 years (poplt17)
- percent of population 65 years or older (pop65p)
- component need score (CNS), an interval variable

Other independent variables such as total number of physicians per 1,000 population, number of primary care physicians, etc, were not used in the regression model estimations because a prior partial correlation analysis showed that each of those variables were correlated significantly (F=.0000) with one or more of the seven selected predictor variables. The multi-collinearity effects of the independent variables were determined by examining and discarding variables whose Pearson correlation coefficients with visneed was greater than 0.5000 with one-tailed significance level>.05. In the actual estimation of the multiple linear regression models, further examination of violations of the assumptions of normality and equality of variances was conducted using values of Durbin-Watson statistic, tolerance, variance inflation factor, and plots of standardised residuals by standardised predicted values.

Other predictor models which included the independent variables – number of primary care physicians and number of specialists (non-primary care physicians) - resulted in a low proportion of the variation in visits needed explained. Log-transformed variables were studied to see if they performed better and had higher adjusted R^2 values. That was not the case. The low values for R^2 indicated that the log-level transformed variables did not provide a better fit for the linear regression model. Thus, these logarithmically transformed independent predictor variables were not useful and were thus discarded.

Logistic regression is a statistical method used by researchers to analyse data in which there are one or more independent variables that can possibly determine an outcome. The outcome is measured with a variable recoded into a categorical type dichotomous variable in which there are only two possible outcomes (Medcalc 2014:1). The theory behind the attempt to use log-transformed variables to improve the model is that since level-level regression is the normal multiple regression used in the above Least Squares

Multiple Regression model, the log-log regression model, the multivariate counterpart to the power regression model, may possibly improve the model (Benoit 2011:1). The revised model's (log-transformed) predictor variables had Pearson correlation statistics which showed a high degree of correlation and inter-dependency (sig. of Pearson corr = .0000) with other study variables. They were therefore eliminated from the estimation models being studied.

4.4.2 Findings: Linear Models using multiple linear regression

4.4.2.1 Regression: Results

Several multiple regression models were tested in this study but only two were not rejected based on the statistics (adjusted R^2, change in F, and model significance of F) . They are listed below as Model #1 and Model #2. The multiple linear regression models were studied in an effort to address the following study hypothesis:

> H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care "visits gap" by census tract or Census Tract Grouping in the District of Columbia.

The results of the testing of the linear models were mixed. Most of the linear models which were tested were rejected at the 95% confidence level and only two models were not rejected. Table 4.1 below shows the results for tested Model #1, the first of the two tested models which was not rejected. In Table 4.1, only a small proportion of the variation in the predictor variable visneed (R^2=0.186 or 18.6 percent) was explained by the included independent variables. The F statistic for the multiple linear regression model for predicting visits needed which used independent variables (PCSI, CNS, and physicians per 1,000 population) was not statistically significant and was rejected.

Model #1 below is a multiple linear regression model which used independent variables, povp, lbwp, poplt17, pop65p, CTG to ascertain their ability to predict values of the dependent variable visits needed (visneed). The model had a significant F, with p=.000. Findings for Model #1 are summarised in Table 4.1 below and can be found in the Appendix (Model #1 LinearRegression):

Predictive Model #1:

TABLE 4.1: PREDICTING DEPENDENT VARIABLE VISNEED USING INDEPENDENT VARIABLES POP65P, LBWP, CTG, POPLT17, POVP2000; DISTRICT OF COLUMBIA, 2004

Model Summary:

Model	R	R Square	Adjusted R Square	Std. Error of the estimate	Change Statistics					Durbin-Watson
					R2 Square Change	F Change	df1	df2	Sig. F Change	
1	.457	.209	.191	130715.205	.209	9.390	5	178	.000	2.068

Model predictors: Constant, plus POP65P, LBWP, CTG, POPLT17, POVP2000
Dependent Variable: VISNEED
Predictor variables: povp, lbwp, poplt17, pop65p, ctg

R^2: 0.209

Significance, F: 0.000

Unstandardised and standardised beta coefficients for Model #1 are presented below:

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	36900.720	26995.110		1.367	.173
	YR3LBWP	355.576	679.507	.035	.523	.601
	POVP2K	-2198.209	662.705	-.235	-3.317	.001
	POPLT17	118.880	24.387	.343	4.875	.000
	POP65P	-177.318	32.682	-.378	-5.426	.000

Dependent Variable: VISNEED

In Table 4.1, poverty% (POVP2K) was one of the significant predictors of *visneed*. In attempts to improve the performance of the included independent variables in their ability to predict values of the dependent variable, the two interval variables, poplt65 and pop65p, were transformed into their respective logarithmic equivalents. Thus independent variables poplt65 and pop65p became loglt17 and log65p respectively. When used in the estimation of a multiple linear regression model, the results showed a significant F value with p=.000, adjusted R^2=.115. Findings for Model #2 are summarised in Table 4.2 below:

4.4.2.2 Regression Results: <u>Predictive Model #2:</u>

TABLE 4.2: PREDICTING DEPENDENT VARIABLE VISNEED USING INDEPENDENT VARIABLES LOGPOP65P, LBWP, CTG, LOGPOPLT17, POVP2000, DISTRICT OF COLUMBIA, 2004

Model Summary:

Model	R	R Square	Adjusted R Square	Std. Error Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df 1	df 2	Sig. F Change	
1	.373	.139	.115	136731.826	.139	5.751	5	178	.000	2.083

a Predictors: Constant, plus LOGPOP65, LBWP, CTG, POVP2000, LOGPOP17
b Dependent Variable: VISNEED
Predictor variables: povp, lbwp, $\log_{10}$poplt17, $\log_{10}$pop65p, CTG

R^2: 0.139

Significance, F: 0.000

The Model #2, above, had a lower adjusted R^2 of 11.5 percent and a significant F, with p=.000. Thus Model #2 was less predictive than Model #1, indicating that from a theoretical standpoint, there was greater likelihood (adj. R^2=0.191, F change=5.572, sig. =.000) to accurately predict visits needed (visneed) using Model #1 which included the original study variables – poverty% and low birth-weight% - than by using log-transformed versions of the variables. The study found that to different extents, socio-demographic characteristics of small, well-defined community areas in an urban area - such as Census Tract Grouping, poverty level, proportion of dependent population segments such as the young and the elderly, and low birth-weight live births - can be used as predictors of, with varying levels of success, the need for *additional* primary care visits to physicians, in the District of Columbia.

4.4.3 Trend Analysis, 1985 to 2004

4.4.3.1 Univariate (Frequencies) and Bivariate (Cross-tabulation) analysis of study variables **CTG, physicians location, poverty% and low birth-weight%**

Findings related to the frequencies and cross-tabulations of the CTGs, physicians, visits and visits shortages are presented below together with detailed trend analyses for the primary care study variables poverty% and low birth-weight%.

As shown in Table 4.3 below, the eleven new CTGs developed and used in this study each contained between 14 and 23 individual DC census tracts. The distribution of the eleven CTGs in the District of Columbia, for the three study periods (1985, 1990-1992, and 2000-2004) are shown, in Table 4.3 below:

TABLE 4.3: NUMBER OF CENSUS TRACTS AGGREGATED TO FORM EACH CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 2004

Census Tract Grouping	Total number of census tracts*
1	17
2	15
3	23
4	18

5	16
6	14
7	16
8	20
9	14
10	16
11	15
TOTAL, DC	184**

** census tracts totals are approximated above:
There were 182 CTs (in 1985), 192 CTs (in 1990), and 188 CTs (in 2004);
** In 2004, four CTs of were excluded due to having resident population of zero (or near zero).

Frequency distributions of the sentinel study variables were analysed as a preliminary step to analysing the six research hypotheses for rejection or non-rejection. Sections 4.4.3.1.1 thru 4.4.3.1.23, below, present results for the frequency (univariate) analysis summarised by Census Tract Grouping (CTG) for the sentinel variables used in this study. The variables total physicians, primary care physicians, health and socio-demographic characteristics for the District of Columbia for the three time periods from 1985 to 2004 were summarised by CTG means, sums, standard deviations and percentage changes over the three study periods for 1985, 1990-1992, and 2000-2004.

4.4.3.1.1 Total Physicians licensed by the District of Columbia

This study showed that most of the DC-licensed physicians resided and practiced in other states, but not in the District. The District had a total of 11,068 licensed physicians in 1985 and 9,675 in 2004. This represented a 12.6 percent decrease in the total number of physicians licensed by the District of Columbia government. Again, the majority of these DC-licensed physicians did not live or practice in the District of Columbia. Those who maintained active business and/or practice addresses in the District of Columbia are the focus of this study, as shown in Table 4.4 below.

4.4.3.1.2 Total Number of Physicians with practices in DC, 1985 to 2004

As shown in Table 4.4 below, this study found that there were 2543 total physicians (primary care physicians plus specialists) who were licensed by, and *actually practiced* medicine, in the District of Columbia in 1985. There were 3863 such physicians in 1990 and 3635 in 2004 as shown in Table 4.5 below. The distribution of the District's active physicians by CTG was analysed in Tables 4.4 thru 4.8 in order to determine if Hypothesis H_{01} can be rejected or not rejected.

Table 4.4 below presents findings for the total number of physicians with practices in DC, from 1985 to 2004. In 2004, CTGs 5, 3 and 2 had the most physicians in 2004 while CTGs 7 and 8 had the fewest. In 1985, CTGs 2, 5 and 9 had the most physicians while CTGs 11, 10 and 7 had the fewest numbers of active physicians in the District.

TABLE 4.4: TOTAL NUMBER OF PHYSICIANS WITH PRACTICES IN DC BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CENSUS TRACT GROUPING	1985 TOTAL PHYS	1990 TOTAL PHYS	2004 TOTAL PHYS	1985-1990 CHANGE	1985-2004 CHANGE
1	268	202	275	-66	7
2	269	122	483	-147	214
3	568	100	601	-468	33
4	101	612	317	511	216
5	362	968	928	606	566
6	100	158	238	58	138
7	42	737	41	695	-1
8	135	212	47	77	-88
9	664	21	432	-643	-232
10	19	140	158	121	139
11	15	591	115	576	100
TOTAL	2543	3863	3635	1320	1092

Active physicians cross-tabulated by CTG differed from District's mean, sig=.000

4.4.3.1.3 Number of Primary Care Physicians (PCP) in DC

Primary care physicians practicing in the District constituted the focus of this study. The three groups of DC-licensed physicians differentiated in this study are as follows:

(i) total DC-licensed physicians (primary care or specialists) resident or practicing elsewhere (outside the District) in the US or abroad; and

(ii) total DC-licensed physicians (of any specialty, primary care or non-primary care/specialists) resident or practicing in DC; and

(iii) DC-licensed primary care physicians resident and/or practicing in DC.

The study focused on active practicing physicians in the District. The first group of physicians, above (total DC-licensed physicians), is not of relevance to this study. This was because DC-licensed physicians can be found all over the United States and indeed, all over the world. A DC-licensed physician does not necessarily mean "practicing medicine in DC".

The third group, primary care physicians resident and/or practicing in DC, is the main focus of this study, although the second group (of non-primary care, specialist physicians) may also play a role, even if a minor one, in delivering some modicum of basic or primary care services to District residents.

Primary care physicians may be either general primary care physicians (*gpc*) or specialist primary care physicians (*spc*). This study differentiated between primary care physicians of both primary care types (*gpc, spc*) who are true specialists. Thus a specialist in this study is one who is neither a general primary care physician nor a specialist primary care physician.

The proportions of DC licensed-and-DC-practising physicians who practice primary health care in the District was found to decrease over the twenty year period 1985 to 2004. For 1985, this study found that there were 1,444 primary care physicians out of a total of 2,543 (56.8 percent) physicians who practiced medicine in the District of

Columbia. In 1990 there were 2,120 primary care physicians out of a total of 3,863 (54.9 percent) physicians who practiced medicine in the District of Columbia. In 2004, there were 1,622 primary care physicians out of a total of 3,635 (44.6 percent) physicians who practiced medicine in the District of Columbia.

Table 4.5 below presents data on DC primary and non-primary care physicians by CTG. The changes in the numbers of primary care physicians between 1985 and 1990 and between 1985 and 2004, are shown. It was found that in 1985, CTG 3, 5 and 9 had the most primary care physicians. In 1992, it was CTG 4, 5, 7 and 11 and in 2004, it was CTG 3, 5 and 9 again having the largest numbers of primary care physicians. Again, physicians total numbers by CTG varied significantly within the District thus providing evidence for the researcher to reject the null hypothesis H_{01}.

TABLE 4.5: NUMBER OF PRIMARY CARE PHYSICIANS (PCP) BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CTG	1985	1990	2004	1985-92	1985-2004
1	177	118	126	-59	-51
2	171	76	205	-95	34
3	304	46	275	-258	-29
4	59	365	147	306	88
5	229	501	403	272	174
6	38	90	100	52	62
7	27	456	20	429	-7
8	50	133	19	83	-31
9	368	8	211	-360	-157
10	14	51	67	37	53
11	7	276	49	269	42
TOTAL	1444	2120	1622	676	178

Active physicians cross-tabulated by CTG differed from District's mean, sig=.000

4.4.3.1.4 Percentage of Primary Care Physicians (PCP) in DC

The percentage of primary care physicians who had active practice addresses or residences within the District of Columbia decreased from 56.8 percent in 1985 to 54.9 percent in 1990 and finally to a twenty-year low of 44.6 percent in 2004. Whereas the primary care physicians data for 1985 used in this study came from the "Washington Physicians directory, 1985" the primary care physicians numbers for 1990 came from the survey of active DC physicians with practice or home addresses in DC according to licensure records.

In all cases, for data from 1985, 1990 and 2004, only physicians who (i) had practice or home addresses in the District of Columbia that could be assigned to a census tract or Census Tract Grouping (CTG), and (ii) who had a self-reported specialty which could be classified as primary care or specialist were considered in this study. The study findings for primary care physicians in the District of Columbia, from 1985 to 2004, could thus be an undercount of the actual number of practicing physicians since the study did not include physicians with no stated specialties or had unverifiable addresses.

TABLE 4.6: PERCENTAGE OF PRIMARY CARE PHYSICIANS (PCP), BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CTG	1985 PERCENT PRIM. CARE	1990 PERCENT PRIM. CARE	2004 PERCENT PRIM. CARE	%CHANGE 1985-1990	%CHANGE 1985-2004
1	66.0	58.4	42.2	-7.6	-23.8
2	63.6	62.3	31.2	-1.3	-32.4
3	53.5	46.0	38.4	-7.5	-15.1
4	58.4	59.6	48	1.2	-10.4
5	63.3	51.8	37	-11.5	-26.3

6	38.0	57.0	41.7	19.0	3.7
7	64.3	61.9	35	-2.4	-29.3
8	37.0	62.7	11.3	25.7	-25.7
9	55.4	38.1	48.8	-17.3	-6.6
10	73.7	36.4	26.5	-37.3	-47.2
11	46.7	46.7	42.3	0.0	-4.4
TOTAL	56.8	54.9	36.1	-1.9	-20.7

Active physicians cross-tabulated by CTG differed from District's mean, sig=.000

4.4.3.1.5 . Total Physicians (ratios) per 1,000 population

To facilitate comparability in the availability of physicians in various cities, states and counties which have different populations, standard physicians per 1,000 or 100,000 population ratios are used. In 1985, there were 3.98 total physicians per 1,000 population in the District of Columbia. In 1990 the ratio of physicians in the population increased to 6.19 physicians per 1,000 population. In 2004, there were 6.74 total physicians per 1,000 population.

TABLE 4.7: TOTAL PHYSICIANS (RATIOS) PER 1,000 POPULATION, BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CTG	1985	1990	2004
1	4.09	3.08	5.7
2	7.86	3.57	18.7
3	6.42	1.13	58.5
4	1.55	9.44	9.8
5	6.77	18.11	44.4
6	2.49	3.95	17.7
7	0.69	12.11	0.9
8	1.82	2.86	1.2
9	17.1	0.54	31.2
10	0.32	2.41	4.1
11	0.32	12.91	79.8

TOTAL	3.98	6.19	6.74

Physicians ratios per 1,000 population by CTG differed from DC mean, sig=.000

As can be seen in Table 4.7 above, in 2004, four of the eleven Census Tract Groupings in the District of Columbia experienced substantial increases in the number of physicians per 1,000 population between 1985 and 2004. These were CTG 3 (from 6.42 to 58.5 per 1,000 population), CTG 5 (from 6.77 to 44.4 per 1,000 population), CTG 9 (from 17.1 to 31.2 per 1,000 population), and CTG 11 (from 0.32 to 79.8 per 1,000 population).

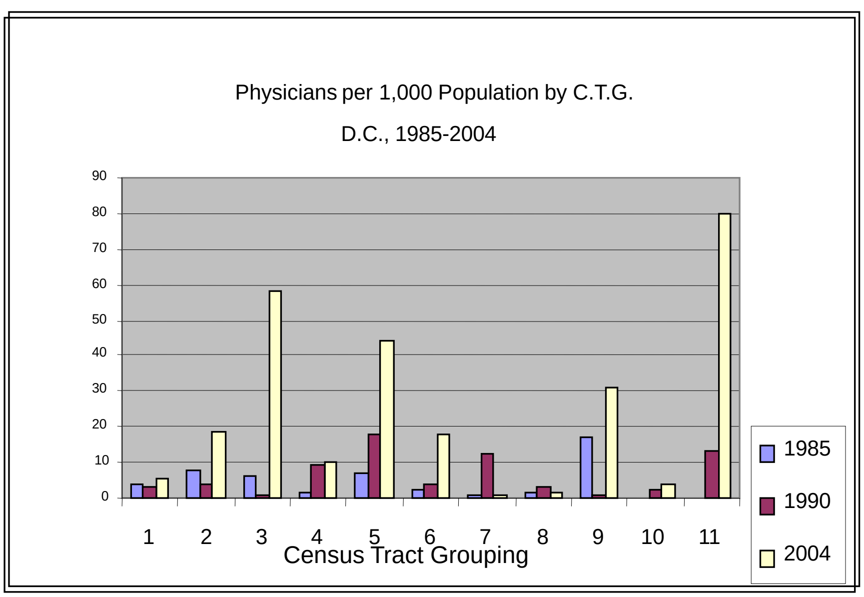


Figure 4.6: Physicians (ratios) per 1,000 Population by Census Tract Grouping, District of Columbia, 1985-2004

Physicians ratios per 1,000 population by CTG differed from DC mean, sig=.000

When compared to other cities of somewhat similar demographics, the District of Columbia, for the study period, appeared to have a relatively high ratio of total (licensed active and non-active) physicians per 1,000 population.

Figure 4.7 below illustrates the above finding for 1985.

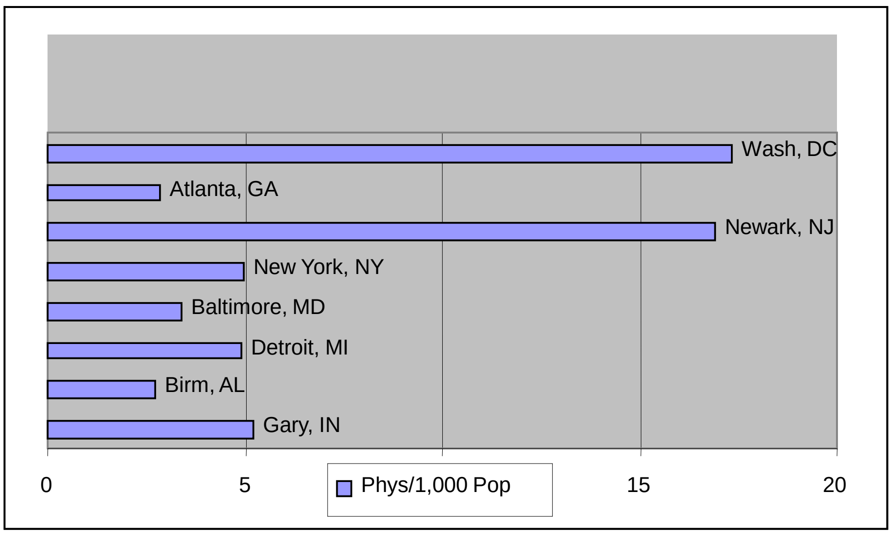


Figure 4.7: Baseline comparison of cities' licensed (active and inactive) physicians per 1,000 Population, District of Columbia versus other major US cities, 1984

SOURCE: "Big Cities Health Inventory," The Health of Urban USA, Chicago Department of Health, Chicago, Illinois, 1994.

This study found that the ratio of primary care physicians per 1,000 population in the District of Columbia was 2.38 in 1985, 3.40 in 1990, and 3.01 in 2004. Over the twenty-year period from 1985 to 2004 the average ratio of DC primary care physicians per 1,000 population was 2.93.

Comparing the District to other US cities of similar demographics and socio-economics, the District enjoys a high availability of active physicians, total physicians and FTE physicians. This finding is presented in section 4.4.3.1.6, below

4.4.3.1.6 Primary Care Physicians Full-Time Equivalents (FTEs)

There is a difference between the numbers of primary care physicians that practice in a given area and the full-time equivalent (FTE) physicians for these primary care physicians. Physician FTEs provide a more realistic estimation of the number of active physicians who devote the equivalence of at access to patients at least 40-hours per work week. Using FTE figures thus eliminate hours of non-direct patient care from a physician's work week. Two separate works in the literature (Staiger, Auerbach, and Buerhaus (2009) and Staiger, D., Auerbach, D., Buerhaus, P. 2010) provide support for the observation that use of physician FTEs, more than mere total physician counts, is a more practical measure of how accessible a physician is, to residents of a community, for direct patient care.

A limitation of this study is that full-time equivalents for primary care physicians were not available in 1985 and 2004 but were obtained for District of Columbia physicians in 1990-1992 via the physician survey. The survey of all physicians who practiced medicine in the District of Columbia and also provided a business or home address in the District was conducted by this researcher. The response rate was very high (in excess of 98 percent) because responding to the survey was linked (by DCRA/HPLA and OHPD) to renewing a physician's license to practice medicine in the city. This survey provided useful information. Physicians were asked to provide the number of hours they actually worked in direct patient care for their primary practice locations and their secondary and tertiary practice locations, if any.

The findings were as follows:

Of the 3,864 physicians who had DC practices and addresses 2,120 were primary care physicians. Also, 620 were primary care physicians who practiced 40 hours or more per week. These 620 primary care physicians together worked a total of 29,492 hours per week, resulting in 737.25 FTE primary care physicians (that is, 29,492 divided by 40). 1,743 were physicians who practiced part-time or less than 40 hours per week inside the District of Columbia. Thus according to the 1990 survey, 29.2 percent of the District's primary care physician workforce worked 40 hours or more per week in direct patient care, producing 737.25 physician primary care FTEs, in 1990.

Using total raw physician counts, while not using physician FTEs, may have the potential for overestimating the proportion of physicians actually working full-time in primary care. For federal HPSA designations primary care physician FTEs are required but the hours worked (and the FTEs) are not easy to obtain in the absence of a comprehensive survey.

This study found that physician FTEs for all physicians (both primary care and non-primary care) for the District of Columbia were generally higher than for physicians practicing in US cities of similar demographics and socio-economics. When comparing primary care physicians in the District to similar US cities, the findings are similar: there are relatively fewer primary care physicians available citywide – and in small area communities – to provide all of the necessary primary care services to the population.

4.4.3.1.7 Population changes in the District, 1980 to 2002

Need and demand estimates for primary care, like any other economic good, depends on population. An increasing population may be assumed to demand a higher level of primary care services. Similarly, a population decrease may lead to a decrease in need and demand for primary care. A finding of this primary care study was that the eleven Census Tract Groupings in the District of Columbia experienced a combined population decrease of 15.5 percent from 1980 to 2004. This is significant because population declines if and when combined with exodus or flight of active physicians, may exacerbate primary care shortages. CTG 10 had the greatest decrease, 30.2 percent, while CTG 1 had the smallest increase of 3.2 percent. Only one community, CTG 9, experienced a population increase, a relatively small increase in population, of 2.9 percent, over the twenty-four year period from 1980 to 2004. Population, population density and changes in population are important factors to consider in a study of primary care in an urban setting such as the District of Columbia.

Table 4.8 below shows that many of the eleven CTGs experienced population declines from 1985 to 2004. This is significant because these population declines were paradoxically accompanied by increases in ratios of active physicians per 100,000 population for most CTGs except for the neediest CTG areas (7, 8, 10 and 11). Population changes by Census Tract Grouping in the District of Columbia, from 1980 to 2002.

TABLE 4.8: TOTAL POPULATION BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CTG	1985	1990	2004	%CHANGE 1985-1990	%CHANGE 1985-2004
1	66828	65508	64698	-3.2	-5.3
2	34803	34192	30054	-13.6	-10.4
3	89767	88426	88335	-1.6	-8.3
4	66360	64826	58981	-11.1	-9.5
5	54676	53448	40998	-25.0	-15.0
6	40873	40012	30919	-24.4	-21.5
7	62544	60850	50446	-19.3	-11.8
8	76381	74091	55177	-27.8	-18.2
9	39385	38762	40544	2.9	3.5
10	59780	58160	41672	-30.3	-19.1
11	46936	45762	37449	-20.2	-7.7
TOTAL	638333	624037	539273	-15.5	-11.1

Cross-tabulation of Total population by CTG differed from DC mean, sig=.000

4.4.3.1.8. Variable poverty%: Numbers of Poor Persons at or below 100 Percent of the Poverty Level, 1985 to 2000

In the District of Columbia overall, for the 11 Census Tract Groupings combined, the actual numbers of poor persons (as defined by the US Census Bureau) was 119,032 (18.6 percent) in 1985, 132,126 (21.2 percent) in 1990, and 117,022 (21.7 percent) in 2000. This showed that the number of poor persons in the District is similar to, but higher than, in as pertained in similar US cities. From 1985 to 2000, individual Census Tract Groupings experienced changes in the numbers of poor persons from a high of 5670 (CTG 2) to a low of -5052 (CTG 11).

TABLE 4.9: NUMBER OF POOR PERSONS BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CTG	1980 # OF POOR PERSONS	1990 # OF POOR PERSONS	2004 # OF POOR PERSONS	%CHANGE 1980-2004	%CHANGE 1985-2004
1	14290	52734	14363	73	833
2	7305	27730	7664	359	5670
3	7451	78257	9629	2178	1123
4	6751	55880	7196	445	-281
5	6916	45698	6273	-643	-376
6	8094	32770	5442	-2652	-2310
7	12468	44968	12864	396	-930
8	20468	48974	22733	2265	-677
9	8815	30196	6446	-2369	-2127
10	14448	42980	11168	-3280	-1278
11	11952	32766	9849	-2103	-5052
TOTAL	118958	491911	117022	-1936	-2010

Poor persons by CTG differed from DC mean, sig=.000

From 1985 to 2004, percent poverty levels decreased in all Census Tract Groupings except one. CTG 10 had a small percent increase in its poverty level from 1985 to 2000 (24.2 percent to 26.8 percent) while the other CTGs had their poverty levels decrease, from a low of -5.3 percent (CTG 1) to a high of -21.5 percent (CTG 6).

4.4.3.1.10 Variable low birth-weight%: Percentage of Low Birth-weight Births in the District

In a given community in a given year, infant mortality rates together with the percentage of live births which are of low birth-weight (i.e. less than 2500 grams or 5 pounds 8 ounces or 5.5 pounds) is a good indicator of infant and maternal health status. Because of small numbers this indicator is unstable thus several years worth of low birth-weight live births were aggregated by the researcher to gain a more stable rate for a community. In this study, for 1985, five years worth of low birth-weight births (for 1978, 1979, 1980, 1981 and 1982) were aggregated and averaged by the researcher. In 2004, three years of low birth-weight births (for 1999, 2000, and 2001) were aggregated and used.

In 1985 about 9.1 percent of all live births were of low birth-weight. In 2004, 13.9 percent of all live births in the District of Columbia were of low birth-weight. In 2004, Census Tract Groupings 5 (24.4 percent), 7 (21.0 percent), 8 (18.8 percent), and 10 (14.6 percent) had low birth-weight percentages higher than the District's average of 13.9 percent.

In 2004, Census Tract Groupings 3 (6.5 percent), 9 (9.4 percent), 4 (10.5 percent), and 1 (10.6 percent) had low birth-weight percentages lower than the District's average of 13.9 percent. In 1999 to 2001, CTGs 5, 8, 10 and 11 had the highest percentages of live births which were of low birth-weight, whereas in 1985 to 2004, CTGs 5, 2 and 7 had the highest percentages of live births which were of low birth-weight. Table 4.10 below displays these low birth-weight% findings.

TABLE 4.10: PERCENTAGE OF LOW BIRTH-WEIGHT BIRTHS CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1978-1982 & 1990-2001

CTG	1978-1982	1999-2001	1985-2004
1	11.9	10.6	-2.1
2	13.5	13.3	9.4
3	5.3	6.5	2.6
4	12.2	10.5	2.5
5	12.6	24.4	19.6
6	13	12.5	5.6
7	14.6	21	9.1
8	14.4	18.8	1.3
9	12.6	9.4	3.9
10	13.5	14.6	-2.6
11	15.1	12.6	5
TOTAL	12.6	13.9	4.8

Note: Calculations are based on annual percent low birth-weight figures by census tracts averaged for 1978-1982, 1999-2001 and 1985 to 2004 maintained by the State Center for Health Statistics, D.C. Department of Health.

CNS values cross-tabulated by CTG differed from DC mean, Chi square sig=.000

4.4.3.1.11 Composite Need Scores (CNS)

This study combined two community socio-demographic variables and health indicators (poverty, low birthweight) into one composite index (composite need score) as a numeric indicator to assist in quantifying the need for primary care visits and services in a given community. Percentage of persons at or below 100 percent of the federal poverty level is one indicator in the Composite Need Score (CNS); the other indicator in the CNS is percentage of live births that were low birth-weight.

Research hypothesis H_{01} for this study concerned determining if the primary care need estimates as calculated by the composite index CNS differed significantly by CTG. Research hypothesis H_{04} states the following:

> H_{04}: The quantitative measure of "need" for primary care - "composite need score (CNS)" - which is calculated the from *study variable low birth-weight%,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

The analysis of percent primary care physicians per CTG table was statistically significant (Sig.=0.023, df=10).

Similarly, Research Hypothesis H_{02} for this study concerned determining if the primary care service index (PCSI) differed significantly by CTG. Research hypothesis H_{02} states the following:

> H_{02}: The primary care service index (PCSI) which is calculated from *study variables active physicians, poverty%* and is the ratio of primary care visits

demanded by the population to the primary care visits satisfied, does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

When PCSI values were re-coded into categories and analysed, the observed variability of the PCSI category variable was *statistically significant (F=9.708, Sig.=0.000, df=10)*. For CNS values (Research Hypothesis H_{04}) for each of the study years 1985, 1990 and 2004, all the census tracts in the District of Columbia were ranked numerically by percentage from lowest to highest for the composite index CNS (Research hypothesis H_{04}). The same was done for composite index PCSI (Research hypothesis H_{02}) for the eleven CTGs. See Table 4.11 for CNS and Table 4.11b for PCSI, below.

The CNS calculation and Finding:

The observed significance level for CNS (Research Hypothesis H_{04}) was less than 0.05. Thus the variability in the difference in means for the CNS variable was *statistically significant (F=13.503, Sig.=0.000, df=10).*

In 1985, a DC census tract with a poverty rate of 1 percent was ranked 1 out of 192 (1/192 = 0.01 or 1 percent) which was a low ranking, and was placed in the first percentile. Similarly a low low birthweight rate earned a census tract a low percentile rank of 1 out of 192, also in the top (first) percentile. These two percentile values are statistically combined (added) and standardised to a denominator of 100 percent (not 200 percent). The standardised quantitative number is the Composite Need Score (CNS) for that census tract.

Composite Need Scores have reverse meanings. Low values indicated high need and high values indicated low level of need. Thus a low CNS value (for example, CNS = 2 percent) indicates that the area has a relatively high need "level." The Composite Need Scores for all the census tracts in a given Census Tract Grouping (CTG) were averaged to obtain a Composite Need Score for that CTG for that study year. Eleven Composite

Need Scores were thus obtained by statistical combination and averaging for each of the eleven Census Tract Groupings (CTGs) in 1985, in 1990, and again in 2004.

The findings of this study regarding CNS values for the period 1985 to 2004 are presented below.

Table 4.11 shows that in 1985, CTG 3 had a CNS of 100 percent, in 1990 CTG 3 had a CNS of 95.5 percent, and in 2004 it was 80.8 percent. In 1985 by comparison, CTG 8 and CTG 11 both had Composite Need Scores of 13.6 percent respectively, the highest in that year. In 1990, CTG 7 had a CNS of 18.2 percent and CTG 8 had a CNS of 22.7 percent, the lowest levels in 1990. In 2004, CTG 3 had a CNS of 80.8 percent, the highest need level, and CTG 8 had a CNS of 27.3 percent, the lowest need level for that year. Overall for the District as a whole, the Composite Need scores were 52.9 percent in 1985, 53.7 in 1990, and 52.5 in 2004, representing and increase then a decrease in the overall calculated levels of primary care need for the District of Columbia from 1985 to 2004.

TABLE 4.11: COMPOSITE NEED SCORES (CNS) BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

COMPOSITE NEED SCORE (CNS)

CTG	1985	1990	2004	% CHANGE 1985-04
1	77.3	59.1	54.3	23.0
2	40.9	72.7	48	7.1
3	100.0	95.5	80.8	-19.2
4	86.4	95.5	65.9	-20.5
5	72.7	45.5	56	-16.7
6	63.6	72.7	56.6	-7.0
7	31.8	18.2	39.2	7.4
8	13.6	22.7	27.3	13.7
9	50.0	36.4	64.3	14.3
10	31.8	36.4	36.3	4.5
11	13.6	36.4	41.7	28.1

TOTAL	52.9	53.7	52.5	-0.4

CNS values cross-tabulated by CTG differed from DC mean, Chi square sig=.000 (F=13.503, Sig.=0.000, df=10).

4.4.3.1.12 Primary Care Service Index (PCSI)

Table 4.11b below presents findings for the composite variable PCSI by CTG. The calculation and findings concerning values for Primary Care Service Index (PCSI) by CTG are presented below (and the rationale and index development process were described in detail in Chapter 3: Methods).

The findings of this study for values of the primary care service index (PCSI) for the small area CTGs in the District for the study period 1985 to 2004, are presented in Figure 4.11b below with CTG areas of lower PCSI values (i.e. areas with physicians shortages thus showing a need for concern), **highlighted in colour**, in the Table.

TABLE 4.11b: PRIMARY CARE SERVICE INDEX (PCSI), BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

		1985	1990	2004
CTG	1	3.04	1.97	0.80*
	2	5.59	2.57	2.40
	3	4.06	0.56*	1.40
	4	1.07	7.04	1.70
	5	4.91	11.54	2.60
	6	1.16	2.69	1.20
	7	0.49*	8.97	0.20*
	8	0.81*	2.19	0.10*
	9	10.60	0.23*	6.10
	10	0.25	1.11	0.60*
	11	0.17*	7.45	4.20
PCSI, TOTAL DC		2.62	3.97	1.80

If PCSI<1, then the CTG is a physician shortage area;
CTG with shortage areas are shown in color, above.

Table 4.11b above shows that in 1985, PCSI ranged from 0.17 for CTG 11 to 10.60 for CTG 9. Four of the eleven CTGs had PCSI less than 1 and seven CTGs had a PCSI greater than 1.0.

In 1990, PCSI ranged from a low of 0.23 for CTG 9 to a high of 11.54 for CTG 5, a dramatic reversal of fortunes for CTG 9 that went from having the largest PCSI in 1985 to the lowest in 1990. Only two of the eleven CTGs had PCSI values less than 1.0 in 1990 - CTG 3 had a PCSI of 0.56 and CTG 9 had a PCSI of 0.23.

In 2004, CTG 8 had a PCSI of 0.10, the lowest for that year and CTG 9 went back up to a PCSI of 6.10, again becoming the CTG with the largest PCSI or largest relative amount of satisfied visits to potential (that is, total) visits demanded.

TABLE 4.12: PRIMARY CARE SERVICE INDEX, CALCULATED FOR DISTRICT OF COLUMBIA, 1978-1982 & 1990-2001

PRIMARY CARE SERVICE INDEX (PCSI)*

CTG	1985	1992	2004
1	3.04	1.97	0.80
2	5.59	2.57	2.40
3	4.06	0.56	1.40
4	1.07	7.04	1.70
5	4.91	11.54	2.60
6	1.16	2.69	1.20
7	0.49	8.97	0.20
8	0.81	2.19	0.10
9	10.60	0.23	6.10
10	0.25	1.11	0.60
11	0.17	7.45	4.20
TOTAL	2.62	3.97	1.80

**If PCSI<1, then the CTG is a physician shortage area;*

4.4.3.1.13 Visits and how they relate to Primary Care Service Index (PCSI)

Research hypothesis H_{03} for this study concerns determining whether the unsatisfied visits (or “visits gap”) in primary care varied significantly by CTG in the District. Hypothesis H_{03} is stated as follows:

> H_{03}: The unsatisfied visits (or “visits gap”) in primary care, which is calculated *from study variables PCSI and CNS,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

To understand the finding of the study concerning PCSI a brief explanation of the concept of the Primary Care Service Index (PCSI) and how it is related to visits made to primary care physicians, is provided in detail in chapter 3 and summarised in this section, below.

Dividing the number of satisfied visits by the potential demand (or total expected visits) produces the Primary Care service Index (PCSI). Primary Care Service Index (PCSI) is a ratio obtained by dividing the number of satisfied visits (or actual visits made) by the total number of visits demanded (or potential demand). PCSI is thus "satisfied (or available) visits" divided by "potential (or total) visits." In Chapter 3 presented the division formula for the calculation of PCSI as follows:

$$\text{C. (H2):Primary Care Service Index (PCSI)} = \frac{\text{Satisfied Demand (B)}}{\text{Potential Demand (A)}}$$

Satisfied demand or *satisfied visits* (the numerator in the PCSI formula above) is calculated by (i) multiplying the number of primary care physicians actually present in the small area by the primary care physician visits per year, then (ii) multiplying the number of specialist physicians in the small area by its productivity estimate per year, and finally, (iii) adding up the two actually made or satisfied visits numbers.

Potential demand or *potential (total) visits* is obtained by (i) multiplying the numbers of poor persons in the small area by the expected visits per person per year to a physician, then (ii) multiplying the numbers of non-poor persons in the small area by the expected visits per non-poor person per year to a physician, then finally (iii) adding up the two expected or potential visits numbers.

Dividing the satisfied visits by the potential demand (or total expected visits) produces the Primary Care service Index (PCSI). This ratio or number lies between zero and 1, that is, it is less than 1.0 or greater than 1.0. If the PCSI is less than 1.0, then there were less satisfied visits than potential visits demanded. If PCSI is greater than 1.0 then there were more satisfied or made visits than the total potential visits demanded.
A brief explanation of the concept of the Primary Care Service Index (PCSI) is provided in this section.

Due to geographical proximity and ease of community accessibility, this study considers primary care physicians as a resource for the residents or population of a community. It is assumed that residents of a small area (census tract or census tract Grouping) make visits to primary care physicians located in the particular area or in close proximity to it. In the United States, based on US data for 1984 from the US National Centers for Health Statistics, normative visit rates to primary and non-primary care physicians have been established.

Physician productivity is measured in number of visits made by residents per year to a physician's practice or office. Estimates of physician productivity in visits made per year are available by area and are calculated per physician separately for areas of low, moderate and high physician densities.

According to federal US (NCHS) data, 4,714 visits were made in the US to a primary care physician in an area with a relatively low density of physicians (such as a rural area). Similarly, 3,757 visits were made to a primary care physician in an area with a relatively high density of physicians (such as the District, an urban area or city). This study used 3,757 visits per physician to estimate the number of physician visits made (or visits satisfied or visits available) to physicians in the District of Columbia. If the physician is a primary care physician the visits are multiplied by a factor of 1.0. If the physician is a specialist (non-primary care physician) a factor of 0.1 is applied to the calculated visits made (or available or satisfied). Total visits satisfied (or made or available) is obtained by adding the visits made to primary care physicians and non-primary care physicians in a given small area, census tract or Census Tract Grouping (CTG).

4.4.3.1.14 Findings: Satisfied Visits, 1985 to 2004

To evaluate Research hypothesis H_{03} for this study which concerned determining whether the unsatisfied visits (or “visits gap”) in primary care varied significantly by CTG in the District, the following PCSI and visits findings are presented. Results for *satisfied visits* are presented in this section. Also, the terms *satisfied* and *potential* are explained and contrasted in this section. Table 4.13 below contains findings related to primary care visits satisfied (that is, visits available due to physicians availability) by CTG.

In 1985, the number of satisfied visits ranged from 36,004 visits (for CTG 11) to 1,845,959 for CTG 9. Three of the eleven CTGs had satisfied visits larger than 1,000,000. They are CTG 3, 5 and 9.

In 1990, satisfied visits ranged from a low of 42,596 visits for CTG 9 to a high of 2,567,166 for CTG 5. As expected, the calculated values for primary care satisfied visits tend to mirror the numbers of physicians (especially primary care physicians) in a given area. Four of the eleven CTGs had satisfied visits larger than 1,000,000 (CTG 4, 5, 7, and 11) and CTG 5 and CTG 7 had satisfied visits larger than 2,000,000.

In 2004, CTGs 2, 3, 5, and 9 had satisfied visits larger than 1,000,000. Only one CTG, CTG 5, had satisfied visits larger than 2,000,000. CTG 7 and CTG 8 had the lowest satisfied visits of 109,684 and 107,224 visits respectively. The largest volume of satisfied visits was 2,248,392 for CTG 5.

Table 4.13 below presents results for satisfied visits for the District of Columbia during the study period.

TABLE 4.13: PRIMARY CARE VISITS SATISFIED, BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

	SATISFIED VISITS		
CTG	1985	1992	2004
1	868567	587811	697282
2	842913	375546	1147833
3	1532241	237132	1522146
4	293905	1813408	812055
5	1129474	2537166	2248392
6	202425	449808	560817
7	132914	2255156	109684
8	267635	656642	107224
9	1845959	42596	1156956
10	67875	273851	375199
11	36004	1419410	274192
TOTAL	7219910	10648525	9011778

In this study the terms “satisfied visits”, “visits satisfied”, “satisfied demand,” “actual visits made,” “available visits” – are all synonymous. They stand for the same concept and have the same meaning. These terms are thus sometimes used interchangeably. They represent the visits *actually made* (or completed) by people to seek care from physicians.

Similarly, the terms “potential visits,” “potential demand,” “total visits,” and “expected visits,” – are all the same, stand for the same concept and have the same meaning. These terms are also sometimes used interchangeably. They represent total (maximum possible) visits that *should* be made based on the calculated need levels of the community.

4.4.3.1.14 Findings: Satisfied Visits, 1985 to 2004

The term *potential visits* is described and explained below.

Potential visits or potential demand as used in this study is a need-based concept. "*Potential visits"* is a term that refers to the projected level of primary care *need* for the community as a whole. Its antithesis is *satisfied* visits or visits actually made or demanded. In this study, satisfied visits are theoretically supposed to be numerically less than potential visits, if complete satisfaction of all existing need levels are assumed to be close to impossible. In practice, satisfied visits were could be less than potential visits, or greater than potential visits. In the District of Columbia, some census tracts and Census Tract Groupings in 1985, 1990, and 2004, satisfied visits were sometimes numerically less than potential visits, and at other times, numerically greater than, potential visits.

Estimates for potential visits, the measure of community need for primary care in this study, are calculated by applying different use rates (physician visits per person per year) to different age groups for both the poor and non-poor segments of a community's (or census tract's or Census Tract Grouping's) population.

Results for *satisfied visits* are explained, summarised and presented in this section.

4.4.3.1.15 Findings: Satisfied Visits, 1985 to 2004

The calculation for potential demand or potential visits is as follows (see Figure 3, Chapter 3): Note that Primary Care Visit Rates are per person per year):

Sum of Population-based Primary Care Visit Rates, For Poor, Non-Poor	=	Total Population Demand for Primary Care Visits (or Potential Demand)

Potential visits or visits demanded are one and the same thing. In 1985 the District of Columbia had 2,751,575 total, potential visits or visits demanded. This number increased to a citywide 2,682,807 in 1990 and to 4,222,431 in 2004. Potential visits or visits demanded are calculated based on "need" for primary care visits as differently expressed by the application of US-based normative per person visit rates to physicians by the poor and non-poor segments of a small area's population.

4.4.3.1.16 Findings: Satisfied Visits, 1985 to 2004

Table 4.14 Potential Visits Demand, By Census Tract Grouping, District of Columbia, 1985-2004

POTENTIAL VISITS (or POTENTIAL DEMAND)

CTG	1985	1992	2004
1	285391	297893	730337
2	150841	146338	387416
3	377379	421109	1119163
4	275680	257609	666480
5	230242	219881	591215
6	175126	166950	419188
7	271210	251285	637582
8	331427	299682	632679
9	174209	183911	413237
10	269386	247659	458319
11	210684	190492	407036
TOTAL	2751575	2682807	6462652

In this study estimates for satisfied visits are calculated by applying US norms to the District. US-based normative physician productivity expected visit rates vary differently for urban areas with high, moderate, or low physician densities. Thus, the relative numbers of primary care physicians and specialists (non-primary care physicians) existing in a community, census tract or Census Tract Grouping have different multipliers or weights that produce an area's total need level or potential visits.

Potential visits (see Table 4.14 above) are based on estimates of a community's socio-demographic profile while satisfied visits are obtained from a community's existing (actual) physician resources by using and adjusting the numbers of primary care physicians and non-primary care physicians who practice in a given geographic area.
The number of satisfied visits is divided by potential visits to obtain the Primary Care Service Index (PCSI), a measure of the relative satisfaction of need levels by an area's available complement of active and practicing physicians who are available to provide care via primary care visits for the community.

4.4.3.1.17 Categories of Primary Care Service Index (PCSI categories):

Research hypothesis H_{02} for this study concerns determining if the calculated PCSI values differ significantly by CTG for the District. This section provides findings of the study by PCSI and CTG. To evaluate Hypothesis H_{02}, values of PCSI by CTG for the District were calculated. Hypothesis H_{02} is stated as follows:

> H_{02}: The primary care service index (PCSI) which is calculated from *study variables active physicians, poverty%* and is the ratio of primary care visits demanded by the population to the primary care visits satisfied, does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

As noted in Chapter 3 (Methods), Primary Care Service Index (PCSI) values have logical and intuitive meanings. Low PCSI values mean that the supply of physicians is low in the community. High PCSI values imply that a high volume of physicians exist in that community. PCSI values range from 0.0 (minimum) to 1.0 or higher (maximum). PCSI values are Categorised using categories 1 to 5, as follows:

<u>PCSI value (range)</u>		
1)	0.0 – 0.24	Very low
2)	0.25 – 0.49	Low
3)	0.50 – 0.74	Medium
4)	0.75 – 0.99	Medium high
5)	1.00+	High

PCSI designation as category 1 implies high need (or low physician availability) while PCSI category 5 implies that a small area community has low need (or high physician availability)

4.4.3.1.18 Findings, PCSI Category by CTG

In 1985, only one CTG had a PCSI category of 1 (CTG 11) while two CTGs had a PCSI category of 2 (CTG 7 and CTG 10), one CTG had a PCSI category of 4 (CTG 8) , and the most, seven, had a PCSI category of 7 (CTGs 1, 2, 3, 4, 5, 6, and 9).

In 1990, the distribution of PCSI categories were as follows: one CTG had a PCSI category of 1 (CTG 9); one CTG had a PCSI category of 3 (CTG 3); and the vast majority, nine CTGs, had a PCSI category of 5 (CTG 1, 2, 4, 5, 6, 7, 8, 10, and 11).

In 2004, two CTGs, CTG 7 and 8, had a PCSI category of 1; none had a PCSI category of 2; one, CTG 10, had a PCSI category of 3; one had a PCSI category of 4 (CTG 1); and the most, seven of the eleven CTGs, had a PCSI category of 5 (CTGs 2, 3, 4, 5, 6, 9, and 11).

TABLE 4.15: SUMMARY: CATEGORIES OF PRIMARY CARE SERVICE INDEX (PCSI CATEGORIES), BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

	PCSI CATEGORY (1=low / 3=moderate / 5=high)			
CTG	1985	1990	2004	CHANGE 1985-2004
1	5	5	4	-1
2	5	5	5	0
3	5	3	5	0
4	5	5	5	0
5	5	5	5	0
6	5	5	5	0
7	2	5	1	-1
8	4	5	1	-3
9	5	1	5	0
10	2	5	3	1
11	1	5	5	4
TOTAL	5	5	5	0

Composite Need Scores were also put into categories (1 to 4) and analysed by CTG. There were four CNS categories. The four CNS categories and their meanings are shown below.

CNS categories		**Description**
1)	0.0 – 24.9	High
2)	25.0 – 49.9	Medium
3)	50.0 – 74.9	Low
4)	75.0 – 99.9	Very Low

In this study, CNS designation as Category 1 implies that a small area CTG has *high need* due to *high poverty, high LBW, or both*; designation as Category 4 implies a *low need due to low poverty, low LBW, or both.*

4.4.3.1.19 *Findings, CNS Category by CTG*

Research hypothesis H_{04} for this study concerns determining if the calculated CNS values by CTG differ significantly from the overall District mean value. This section provides findings of the study by CNS and CTG. To evaluate Hypothesis H_{04}, values of CNS by CTG for the District were calculated and compared for study periods 1985 to 2004. Hypothesis H_{04} is stated as follows:

> H_{04}: The quantitative measure of "need" for primary care - "composite need score (CNS)" - which is calculated the from *study variable low birth-weight%,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

As described in detail in the Methods chapter (chapter 3), the raw values for CNS were calculated by the researcher by adding together the numerical poverty and low birth-weight values. Because of this addition, the maximum possible CNS raw score was 200 (i.e. 100%+100%). The raw CNS values were then standardised (from the raw summed value of 200) to a possible maximum score of 100%. By definition, a *CNS standardised score of 50 percent or less indicated a CTG area of high need*. The alternative meaning is that 50 percent or less of the area's need was met while 50% was not met.

Table 4.15b below presents findings for Composite Need Scores (CNS) by CTG for the District. In this table, it must be noted that if a value for *CNS<50%, then the CTG is an area of need*; (See chapter 3). Also, it is important to note that *CTG areas with populations in need (that is, CNS values are <50%) are shown in color, below.*

The CNS finding is that for each of the three study periods, about five or six of the eleven new CTG areas were areas of high need, with CNS values of 50% or less. In 1984-1985, CTGs 2, 7, 8, 10 and 11 had lower CNS values; in 1990-1992, CTGs 5, 7, 8, 9, 10 and 11 had lower CNS values and *in 2004-2005, CTGs 2, 7, 8, 10 and 11 (same as in 1984-1985, twenty years earlier) had lower CNS values*. High areas of need in the District appeared not to have budged in about twenty years of physicians providing primary care visits in the District of Columbia. It appeared that CNS values differed significantly by CTG from the total District mean CNS value, thus leading to the conclusion to reject null hypothesis H_{04}. The District's CTG areas with lower CNS values (i.e. areas with high community need or low CNS values as measured by study variable low birth-weight%), are **highlighted in colour**, in the Tables below.

TABLE 4.15b: COMPOSITE NEED SCORES BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CTG	1985	1990	2004	%CHANGE 1985-2004
1	**77.3**	**59.1**	**54.3**	**-23.0**
2	**40.9***	**72.7**	**48***	**7.1**
3	**100.0**	**95.5**	**80.8**	**-19.2**
4	**86.4**	**95.5**	**65.9**	**-20.5**
5	**72.7**	**45.5***	**56**	**-16.7**
6	**63.6**	**72.7**	**56.6**	**-7.0**
7	**31.8***	**18.2***	**39.2***	**7.4**
8	**13.6***	**22.7***	**27.3***	**13.7**
9	**50.0**	**36.4***	**64.3**	**14.3**
10	**31.8***	**36.4***	**36.3***	**4.5**
11	**13.6***	**36.4***	**41.7***	**28.1**
TOTAL, DC	52.9	53.7	52.5	-0.4

All CNS numbers above are standardised, maximum = 100% (See chapter 3)
**If CNS<50%, then the CTG is an area of need; (See chapter 3)*
** **CTG areas with populations in need are shown in** color, above.*

As shown above in Table 4.15b, in 1985, this study found that 5 or more of the eleven CTGs, in each study period, had CNS values of 50% or less, indicating that they were high need areas.

Table 4.16 below puts CNS standardised scores into categories (CNS category 1=very high need for primary care visits; CNS category 4=very low need for primary care visits).

The finding is that two CTGs had a CNS category of 1 (CTG 8 and CTG 11); three CTGs had a CNS category of 2 (CTG 2, 7 and 10), three CTGs had a CNS category of 3 (CTG 5, CTG 6, and CTG 9), and three CTGs had a CNS category of 4 (CTG 1, CTG 3, and CTG 4).

In 1990, the distribution of CNS categories was as follows: two CTGs had very high need with a CNS category of 1 (CTG 7 and 8); three CTGs had a medium need CNS category of 3 (CTG 1, 2, and 6); and two CTGs had a low need CNS category of 4 (CTG 3 and CTG 4).

Figure 4.10 shows that in 2004, none of the eleven CTGs in the District of Columbia had a CNS category of 1 indicating very high need. This means that none of the District's eleven CTGs were areas of very high need in year 2004, though five of the CTGs had a CNS category of 2 indicating high need (CTG 2, CTG 7, CTG 8, CTG 10, and CTG 11). Another group of five CTGs had a medium need CNS category of 3 (CTG 1, CTG 4, CTG 5, CTG 6, and CTG 9).

Findings by CNS category (low need, moderate need, high need) are summarised by CTG in Table 4.16 below.

TABLE 4.16: SUMMARY: CATEGORIES OF COMPOSITE NEED SCORES (CNS CATEGORIES) BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CNS CATEGORY (1=high / 2=medium / 3=low / 4=very low)

CTG	1985	1990	2004	CHANGE 1985-2004
1	4	3	3	-1
2	2	3	2	0
3	4	4	4	0
4	4	4	3	-1
5	3	2	3	0
6	3	3	3	0
7	2	1	2	0
8	1	1	2	1
9	3	2	3	0
10	2	2	2	0
11	1	2	2	1
TOTAL	3	3	3	0

4.4.3.1.20 Findings, Categories of Primary Care Priority Scores (PCSI)

Research hypothesis H_{05} for this study concerns determining if the calculated primary care priority scores (PCPS) differed significantly by CTG for the District.

This section provides findings of the study by PCPS and CTG. To evaluate Hypothesis H_{05} values of PCPS by CTG for the District were calculated and compared for study periods 1985 to 2004.

A description of the Tables in this section and how each Table relates to one or more of the six hypothesis of this study, follows below. Hypothesis H_{02}: pertains to PCSI, the primary care service index and H_{05} pertains to PCPS, the priority score.
Hypothesis H_{02} states the following:

> H_{02}: The primary care service index (PCSI) which is calculated from *study variables active physicians, poverty%* and is the ratio of primary care visits demanded by the population to the primary care visits satisfied, does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Hypothesis H_{05} states the following:

> H_{05}: The primary care priority scores (PCPS) – which is calculated from *study variables PCSI and CNS* - when cross-tabulated by census tract or Census Tract Grouping, do not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

As described in Chapter 3: Methods, the cross-tabulation of PCSI categories by CNS categories created the primary care *priority* score categories.

In this study, priority score is a combined category obtained by cross-tabulating PCSI categories with CNS categories. Priority scores are more precisely referred to as *primary care priority scores (PCPS).* They range from a priority score of 1 (low priority) to a priority score of 3 (high priority).

As described in the Methods section (chapter 3), in this study, the values of Primary Care Service Index (PCSI) and Composite Need Scores (CNS) were put into categories and cross-tabulated in order *to obtain the primary care priority scores (PCPS)*. There were five categories for PCSI (category 1= low available physician visits, to category 5= high physician available visits) and four CNS categories (category 1 = high need, to category 4 = low need) for CNS. Finally, the two categorical variables (PCSI category and CNS category) were cross-tabulated to generate priority (PCPS) three scores (PCPS category 1 = high priority, 2 = medium priority, category 3 = low priority). .

As described in detail in the Methods section (chapter 3) and summarised above, the primary care priorities and their meanings are as shown below, in Table 4.16b:

TABLE 4.16b: PRIMARY CARE PIORITY SCORE CATEGORIES AND THEIR MEANINGS, BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

PCPS (1=high / 2=medium / 3=low)

	PCSI categories				
	1 (very low satisfied visits)	**2 (low satisfied visits)**	**3 (med satisfied visits)**	**4 (med high satisfied visits)**	**5 (high satisfied visits)**
CNS categories					
1 (high need)	**1-HIGH**	**1-HIGH**	**2-MED**	**2-MED**	**2-MED**
2 (med high)	**1-HIGH**	**1-HIGH**	**2-MED**	**2-MED**	**2-MED**
3 (med low)	**2-MED**	**2-MED**	**2-MED**	***3-LOW***	***3-LOW***
4 (low need)	**2-MED**	**2-MED**	**2-MED**	***3-LOW***	***3-LOW***

From the above, it is seen that:

If PCSI Category is: and CNS Category is: THEN Priority Score is:

1 or 2 (low physicians)	1 or 2 (high need)	1 = high priority
3 (medium physicians)	3 (medium need)	2 = medium priority
4 or 5 (high physicians)	3 or 4 (low need)	3 = low priority

The District of Columbia, based on the comparative values of PCSI and CNS for the 192 census tracts which were aggregated by researcher into the eleven Census Tract Groupings, was grouped by priorities for primary care services. The year-specific priority score (PCPS) findings for 1985, 1992 and for 2004 are shown in the Tables below.

4.4.3.1.21 Findings, priority score categories by CTG, for 1985 to 2004

Primary Care PRIORITY AREAS, 2004

LEGEND: HIGH MED LOW

	CNS 1	2	3	4
PCSI				
1		CTG 7, 8		
2				
3		CTG 10		
4			CTG 1	
5		CTG 2, 11	CTG 3, 4, 5, 6, 9	

Figure 4.11: Study findings for Year 2004: Primary care priority areas, District of Columbia, 1985-2004

In 2004, CTG 7 and CTG 8 in the District of Columbia were the only two CTGS to have a primary care priority score of 1 (indicating a high priority for *additional* primary care physicians services); CTG 2, CTG 10, and CTG 11 had priority scores of 2; and six CTGS (CTG 1, CTG 3, CTG 4, CTG 5, CTG 6, and CTG 9) had priority scores of 3 (low priority for primary care physicians and services).

Primary Care PRIORITY AREAS, 1992

LEGEND: HIGH MED LOW

	CNS 1	2	3	4
PCSI				
1		CTG 9		
2				
3				CTG 3
4				
5	CTG 7,8	CTG 5, 10, 11	CTG 1, 2, 6	CTG 4

Figure 4.12: **Study findings for Year 1992: Primary care priority areas, District of Columbia, 1985-2004**

In 1990, CTG 9 had a priority score of 1 (high priority for primary care physicians services); six CTGs (CTGs 3, 5, 7, 8, 10, and 11) had priority scores of 2 (moderate priority for primary care physicians services); and three CTGS (CTGs 1, 2, and 6) had priority scores of 3 (low priority for primary care physicians services).

Primary Care PRIORITY AREAS, 1985

LEGEND:

HIGH MED LOW

	CNS 1	2	3	4
PCSI				
1	CTG 11			
2		CTG 7, 10		
3				
4	CTG 8			
5		CTG 2	CTG 5, 6, 9	CTG 1, 3, 4

Figure 4.13: Study findings for Year 1985: Primary care priority areas, District of Columbia, 1985-2004

In 1985, this study found that CTG 7, CTG 10 and CTG 11 had priority scores of 1 (high priority); CTG 2 and CTG 8 had priority scores of 2 (moderate priority); and six CTG (CTG 1, CTG 3, CTG 4, CTG 5, CTG 6, and CTG 9) had priority scores of 3 (low priority).

The findings show that the distribution of the primary care priority scores (PCPS) for the District for 1985 was similar to the priority distribution for 2004, twenty years later. For example, CTG 7 had a priority score of 1 in 1985, 1 in 1990, and 1 in 2004. CTG 8 had a priority of 1 in 1990 and again in 2004. The implications of the stable as well as changing primary care priority scores (PCPS) over the twenty-year period covered by this study are discussed further in Chapter 5: Conclusions and Recommendations.

4.4.3.1.22 Findings, Shortage areas: The Gap or additional "Visits Needed"

Research hypothesis H_{06} for this study aimed to determine if the study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, can significantly predict the existence of a primary care "visits gap" in the District of Columbia. To evaluate Hypothesis H_{06}, values of physician supply and location, PCSI, CNS were analysed separately and in combination to see if they could be used to estimate the scope and extent, if any, of primary care "visits gaps" by CTG in the District. Research hypothesis H_{06} states the following:

> H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care "visits gap" by census tract or Census Tract Grouping in the District of Columbia.

Additionally, research hypothesis H_{03} is about the visits gap. It is stated as follows:

> The unsatisfied visits (or "visits gap") in primary care, which is calculated *from study variables PCSI and CNS,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Visits gap is a variable whose values are calculated by subtracting visits demanded from available visits. Visits demanded was a variable whose values were calculated by using population and physician ratios based on community need. Visits satisfied was a variable whose values were calculated by multiplying nationally-estimated standards for physician productivity by local population densities and physician supply numbers. The values of the variable visits gaps were thus able to be calculated in this study by computing the difference, for each CTG, between visits available and visits demanded.

This study found that gaps (or primary care visits gaps) did exist in District communities, based on need or potential demand (as estimated by poverty and low birth-weight percentages) and satisfied demand (based on numbers of primary care and specialist physicians in existence and in active practice in a community. In this study, all references to “gaps” refer to visits gaps or gaps in physician visits (or numbers of visits) lacked by the resident population of a small area (CTG) within the District of Columbia.
Visits demanded In this study, using DC-specific populations by age-groups, community-specific poverty percentages, and normative physician productivity visit rates for the US, quantitative estimates of total potential visits demand were produced for each of the eleven Census Tract Groupings (CTG) in the District of Columbia over the twenty year period from 1985 to 2004. This is the estimated level of “need” within a particular small area in an urban context. Similarly, this study used the actual numbers of active, practicing primary care and other specialist physicians and low, moderate and high physician productivity estimates to generate estimates for “satisfied’ visits or “actual visits” by small area (CTGs). This satisfied demand is the portion of the total “need” that has been met by the presence in a community of primary care physicians and specialists. A community with a higher number of physicians will have a larger proportion of its “need” met or satisfied.

In general economics theory, when supply is equal to demand, the optimum condition for price is set. Thus *economic need* is met when supply for a product or service equals demand. In other words, economic need less economic demand is zero and there is no unmet need (i.e. unmet need equals zero). A similar approach is assumed in this study. In an ideal situation, primary care demand would equal primary care need. Available visits would be equal to actual visits needed. The difference between what was needed and what was needed would, by definition, be a deficit, a shortage or a gap.

Visits gap, the study variable used for evaluating research hypothesis $H_{03,}$ was calculated as follows: As described in detail in chapter 3 (Methods), by definition, the numerical difference between the potential demand (total "need") and satisfied demand (actual visits) equals the "unmet need" or "visits needed," (variable name: *visneed*) as depicted in the formula below:

IV:	(H_{03}):	Potential Demand (A)	–	Satisfied Demand (B)	=	Unsatisfied Visits, or "Visits Gap" or "Unmet" Demand

This study produced estimates (i.e. numerical differences between what is needed and what is available) for each Census Tract Grouping's level of "unmet need" or "visits needed" or "visits gap" or "unsatisfied visits." In this study, "unmet need" and "unmet demand" are one and the same concept. Findings for the variable, *visneed*, calculated as per the above formula (the difference between potential visits and satisfied visits), are shown below.

Table 4.17 below is to be interpreted as follows: Four CTGs had visits shortages (positive numerical difference) in year 1985, two CTGs had visits shortages (positive numerical difference) in 1992 and two CTGS had visits shortages (positive numerical difference) in year 2002. It is worth remembering that the poverty% statistics displayed earlier by CTG showed that CTG 7 and CTG 8 – with the largest visits deficits or visits shortages were the two areas with the highest poverty percentages in the District.

Another finding from Table 4.17 is that when the entire twenty-year study period is considered, the visits trend from 1985 to 2004 created a situation where five of the eleven CTG had shortages in 2004 when compared to the situation in year 1984. In other words, a finding of the study is that CTGS were relatively worse off in 2004 than they were in 1985. This 1985 to 2004 period of great changes in the structure, administration, and financing of primary care in the District actually led to a relatively worse off situation in 2004 than in 1984.

Interpretation:

It must be noted that the numerical value of potential visits minus satisfied visits is either a positive or negative number. If this difference (or subtraction) is a positive number, it means that there was a visits shortage (or that there was unmet demand) in the CTG. Conversely, if the difference is a negative value, then it means that there was no shortage of primary care visits in the CTG – another way of stating that the demand for visits (based on community need) was met (or satisfied). Table 4.17 below shows the following: Contrary to null hypothesis H_{03} which proffers that visits gaps do not differ by CTG, in 1985 there were 4 CTGs with unmet demand (or visits deficits) which differed significantly from the overall visits gap mean for the District. Also in 1990 there were 2 CTGs with unmet demand and in 2004 there were 5 CTGS with unmet demand.

TABLE 4.17: ADDITIONAL VISITS NEEDED (VISNEED)* BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 1985-2004

CTG	1985	1990	2004	1985-2004 CHANGE
1	-583176	-289918	33056	616232
2	-692072	-229208	-760418	-68346
3	-1154862	183977	-402983	751879
4	-18225	-1555799	-145575	-127349
5	-899232	-2317285	-1657177	-757944
6	-27299	-282857	-141629	-114329
7	138297	-2003871	527898	389602
8	63793	-356960	525455	461662
9	-1671750	141315	-743720	928031
10	201512	-26193	83121	-118391
11	174680	-1228918	132844	-41836
TOTAL, DC	-4468335	-7965718	-2549126	1919210

It must be noted from the findings in Table 4.17, that:

- If additional visits needed, above, is negative (-) then satisfied visits exceed total demanded visits, and the CTG **is not** a visits shortage area;

- If additional visits needed, above, is positive (+) or non-negative then total demanded visits exceed satisfied visits, and CTG **is** a visits shortage area.

4.4.3.1.23 Findings: “Visits Needed” or Visits Gap

Findings on visits shortage areas (visits gaps) and the trend of visits shortages (or visits excess) over the study period 1985 to 2004, are shown in Table 4.18 below. The finding is that when comparing the situation in 2004 to the situation as existed in 1985 (twenty years prior), there were visits primary care visits shortages in CTG 1, CTG 3, CTG 7, CTG 8 and CTG 11. These are the CTGs for which the answer to the question: “is there unmet demand in 2004 compared to 1985” was “yes”.

Interpretation: Table 4.18 is explained I the following paragraphs. In this study, the simple equation, “Total Visits Demanded” minus “Satisfied Visits,” produced a number which is either a positive number or a negative number. If the total potential demand for primary care visits in a small area CTG is larger than the satisfied demand, then there is unmet demand or excess demanded visits. Conversely, if the total potential demand for primary care visits in a small area is less than the satisfied demand (or if the satisfied visits is larger than the potential demanded visits) there is a shortage in satisfied or available visits.

“Visneed” represents the volume of unsatisfied visits in a given small area. *A positive visneed number is not desirable. Conversely, a negative visneed number for a small area is desirable. If visneed* estimates for 2004 show that a given CTG has a positive visneed number, then there was existing demand that was not met, or there existed more potential visits than satisfied visits. In 2004, five CTGs (CTG 1, 7, 8, 10, and 11) had excess demand, that is, they had more visits demanded than visits satisfied, which means that they had unmet demand or unsatisfied demand for primary care visits in those respective. An examination of the twenty-year trend from 1985 to 2004 showed that for five CTGs (CTG 1, 3, 7, 8, and 9) in the District, the unsatisfied needs were larger in 2004 than they were in 1985. In addition, *the District, as one city overall, had unsatisfied needs which were larger in 2004 than they were in 1985*. Over the twenty year period 1985 to 2004, the five CTGs (CTG 1, 3, 7, 8, and 9) experienced increasing levels of unmet primary care visits. This is discussed further in Chapter 5: Conclusions.

TABLE 4.18: OVERVIEW OF PRIMARY CARE SHORTAGES AND PRIORITIES OVER THE 20-YEAR PERIOD,

BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 2004 VERSUS 1985-2004

CTG	"Excess" Unmet Demand in 2004	Primary care shortage area **in 2004?**	Visits Needed, Actual Gap **1984to 2004**	Unmet Demand in 2004 **compared to 1985?**	Overall Trend over 20-year period: **(incr or decr?)**	PCPS: Priority 1=high 3=low **1985to 2004**
1	yes	yes	616232	yes	Incr. gap	1
2		yes	-68346			2
3			751879	yes	Incr. gap	3
4			-127349			3
5			-757944			3
6			-114329			3
7	yes	yes	389602	yes	Incr. gap	1
8	yes	yes	461662	yes	Incr. gap	1
9			928031	yes	Incr. gap	3
10	yes	yes	-118391			2
11	yes	yes	-41836			2
TOTAL		no	1919210	yes	Incr. gap	3

"Excess" ===➔ excess demand, thus unsatisfied visits remain.

"Increasing gap" == the excess demand in 2004 was larger than the excess demand in 1985, thus the excess demand was actually increasing over the 20-year period.

Gap priority, PCPS ==primary care priority score (1=high priority; 3=low priority).

4.4.4 Bivariate Analysis – Correlates of variable “*Vgap*,” or Visits Gap, CTG, PCSI and CNS

Research hypothesis H_{06} stated the following:

> H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care “visits gap” by census tract or Census Tract Grouping in the District of Columbia.

Additional analysis for research hypothesis H_{06} is presented in this section. Research hypothesis H_{06} seeks to determine if the study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, can significantly *predict the existence of a primary care “visits gap”* in the District of Columbia.

As described in chapter 3 (Methods), chi-square test for independence, which is also called Pearson's chi-square test for independence or the chi-square test of association, is used to determine whether there is a significant relationship between two categorical variables. The Chi-square test is intended to test how likely it is that an observed distribution is due to chance. It is also called a "goodness of fit" statistic, because it measures how well the observed distribution of data fits with the distribution that is expected if the variables are independent (Fos 2011).

Bivariate analysis (cross-tabulations and chi square test for independence) was conducted on selected study variables including visits gap or variable *vgap*. The purpose of a cross-tabulation was to show the existence of a correlation (or lack thereof) between two variables. The variables studied in the bivariate analysis were *vgap* (visits gap) and primary care service category (pcsicat), composite need score category (cnscat), priority score category (prscat), and Census Tract Grouping (CTG). The visits gap (*vgap*) dichotomized variable represented the continuous variable, *visneed* which is the numerical gap (excess or shortage) between existing total potential demand and satisfied demand). Results for the variables (pcsicat, cnscat, prscat, ctg) are presented below. The following cross-tabulation information is provided for each table:

-visits gap by one categorical variable,

-Pearson chi-square statistic,

-degrees of freedom and chi-square significance level.

To interpret the results and tables presented in section 4.4.4.1 below, it must be noted that the Pearson chi-square tests the hypothesis that the row and column variables are independent. In this study, the chi-square statistic is used as a measure of divergence between the distribution of the study variables and an expected distribution. "Asymp. Sig." is an abbreviation for asymptotic significance, which means that the significance is close to zero. In the IBM SPSS outputs, if the Pearson chi-square value listed under "Asymp. Sig" is less than .05 it indicates that the rows and columns of the contingency table are dependent based on the level of confidence. The chi-square statistics by themselves are not very informative alone, but are used to determine the p-value (Presnell 2012: 1-5; Garth 2008:68-72; Minitab 2013: 1).

In IBM SPSS20, the computer statistical analysis software used by this researcher to analyse the data in this study, "Asymp. Sig. (2-sided)" is equivalent to "p." The significance value (Asymp. Sig.) provides important information. The lower the significance value, the less likely it is that the two variables are independent (unrelated) and the more likely it is that the two variables are dependent (Minitab 2013: 1).

In the Tables presented below in section 4.4.4.1, the percentages in the "%" column, below, are the percentage of the sample of 184 census tracts in DC in 2004 for which the bivariate analysis was conducted, that fell in a particular table cell junction of the two cross-tabulated variables. DC had 188 census tracts in 2004 but four of the census tracts had no resident populations, e.g. parks, office buildings, water bodies. These were excluded from the census tract-based cross-tabulations. Thus 184 census tracts and not 188 constituted the sample size for the cross-tabulations.

The chi-square statistic is given in the "chi-square" column. The chi-square evaluates discrepancies between a set of observed frequencies and expected frequencies, and it is equal to the sum of squared differences between the observed and expected frequencies (residuals) divided by the expected frequency.

A numerically small chi-square statistic indicates that there was no relationship between the variables in the table. A numerically large chi-square statistic indicates that the variables were most likely related to one another and the relationship was not merely the result of random error. The degrees of freedom are listed in the “df” column. This number accounts for the number of different cells in a cross-tabulation table that can contribute information to the chi-square, and it is equal to (number of rows in the table - 1) multiplied by (number of columns - 1).

The chi-square significance level is listed in the “Sig.” column below. The significance level indicates to a researcher how often one would obtain a value of the chi-square statistic at least as large as the one observed in the cross-tabulation table if the variables are not related in a population based on the observed significance level of .05. If the chi-square significance level is less half .05, then the dependent and independent variables are related to one another. In this case, the category of the variable with the highest percentage is the variable category which is more likely to be useful as a predictor for the dependent variable, visits gap (or vgap).

If the significance level is greater than .05, this means that the dependent and independent variables are not related, and the categories/groups of the independent variables are equally likely as predictors of the existence of a visits gap (shortage=0; excess=1) in a community or small area of the District.

4.4.4.1 Findings: Cross-tabulation, Visits Gap (vgap) by CTG

The results of this cross-tabulation is shown in Table 4.23 to 4.28 below. Of the 184 census tracts with resident populations used in this bivariate analysis, 142 (77.2 percent) were primary care visits excess areas and 42 (22.8 percent) were visits shortage areas. Excess areas are areas where vgap = 0 or visits demanded exceed visits satisfied. Thus there is unsatisfied demand in the excess areas. Non-excess areas are areas where vgap=1 or visits satisfied exceed visits demanded. There is no unsatisfied demand in these areas.

Of particular interest to the District's public health and planning officials, is the finding that all census tracts within Census Tract Grouping 7 (100%) were identified as areas with unsatisfied demand. Other CTGs with large numbers of unsatisfied demand areas were CTG 8 (95.0 percent), CTG 11 (93.3 percent), CTG 10 (87.5 percent), CTG 5 (87.5 percent), and CTG 1 (82.4 percent).

This analysis (see Table 4.19 below) provides the first indication that the Census Tract Groupings (CTGs) for the District of Columbia can be included as one of the useful predictors of gaps in primary care as well as socioeconomic and health-related conditions in the District. For this table (see Table 4.20), Pearson chi square = 26.995; df = 10, Asymp. Sig = 0.003. Thus, there appears to be a relationship between CTGs and the existence of visits gap (shortage or excess).

4.4.4.2(i) Visits Gap (vgap) by Primary Care Service Index Category (pcsicat)

Based on the results of the preliminary analysis of the primary care physicians and specialist distributions within the District of Columbia in 2004, all the census tract areas in the District were classified into primary care service index categories (pcsicat). There were 5 PCSI categories as follows, ranging from the neediest (needing the most additional physicians) to the least in need (for additional physicians):

1) 0.0 – 0.24 : Very low available physicians (has *high need* for additional physicians)
2) 0.25 – 0.49 : Low available physicians
3) 0.50 – 0.74 : Medium available physicians
4) 0.75 – 0.99 : Medium high available physicians

5) 1.00+ : High available physicians (has *low need* or no need for additional physicians).

The bivariate analysis of the variable vgap (visits gap) by PCSI categories (physicians distribution gap) showed that of the 142 census tracts in the excess demand (unsatisfied demand) category, 100 of them had a pcsicat value of 1, and 25 of them had a pcsicat value of 2, both high need categories. The Pearson chi square was significant (Asymp. Sig = 0.000) – see Table 4.22, documenting the existence of a relationship between the pcsi categories and unsatisfied demand/no unsatisfied demand areas within the District.

4.4.4.2(ii) Visits Gap (vgap) by Composite Need Score Category (cnscat)

Results of the preliminary analysis of the socio-demographic characteristics (percent poverty, percent low birth-weight) used in this study provided a basis for classifying census tracts and Census Tract Groupings into four CNS category areas. The 4 CNS categories as follows, ranging from the neediest to the relatively less needy:

1) 0 – 24.0 Very high need (has high levels of socioeconomic and relatively poor health status).
2) 25.0 – 49.9 Medium high
3) 50.0 – 74.9 Medium
4) 75.0 – 100.0 Low need (has low levels of socioeconomic stress and relatively poor health status).

Of the 142 census tracts in the District with unsatisfied demand for primary care visits, 43 were in CNS category 2, 42 in CNS category 3, and 31 in CNS category 1. Composite need score categories appear to be statistically significantly related to visits need gap category. The Pearson chi square was significant (Asymp. Sig = 0.009), documenting the existence of this relationship between the CNS categories and unsatisfied demand/no unsatisfied demand areas within the District.

This finding provides additional support for rejecting the study hypothesis H_{06}: which stated that primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care "visits gap" by census tract or Census Tract Grouping in the District of Columbia.

TABLE 4.23: CROSS-TABULATION OF VISITS GAP BY CNS CATEGORIES, DISTRICT OF COLUMBIA, 1985-2004

			visits need gap category		Total
			.00=excess	1.00= shortage	
1.00	Count	3	31	34	
cns categories	1.00	Count	3	31	34
		% within cns categories	8.8%	91.2%	100.0%
	2.00	Count	7	43	50
		% within cns categories	14.0%	86.0%	100.0%
	3.00	Count	17	42	59
		% within cns categories	28.8%	71.2%	100.0%
	4.00	Count	15	26	41
		% within cns categories	36.6%	63.4%	100.0%
Total		**Count**	**42**	**142**	**184**
		% within cns categories	**22.8%**	**77.2%**	**100.0%**

TABLE 4.24: SIGNIFICANCE TESTING FOR CROSS-TABULATION OF VISITS GAP BY CENSUS TRACT GROUPING, DISTRICT OF COLUMBIA, 2004

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.602(a)	3	.009
Likelihood Ratio	12.181	3	.007
Linear-by-Linear Association	11.108	1	.001
N of Valid Cases	184		

(a) 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.76.

4.4.4.3 Visits Gap (vgap) by Census Tract Grouping

A finding of this study is that there were, in 1985, 1990, and 2004, Census Tract Groupings in the District of Columbia that contained census tracts or smaller areas that were either (i) primary care visits shortage areas, or (ii) non-shortage areas. In addition to knowing which Census Tract Groupings were shortage areas this study also showed which specific census tract small areas within a Census Tract Grouping were shortage areas.

The shortage/non-shortage areas findings are presented below for the 2004 data analysis for the District of Columbia. The variable, *vgap*, is visits gap or excess/shortage. In Table 25 below, if *vgap* (the column variable) is 0, the census tract area is not a shortage area (the area has more satisfied demand than potential demand). If *vgap* is 1, the census tract area is a shortage area (that is, the area has more potential demand than satisfied visits).

The shortage area findings are summarised below, for study year 2004:

- Of the 17 census tracts in CTG 1, 14 were primary care visits shortage areas.
- Of the 15 census tracts in CTG 2, 10 were shortage areas.
- Of the 23 census tracts in CTG 3, 14 were shortage areas.
- Of the 18 census tracts in CTG 4, 11 were shortage areas.
- Of the 16 census tracts in CTG 5, 14 were shortage areas.
- Of the 14 census tracts in CTG 6, 9 were shortage areas.
- Of the 16 census tracts in CTG 7, all 16 were shortage areas.
- Of the 20 census tracts in CTG 8, 19 were shortage areas.
- Of the 14 census tracts in CTG 9, 7 were shortage areas.
- Of the 16 census tracts in CTG 10, 14 were shortage areas.
- Of the 15 census tracts in CTG 11, 14 were shortage areas.

Overall, in the District of Columbia in 2004, of the 188 census tracts (of which 184 had nonzero resident populations), 142 (or 77.2 percent) were primary care visits shortage areas. In these shortage areas, primary care demanded visits exceeded primary care satisfied (available) visits. The unmet visits constitute the "need" gap or visits gap.

In Table 4.25 below, the following variables are shown:

● vgap = visits gap, the difference between visits demanded and visits available

● vgap category = 0 is not a shortage area;
vgap category= 1 is a shortage area

● census tracts are smaller areas within a Census Tract Grouping

In table 4.25 below, the finding is that for the District of Columbia, for the study period 1985 to 2004, the primary care shortage areas (or visits gaps) existed in all of the eleven Census Tract Groupings (CTG).

TABLE 4.25: CENSUS TRACTS THAT HAD VISITS GAPS (VGAP), OR PRIMARY CARE VISITS SHORTGES, BY CENSUS TRACT GROUPINGS DISTRICT OF COLUMBIA, YEAR 2004

(Note: *vgap=0 is not a shortage area; vgap=1 is a shortage area)

●vgap = visits gap, the difference between visits demanded and visits available)
●*vgap category =0 is not a shortage area;
vgap category=1 is a shortage area
●**census tracts are smaller areas within a Census Tract Grouping

CTG			visits need gap *(vgap) category	
			0 is not shortage	1 is shortage
1	**CT	29	0	1
		30	0	1
		31	0	1
		32	0	1
		34	1	0
		35	0	1
		36	0	1
		37	0	1
		38	0	1
		39	0	1
		41	1	0
		2701	0	1
		2702	0	1
		2801	0	1
		2802	0	1
		4001	1	0
		4002	0	1
	Total		3	14
2	CT	56	1	0
		58	1	0
		59	0	1
		61	0	1
		64	0	1
		65	0	1
		70	1	0

		72	0	1
		82	0	1
		5701	1	0
		6001	0	1
		6002	0	1
		6201	1	0
		6301	0	1
		6302	0	1
	Total		5	10
3	CT	1	1	0
		3	0	1
		4	1	0
		6	1	0
		11	1	0
		12	1	0
		15	0	1
		201	1	0
		202	0	1
		501	0	1
		502	0	1
		701	0	1
		702	0	1
		801	0	1
		802	0	1
		901	0	1
		902	0	1
		1001	0	1
		1002	0	1
		1301	1	0
		1302	1	0
		1401	1	0
		1402	0	1
	Total		9	14
4	CT	16	1	0
		24	0	1
		26	1	0
		1701	1	0
		1702	0	1
		1801	1	0
		1802	0	1
		1804	0	1
		1901	1	0
		1902	0	1
		2001	1	0

		2002	1	0
		2101	0	1
		2102	0	1
		2201	0	1
		2202	0	1
		2501	0	1
		2502	0	1
	Total		7	11
5	CT	94	0	1
		2301	0	1
		2302	1	0
		3301	0	1
		9201	0	1
		9203	0	1
		9204	0	1
		9301	0	1
		9302	0	1
		9501	0	1
		9503	0	1
		9504	1	0
		9505	0	1
		9507	0	1
		9508	0	1
		9509	0	1
	Total		2	14
6	CT	66	1	0
		67	0	1
		69	0	1
		71	0	1
		81	1	0
		841	0	1
		6801	0	1
		6802	0	1
		6804	1	0
		7901	0	1
		7903	0	1
		8001	1	0
		8002	1	0
		8302	0	1
	Total		5	9
7	CT	7502		1
		7503		1
		7504		1
		7601		1

		7603		1
		7604		1
		7605		1
		7703		1
		7707		1
		7708		1
		7709		1
		9901		1
		9902		1
		9905		1
		9906		1
		9907		1
	Total			16
8	CT	97	1	0
		7301	0	1
		7302	0	1
		7304	0	1
		7308	0	1
		7401	0	1
		7403	0	1
		7404	0	1
		7405	0	1
		7406	0	1
		7407	0	1
		7409	0	1
		9801	0	1
		9802	0	1
		9803	0	1
		9804	0	1
		9806	0	1
		9807	0	1
		9808	0	1
		9809	0	1
	Total		1	19
9	CT	43	0	1
		44	1	0
		50	1	0
		51	0	1
		55	1	0
		4201	0	1
		4202	1	0
		4901	0	1
		4902	0	1
		5201	0	1

		5202	1	0
		5301	0	1
		5302	1	0
		5401	1	0
	Total		7	7
10	CT	90	1	0
		7803	0	1
		7804	0	1
		7806	0	1
		7807	0	1
		7808	0	1
		7809	0	1
		8903	0	1
		8904	0	1
		9101	0	1
		9601	1	0
		9602	0	1
		9603	0	1
		9604	0	1
		9903	0	1
		9904	0	1
	Total		2	14
11	CT	46	0	1
		47	0	1
		85	0	1
		86	1	0
		3302	0	1
		4801	0	1
		4802	0	1
		8301	0	1
		8402	0	1
		8701	0	1
		8702	0	1
		8802	0	1
		8803	0	1
		8804	0	1
		9102	0	1
	Total		1	14

(Note: *vgap=0 is not a shortage area; vgap=1 is a shortage area)

4.4.4.4 Primary Care Priority Scores (PCPS)

Priorities, or more precisely primary care need area priorities, are assigned in this study based on mapped intersections between values of primary care service indexes (PCSI categories) and composite need scores (CNS categories).

Low PCSI scores and high CNS values were synonymous with high need and thus assigned high priority (priority=1). Similarly, high PCSI scores and low CNS values were synonymous with low levels of need and were thus assigned low priority values (priority=3).

The priority scores were recoded and a priority variable, primary care priority score (or PCPS) was created in SPSS using the following logic:

PCSI	CNS	PRIORITY SCORE (PCPS)
low PCSI (1, 2)	with high CNS (4, 5)	====➔1 = high priority area
medium PCSI (3)	with medium CNS (3)	====➔2 = medium priority area
high PCSI (4, 5)	with low CNS (1, 2)	====➔3 = low priority area

4.4.5 Census Tract Groupings (CTGs) with low, moderate and high primary care priority designations, 2004

Research hypothesis H_{06} states the following:

> H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care “visits gap” by census tract or Census Tract Grouping in the District of Columbia.

To evaluate whether or not hypothesis can be rejected or not rejected, additional analysis of primary care priorities was undertaken. In 2004, priority areas based on the mapped intersection of primary care service indexes (PCSI) and composite need scores (CNS) are as follows, as shown in Table 4.26:

Priority 1: High priority (high need) : CTG 7, 8.
Priority 2: Medium priority (medium need) : CTG 2, 10, 11.
Priority 3: Low priority (low need) : CTG 1, 3, 4, 5, 6, 9.

TABLE 4.26: CROSS-TABULATION OF PCSI BY CNS TO SHOW CTGs AND THEIR PRIORITIES, DISTRICT OF COLUMBIA, 2004

CNS (columns)

	1	2	3	4
PCSI category (rows)				
1		CTG 7,8		
2				
3		CTG 10		
4			CTG 1	
5		CTG 2, 11	CTG 3, 4, 5, 6, 9	

4.4.6 Census Tract Groupings (CTGs) with low, moderate and high priorities, 1992

In 1990-1992, priority areas based on the intersection of primary care service indexes (PCSI) and composite need scores (CNS) are as follows, as shown in Table 4.27:

Priority 1: High priority (high need) : CTG 9.

Priority 2: Medium priority (medium need) : CTG 3, 5, 7, 8, 10, 11.

Priority 3: Low priority (low need) : CTG 1, 2, 4, 6.

TABLE 4.27: CROSS-TABULATION OF PCSI BY CNS TO SHOW CTGs AND THEIR PRIORITIES, DISTRICT OF COLUMBIA, 1992

CNS (columns)

	1	2	3	4
PCSI category (rows)				
1		CTG 9		
2				
3				CTG 3
4				
5	CTG 7,8	CTG 5, 10, 11	CTG 1, 2, 6	CTG 4

4.4.7 Census Tract Groupings (CTGs) with low, moderate and high priorities, 1985

In 1985, priority areas based on the intersection of primary care service indexes (PCSI) and composite need scores (CNS) are as follows, as shown in Table 4.28 below:

Priority 1: High priority (high need) : CTG 9.
Priority 2: Medium priority (medium need) : CTG 3, 5, 7, 8, 10, 11.
Priority 3: Low priority (low need) : CTG 1, 2, 4, 6.

TABLE 4.28: CROSS-TABULATION OF PCSI BY CNS TO SHOW CTGS AND THEIR PRIORITIES, DISTRICT OF COLUMBIA, 1985

CNS (columns)

	1	2	3	4
PCSI category (rows)				
1	CTG 11			
2		CTG 7, 10		
3				
4	CTG 8			
5		CTG 2	CTG 5, 6, 9	CTG 1, 3, 4

4.4.8 Trend in the changes of Primary Care Priorities by Census Tract Groupings (CTGs), 1985-2004

The findings show that District of Columbia is a city with plentiful supply of physicians though short on the supply of available primary care physicians. This finding alone explains the anomalous finding that overall, the city had a low priority for obtaining additional total physicians in 1985, a low priority in 1992, and a low priority in 2004. The District has an abundant total physician capacity. It is in the area of primary care physician – and their equitable geographic distribution - that this study found the District to lack.

This study analysed the distribution of physicians by small area and identifiable communities, by census tracts and by Census Tract Groupings. This analysis of physician distribution by small area, coupled with an analysis of small area poverty levels and low birth-weight percentages, provides a more refined analysis of physician distribution and its impact on population need and visits demand.

Over the twenty year period from 1985 to 2004, there have been changes in the Census Tract Groupings in the District of Columbia that this study designated as low, moderate, or high priority areas. The basis for these designations remained the same in all three periods, 1985, 1990-1992, and 2004: high community need as depicted by a low CNS score (0 to 24.9 percent) combined with a low percentage of satisfied physician visits (0.0-0.249), earned an area a high priority designation or rating.

In 1985 there were three high priority Census Tract Groupings in the District of Columbia (CTG 7, 10, and 11). In 1990, there was only one high priority Census Tract Grouping (CTG 9). In 2004, there were two high priority Census Tract Groupings (CTG 7 and 8. Thus only Census Tract Grouping 7 was designated high priority in 1985, and twenty years later, is again a high priority designated area.

This study has shown that changes at the community level in socioeconomic stress levels and health status have varied widely from decade to decade. Further analysis, additional study and refinement of these community-based prioritization processes are needed especially of the Census Tract Groupings (see below) with moderate assigned priorities.

These findings are shown in Table 4.29 below:

TABLE 4.29: CHANGES IN PRIMARY CARE PRIORITY DESIGNATIONS OVER THE TWENTY-YEAR PERIOD, DISTRICT OF COLUMBIA, 1985 TO 2004

CTG	**1985**	**1992**	**2004**
1	L	L	L
2	M	L	M
3	L	M	L
4	L	L	L
5	L	M	L
6	L	L	L
7	H	M	H
8	M	M	H
9	L	H	L
10	H	M	M
11	H	M	M
DC, Overall	**L**	**L**	**L**

* Priorities shown above are as follows: L-low; M-medium; H-high.
High priority is *high need*.

4.5.1 Introduction to findings about CTGs in this study and how they relate to the federal Health Professional Shortage Area (HPSA) areas

As describes in chapter 3 (Methods), the US Federal Government's bureau of primary health care, in the Health Services and Resources Administration (HRSA) of DHHS has promulgated criteria for designating areas of the country as underserved for health care purposes. These designated areas have less than a generally accepted minimum number of clinicians (physicians, dentists and mental health workers) per thousand population. These areas are called Health Professional Shortage Areas (HPSAs) and the Primary Care HPSA designation allows sites within the area to apply for National Health Service Corps (NHSC) recruitment assistance, the J-1 Visa Waiver Program and Rural Health Clinic status. The federal HPSA criteria aligns very well with the criteria this researcher has used to create the eleven new CTG areas for the District.

Federal HPSA data of relevance to the study period for this study is the 2003 HPSA data for the District of Columbia which coincided, approximately, with year 2004 of this study. Twenty-six (26) census tracts out of the 182 census tracts in the city were designated as HPSAs in the District by the federal DHHS/HRSA in 2003. Another twenty-four census tracts in the District at some time prior were HPSA-designated but had their designations formally withdrawn due to changes in population or changes in numbers of physicians available.

The federal HPSA-designated areas are broken down by District geography as follows:

TABLE 4.30: 2003 FEDERAL HPSA DESIGNATIONS OF RELEVANCE TO THIS DCPC STUDY PERIOD OF 1985-2004, DISTRICT OF COLUMBIA, 2003

Area within the District or Population Group	# Census tracts designated as:	
	HPSA	(no longer HPSA)
East Capitol	19	8
North Capitol	0	5
Spanish-speaking Population	1	11
Mount Pleasant	6	0
Total	**26**	**24**

The geographic areas within the District of Columbia which were designated via the HPSA process are not the same as the Census Tract Groupings used in this study. However, there are more census tracts classified as shortage areas in this study of DC primary care than were designated in the federal HPSA designation process. Thus, the HPSA-designated census tracts are all contained within and coincide with the more expansive number of census tracts (in the CTGs) determined in this study to be primary care shortage areas in the District of Columbia, in 2004.

This study (DCPC) used US census tract poverty rates and 3- to 5-year averaged low birth-weight percentages together in combination with primary care physician distributions in making shortage area identifications. Using this approach, this study has identified more census tracts that qualify as primary care shortage areas than was the case via the federal HPSA process. The HPSA designation process does not use the same variables or criteria as this DCPC study.

There are similarities between the HPSA designation and the DCPC study methods, as follows:

- Both HPSA and this DCPC study use the concept of rational service areas for medical care;

- both use the same definitions of primary care physician specialties (general practice, family practice, internal medicine, pediatrics, obstetrics-gynecology);

- both are based on data for established neighborhoods and communities (though possessing different area definitions) within metropolitan areas which display a strong self-identity (as indicated by a homogeneous socioeconomic or demographic structure and/or a tradition of interaction or interdependency);

- both can be applied to cities or urban areas whose population centers are within 30 minutes travel time of each other; and

- both allow for the determination of unusually high needs for primary medical care services.

    - For federal HPSA designation, these are areas with:

more than 100 births per year per 1,000 women aged 15 to 44 or areas with more than 20 infant deaths per 1,000 live births, or areas with more than 20% of the population (or of all households) have incomes below the poverty level.

- For this DCPC study, areas of very high need are delineated using the primary care priority scores which are calculated in this study by cross-tabulation of two composite indices: CNS (combined poverty and low birth-weight percentages), PCSI (physician availability and distribution in small areas).

A distinction between the HPSA designation and this DCPC study is that HPSA is *not* primarily designed for cities or urban areas with population less than 20,000.

DCPC is based on aggregations of census tracts as its unit of analysis and each census tract has approximately 3,200 residents. However, this DCPC study method did *not* use census tracts per se. Instead, it aggregated several census tracts into one (much larger) CTG and thus obtained for the District, eleven Census Tract Grouping areas. Hence, the populations of each CTG area did exceed 20,000 persons, the limit for HPSA designations District CTG populations ranged from about 34,000 to 89,000. As was shown in Table 4.8 in section 4.4.3.1.7 above (earlier in this chapter), in the District of Columbia, in 1985, the CTG populations ranged from 34,803 (CTG 2) to 89,767 (CTG 3); in 1990 the CTG populations ranged from 34,192 (CTG 2) to 88,426 (CTG 3); and in 2004, CTG populations went from a low of 30,054 (CTG 2) to a high of 88,335 (CTG 3).

4.5.2 Physician Full-Time Equivalents (FTEs)

A limitation of this DCPC study is the limited availability of physician full-time equivalent ratios. FTEs, which are required for the HPSA designations, were not available for this DCPC study for two out of the three study periods: year 1985 and year 2004. However, FTEs were available for this study for the study period of 1990-1992. This DCPC study analysed this researcher’s original citywide survey of active physicians for 1990-1992 which was conducted as part of the District’s physician licensing process. It was a primary survey of active, DC-based physicians. The survey instrument (see Appendix) requested from physicians their estimated total hours worked in direct patient care for their primary practice location and a secondary or tertiary practice location, if any. As a norm, forty (40) hours worked per week was equivalent to one physician full time equivalent (FTE). The results of this survey are an original contribution by this researcher to primary care in the District. This study did not include physician FTE data for 1985 or 2004.

This study found that there were a total of 3,863 physicians in 1992, of which 2,120 were primary care physicians. Analysis of total hours worked by physicians in direct patient care, in primary practice and secondary practice locations within the District, found that the 2,120 primary care physicians translated into approximately 762.0 full-time equivalent physicians. This finding is significant since it shows that the although the District had many active physicians, only about a third practiced full-time in the District.

HPSA designations cover areas with shortages of primary medical care, dental or mental health practitioners; the areas may be urban or rural areas, population groups or medical or other public facilities. In contrast, this DCPC study only covered designations as shortage areas for *medical (primary care) reasons only*. It did not include dental or mental health reasons.

The limitations of the HPSA process include its reliance on the numbers and distribution of physicians and physician FTEs, numbers which are not readily available in the absence of a comprehensive (and often costly) physician survey. The HPSA designation criteria and method, which are can be fairly extensive, are briefly listed below.

The criteria used by the federal DHHS/HRSA for designation areas as federal Health Professional Shortage Areas is included in the list of references (42 CFR, CHAPTER 1, PART 5, Appendix A).

Federal HPSA designations include the following three parts:

Part I -- Geographic Areas Criteria.

2. Population Count.
3. Counting of Primary Care Practitioners.
4. Determination of Unusually High Needs for Primary Medical Care Services.
5. Determination of Insufficient Capacity of Existing Primary Care Providers.
6. Contiguous Area Considerations.

Part II -- Population Groups

Part III -- Facilities

A. Federal and State Correctional Institutions.

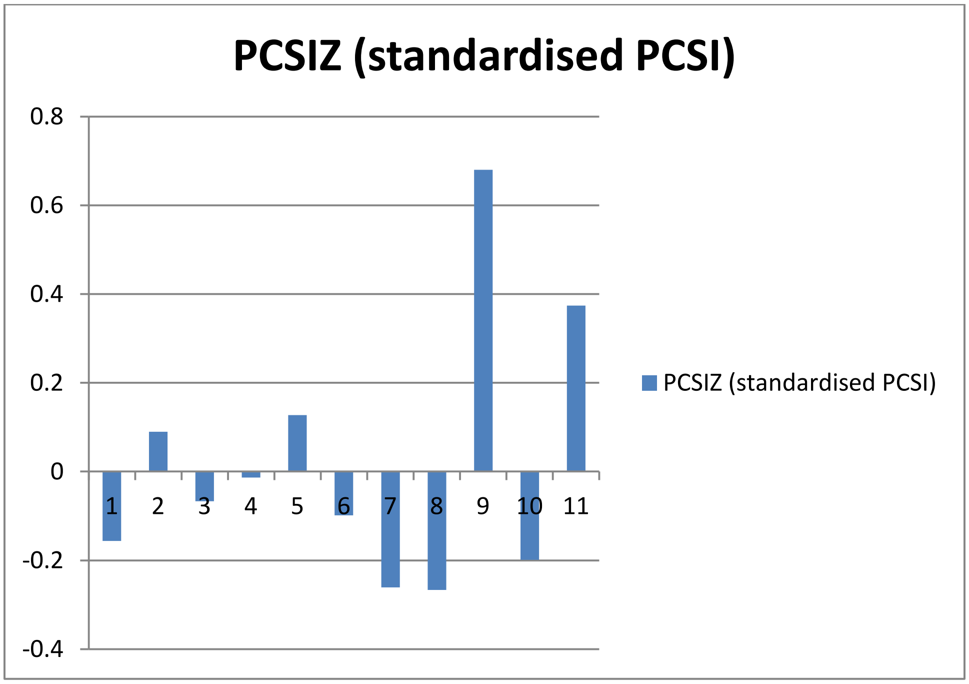
B. Public or Non-Profit Medical Facilities.

4.5.3 Standardised (z-score) values of PCSI and CNS

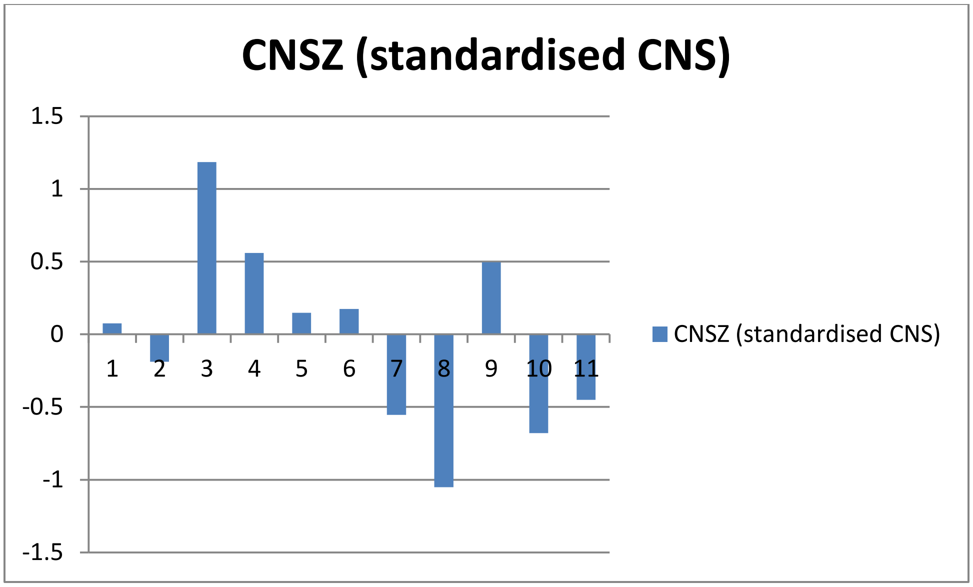
In this study raw (non-standardised) data were collected, organised, analysed and presented by census tracts in the District of Columbia. The results for the census tracts small areas (182 in 1985, 192 in 1990, and 188 in 2004) were then aggregated into larger rational health service areas, the eleven Census Tract Groupings (CTGs). The results are presented by CTG for Primary Care Service Index (PCSI) and Composite Need Score (CNS). These two indexes (or indices) were then statistically combined to create Primary Care Priority scores (PCPS) for each CTG.

For comprehensiveness and to provide intuitive results interpretation, standardised z-scores were calculated in this study for the two derived scores of this study – PCSI and CNS. The actual (raw) CNS scores for 2004 for the District of Columbia ranged from 0 to 100 percent. The actual PCSI (raw) scores ranged from 0.0 to 1.0 or larger. The results are displayed in the two histograms below, for PCSI standardised and for CNS standardised, respectively.

The diagram below shows that when the study variable PCSI is standardised, CTGs 2, 5, 9 and 11 fare relatively well while CTGs 1, 3, 6, 7, 8 and 10 fare relatively poorly. Thus the ratio of satisfied demand visits were higher (closer to 1 or higher than 1) for CTGs 2, 5, 9 and 11 while ratios of satisfied demand were lower (less than 1 or closer to zero) for CTGs 1, 3, 6, 7, 8 and 10.



When the study variable CNSI is standardised, CTGs 1, 3, 4, 5, 6 and 9 fared relatively well while CTGs 2, 7, 8, 10 and 11 fared relatively poorly. Thus the ratio of satisfied demand visits were higher (closer to 1 or higher than 1) for CTGs 2, 5, 9 and 11 while ratios of satisfied demand were lower (less than 1 or closer to zero) for CTGs 1, 3, 6, 7, 8 and 10.



Interpreting the standardised scores:

This section provides further explanation for standardising study variables PCSI and CNS. Standardising a variable creates a new variable z divided by standard deviation where the mean is zero and standard deviation is one. The definition is: z = (raw score minus mean score) divided by standard deviation. The interval-scaled raw variable values for PCSI and CNS were converted into standardised z-scores. The z-scores for PCSI and CNS, or standardised PCSI and CNS, provide indications to a researcher at-a-glance about how the (standardised) z-score for PCSI and CNS for one Census Tract Grouping fared when compared to the PCSI and CNS z-score for other CTGs.

In Table 4.31 below,

- for the PCSI indicator:

  a high PCSI z-score indicated high need;

  a low PCSI z-score indicated low need, relative to other census tracts or Census Tract Groupings.

The reverse is the case for the indicator, CNS: Examining the CNS-Z indicator standardised values in table 30 below,

- for the CNS indicator,

  a high CNS z-score indicated low need;

  a low CNS z-score indicated high need, relative to other census tracts or Census Tract Groupings.

In 2004, the PCSI z-scores (PCSI-Z) ranged from a low of -0.2667 (CTG 7) to 0 (CTG 11) to a high of +6797 (CTG 8). Also, in 2004, the CNS z-scores (CNS-Z) ranged from a low of -1.0523 (CTG 7) to 0 (CTG 11) to a high of +1.1844 (CTG 3).This is expounded upon in Chapter 5: Conclusions.

When the set of PCSI and CNS scores from this study are converted to z-scores, the scores are said to be standardised and are referred to as standard scores. *Standard scores have a mean of 0 and a standard deviation of 1*. This is so because in statistics, all normal distributions can be converted to the standard normal distribution using the standard score formula:

$$Z = \frac{X - \overline{X}}{s}$$

The standard normal distribution has a mean of zero (mean = 0) and a variance of one (s^2 = 1) thus, the standard deviation is one (s = 1). Since most distributions are observed rather than generated mathematically, there are features of normal distributions that can also be observed. In a normal distribution 68.26% of the distribution fall between plus and minus one standard deviation (±1.0s). Usually, this is denoted using the standard normal (Z-score) distribution as ±1.0Z. By examining the z-scores in Table 4.30 below, it can be seen that PCSIZ and CNSZ scores have a standard normal distribution thus 95.44% of the CTG means fall between ±2.0Z and 99.74% between ±3.0Z.

TABLE 4.30b: MEAN STANDARDISED (Z-) SCORES FOR PRIMARY CARE SERVICE INDEX (PCSI) AND COMPOSITE NEED SCORES (CNS), DISTRICT OF COLUMBIA, 2004

Means

CTG	PCSIZ	CNSZ	PCSI	CNS
1	-.1561	.0757	.8407	54.293
2	.0896	-.1885	2.4009	47.978
3	-.0669	1.1844	1.4075	80.791
4	-.0134	.5604	1.7466	65.877
5	.1269	.1479	2.6373	56.017
6	-.0989	.1737	1.2040	56.635
7	-.2607	-.5539	.1767	39.245
8	-.2667	-1.0523	.1386	27.333
9	.6797	.4951	6.1474	64.315
10	-.1988	-.6788	.5699	36.259
11	.3742	-.4501	4.2077	41.726
Total	.0000	.0000	1.8319	52.483

4.6.1 Physicians: Frequency Distributions by Specialty, DC 2004

Research hypothesis H_{01} proposed by the researcher for this study concerned determining whether the number and specialty of active physicians - both total physicians and primary care physicians - differed significantly by CTG for the District. In order to determine whether hypothesis H_{01} can be rejected or not rejected, this section provides findings of the study of the numbers and specialties of total active physicians by CTG as well as active primary care physicians by CTG. To evaluate Hypothesis H_{01}, values of active total and primary care physicians by CTG for the District were calculated and compared for study periods 1985 to 2004. Hypothesis H_{01} is stated as follows:

H_{01}: The distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia.

In this section of this DCPC study, additional findings on physician profiles and physician distributions in the District of Columbia by census tracts and Census tract Groupings for 1985, 1990 and 2004 are presented. In the District of Columbia in 2004, study findings showed that the medical specialty with the highest numbers of active physicians were as follows: Internal medicine, Pediatrics, Psychiatry and neurology, and radiology. Internal medicine is the primary care specialty with the most physicians in the District. For 2004, Table 4.31 below presents the frequency distributions of DC-based, *active* physicians, by specialty. For each specialty, the number of physicians who are Board certified are also indicated.

Finding Summary:

Table 4.31 shows that, contrary to null hypothesis $H_{01,}$ the numbers of total, active physicians in the District of Columbia differed by specialty, from a low of 8 citywide (for non-primary care specialty Nuclear Genetics) to a high of 970 citywide (for primary care specialty Internal medicine). Table 4.33, below, also showed that physician distributions by CTG differed significantly from the city's average, for the District.

TABLE 4.31: YEAR 2004 PHYSICIANS IN ACTIVE PRACTICE: FREQUENCIES BY MEDICAL SPECIALTY, DISTRICT OF COLUMBIA, 1985 to 2004

MEDICAL SPECIALTY	NUMBER	PERCENT
Administrative Medicine – Board certified	2	0.1
Administrative Medicine	32	0.9
Allergy & Immunology – Board certified	17	0.5
Allergy & immunology	6	0.2

Anesthesiology – Board Certified	85	2.3
Anesthesiology	66	1.8
Colon & Rectal Surgery – Board certified	3	0.1
Colon & Rectal Surgery	2	0.1
Dermatology – Board certified	30	0.8
Dermatology	19	0.5
Emergency Medicine – Board certified	47	1.3
Emergency Medicine	72	1.9
Family Medicine – Board certified	64	1.7
Family medicine	89	2.4
Internal medicine – Board certified	528	14.3
Internal Medicine	342	9.3
Medical Genetics – Board certified	4	0.1
Medical Genetics	4	0.1
Neurological Surgery – Board certified	11	0.3
Neurological Surgery	20	0.5
Nuclear Medicine – Board certified	11	0.3
Nuclear Medicine	3	0.1
Obstetrics & gynecology – Board certified	98	2.7
Obstetrics & Gynecology	48	1.3
Ophthalmology – Board certified	51	1.4
Ophthalmology	30	0.8
Orthopedic Surgery – Board certified	37	1.0
Orthopedic Surgery	37	1.0
Otolaryngology – Board certified	29	0.8
Otolaryngology	18	0.5
Pathology – Board certified	60	1.6
Pathology	26	0.7
Pediatrics – Board certified	204	5.5
Pediatrics	148	0.4
Physical Medicine & Rehab – Board certified	14	0.4
Physical medicine & Rehab	7	0.2
Plastic surgery – Board certified	10	0.3
Plastic Surgery	10	0.3
Preventive Medicine – Board certified	9	0.2
Preventive Medicine/Public Health	10	0.3
Psychiatry & Neurology – Board certified	253	6.8
Psychiatry & Neurology	132	3.6
Radiology – Board certified	110	3.0
Radiology	36	1.0
Surgery – Board certified	69	1.9
Surgery	68	1.8
Thoracic Surgery – Board certified	12	0.3
Thoracic Surgery	5	0.1
Urology – Board certified	27	0.7
Urology	11	0.3

No Specialty Provided	671	18.1
TOTAL, DC	3697	100.0

4.6.2 Physicians: Distribution of Physician Specialties by CTGs

The distribution of District physicians by medical specialty, as presented in Table 4.31 above, was analysed by Census Tract Grouping in order to specifically test hypothesis H_{01} for rejection or non-rejection (see Tables 4.33 and 4.34 below).

Table 4.33 and 4.34 below show that the CTGs with the most physicians, in decreasing order, were CTG 5 (with 930 physicians, the highest), followed by CTG 3 (with 569 physicians), CTG 9 (with 524), CTG 2 (with 475), CTG 4 (with 317), CTG 1 (with 274), CTG 6 (with 249), CTG 10 (with 157), CTG 11 (with 104), CTG 8 (with 47), and CTG 7 (with 41 physicians, the lowest in the city).

When examining poverty% by CTG, it must be noted that CTG areas 7 and 8 (with the fewest primary care physicians during the study period) were and are the highest poverty% areas within the District.

District-wide, the medical specialties with the most physicians were internal medicine (867), unspecified specialty (670), psychiatry and neurology (385), pediatrics (352), surgery (all types, 252), family practice (152), anesthesiology)151), radiology (146), and obstetrics and gynecology (145).

The top specialties by CTG were as follows: internal medicine practitioners in CTG 5 (201), internal medicine in CTG 9 (138), internal medicine in CTG 3 (130), internal medicine in CTG 2 (111), psychiatry and neurology in CTG 5 (109) and pediatrics in CTG 5 (98). There were several specialties, mostly specialist non-primary care physicians, with 5 or less physicians in almost all the eleven CTGs.

Of particular note is the observation that some CTGs had primary care primary care physicians numbering a meager total of 5 or less, for example, family practice (2 in CTG 7, 1 in CTG 8, and 4 in CTG 11); obstetrics and gynecology (5 in CTG 10); pediatrics (2 in CTG 7, 5 in CTG 8). CTGs 5 (157 physicians), CTG 3 (121), CTG 2 (85), and CTG 9 (76) were the areas with the most physicians for who a medical specialty was not recorded in the Department of Health's physician licensing files for 2004.

Table 4.32 below shows the medical specialty abbreviations for primary care and non-primary care (specialists) physicians that are used in this study to present physicians profiles as well as to evaluate research hypothesis H_{01}:

TABLE 4.32: ABBREVIATIONS FOR PHYSICIAN MEDICAL SPECIALTIES USED IN THIS STUDY, DISTRICT OF COLUMBIA, 1985 to 2004

Abbreviation used in this DCPC study	**Medical Specialty**
Adm	Administration/Administrative medicine
Ai	Allergy and Immunology
Anes	Anesthesiology
Crsurg	Colon and Rectal Surgery
Derm	Dermatology
Emerg	Emergency Medicine
Fp	Family Practice
Im	Internal medicine
Mgen	Medical Genetics
Nsurg	Neurological Surgery
Nucm	Nuclear medicine
Obg	Obstetrics/Obstetrics & Gynecology
Opth	Optometry/Ophthalmology
Opthal	Optometry/Ophthalmology
Osurg	Orthopedic Surgery
Otol	Otolaryngology
Path	Pathology
Ped	Pediatrics
Pmedr	Palliative Medicine
Pneu	Pediatric Neurology
Prev	Preventive/Prevention medicine
Prpub	Prevention/Public health
Psurg	Pediatric surgery
Rad	Radiology
Surg	Surgery
Tsurg	Traumatic Surgery
Urol	Urology
NA/NS	Specialty Not specified

*abbreviation used in this study for medical physician specialties

TABLE 4.33: YEAR 2004 PHYSICIANS: SPECIALTIES BY CTG, DISTRICT OF COLUMBIA, 1985-2004

Census Tract Grouping (CTG)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**TOTAL, DC**
Medical Specialty*												
Adm	6	5	4	6	7	1	0	0	4	0	0	**33**
Ai	0	1	8	1	8	2	0	0	3	0	0	**23**
Anes	14	15	18	14	44	10	4	3	23	1	5	**151**
Crsurg	0	0	1	0	2	0	0	1	0	0	1	**5**
Derm	2	8	6	2	16	5	0	3	6	0	1	**49**
Emerg	5	17	19	12	32	8	1	2	19	3	1	**119**
Fp	7	18	26	16	35	8	2	1	27	8	4	**152**
Im	75	111	130	79	201	52	13	10	138	38	20	**867**
Mgen	0	0	1	2	3	1	1	0	0	0	0	**8**
Nsurg	1	5	7	9	1	0	0	0	6	1	1	**31**
Nucm	1	2	2	0	4	0	0	0	4	0	1	**14**
Obg	12	19	32	9	33	9	2	0	18	5	6	**145**
Opth	3	10	3	3	10	4	1	0	10	5	2	**51**
Opthal	4	4	3	1	8	2	0	0	7	1	1	**30**
Osurg	5	9	10	1	20	7	1	2	9	1	1	**74**
Otol	4	5	5	5	11	4	0	2	9	1	1	**47**
Path	8	11	9	4	21	6	1	0	15	8	2	**85**
Ped	24	45	55	29	98	27	2	5	44	10	13	**352**
Pmedr	1	3	1	2	6	1	1	0	1	1	3	**20**
Pneu	21	52	52	33	109	31	3	2	54	19	9	**385**
Prev	0	1	0	0	3	1	0	1	2	1	0	**9**
Prpub	2	1	2	2	1	0	0	0	0	2	0	**10**
Psurg	2	0	3	2	5	2	0	0	5	1	0	**20**
Rad	10	16	22	9	40	11	0	1	21	12	4	**146**
Surg	8	23	20	11	34	10	2	0	2	0	0	**17**
Tsurg	2	3	4	2	3	1	0	0	2	0	0	**17**

Urol	4	6	5	3	10	1	0	0	4	1	4	**38**
Specialty Not specified	53	85	121	60	157	45	7	14	76	30	22	**670**
TOTAL	274	475	569	317	930	249	41	47	524	157	104	**3,687**

* medical specialties abbreviation (see list of abbreviations of medical specialties provided in Table 4.32).

TABLE 4.34: SUMMARY: NUMBER OF YEAR 2004 PRIMARY CARE AND NON-PRIMARY CARE (SPECIALIST) PHYSICIANS, BY CTG, DISTRICT OF COLUMBIA

	Non-Primary Care Physicians	**Primary Care Physicians**	**TOTAL**
CTG:			
1	149	125	274
2	263	212	475
3	305	264	569
4	170	147	317
5	527	403	930
6	144	105	249
7	21	20	41
8	28	19	47
9	276	248	524
10	90	67	157
11	60	44	104
TOTAL, DC	**2,033**	**1,654**	**3,687**

Per this study's hypothesis H_{05} which states that the distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia, it can be seen from Table 4.34 above that there appeared to be large and significant differences between the District of Columbia's active physicians when compared by CTG.

4.7 Priority Scores by census tracts, Year 2004

Research hypothesis H_{05} for this study concerns determining if the calculated primary care priority scores (PCPS) – calculated from combining *study variables PCSI and CNS* - differed significantly by CTG for the District. This section provides additional findings of this study by PCPS and CTG to assist in evaluating Hypothesis $H_{05.}$ Hypothesis H_{05} is stated as follows:

> H_{05}: The primary care priority scores (PCPS) – which is calculated from *study variables PCSI and CNS* - when cross-tabulated by census tract or Census Tract Grouping, do not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

In this section, values of PCPS by CTG for the District calculated and compared for study periods 1985 to 2004, are presented. Specific identification of small areas in the District and their estimated primary care priority scores are provided below, in Table 4.35. In this table, census tracts with a 1 in the column titled “priority 1.00=high” have combinations of PCSI and CNS scores that qualify them to be considered as high priority census tracts, in the District of Columbia.

To contextualize these findings in terms of study variables poverty% and low birth-weight%, the results shown in Table 4.35 were used in conjunction with Figure 4.15 below, which shows a map of the District of Columbia by CTG created by the researcher. This figure was created by the researcher in order to facilitate the visualization of the high priority primary care shortage areas in the District uncovered by this study. It can be seen from the data in Table 4.35 and the map in Figure 4.15 below show that primary care physician distributions differed by small area in the District (i.e. by census tracts and thus CTG in the District of Columbia) for the study period. Physicians appear to be mostly located in the western parts of the District and are sparsely located in the highest poverty, eastern parts of the District where the majority of public welfare adult recipients reside.

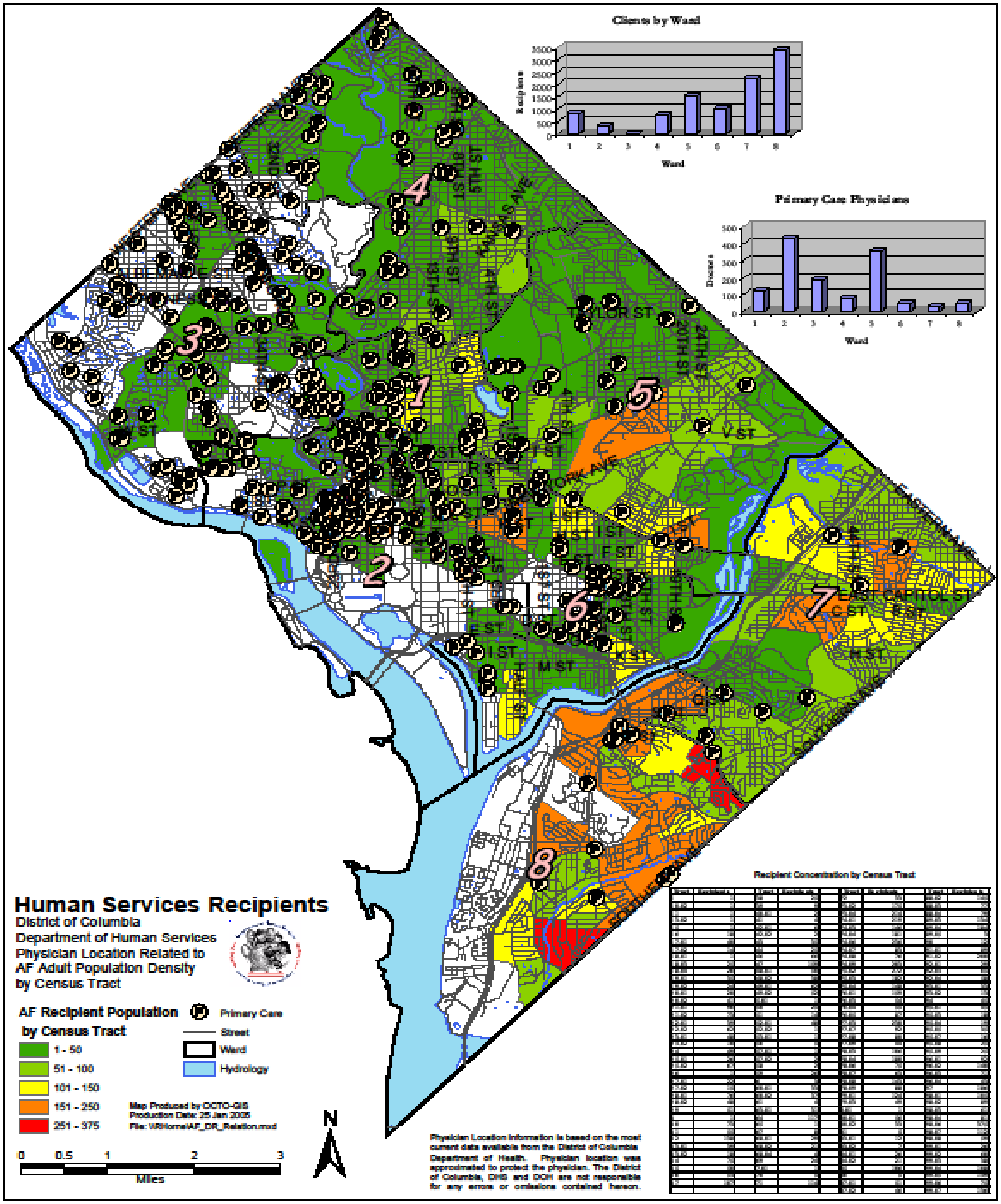


FIGURE 4.15 Map and census tracts data of DCPC primary care physicians 2004 combined with public assistance (ACEDS) Adults recipients, District of Columbia Year 2005

Source: J. Andoh

The map of the District created by the researcher and shown in Figure 4.9.3(ii) above shows that areas of the District that contain high numbers of high-poverty adults receiving public welfare services (areas coloured orange and/or red) also happen to be the census tract areas of the District with some of the lowest numbers of active primary care physicians.

It can be seen that these high priority areas of the District are clustered mostly in CTG 7 and CTG 8, both of which border the eastern sections of the city (and coincide with DC Wards 7 and 8), as well as CTG 9 (in the central part of the city) with large numbers of Hispanic and immigrant families. High primary care priority areas thus appear to differ significantly by census tracts and CTG. This finding provides further evidence that priority areas differ significantly by census tract and by CTG thus providing evidence that hypothesis H_{01} of this study should be rejected.

Table 4.3.5 below shows high primary care priority areas for the District, which are characterized as follows:

- priority 1=high priority census tracts (meaning: areas showing high need)
- priority 2=medium priority census tracts (meaning: medium/moderate need)
- priority 3=low priority census tracts (meaning: low need)

Citywide, in 2004-2005, there were 69, 97 and 18 census tracts which were found in this study to be of high priority, medium priority and low priority, respectively. Again, it must be noted that priority scores per the methods used in this research were determined by the researcher by cross-tabulating PCSI values by CNS values. This process thus combined physicians availability with poverty% and low birth-weight%.

The finding in the Table 4.35 below is one way of identifying and thus targeting census tracts in the District with high priorities for additional primary care physician placement which may be alleviated via and incentives to motivate physician re-locations.

TABLE 4.35: PRIORITY SCORES FOR ALL OF THE 182 CENSUS TRACTS (SMALL AREAS) IN THE DISTRICT OF COLUMBIA

DC census Tracts	Priority Scores (PCPS)		
	1.00= high	2.00= medium	3.00= low
CT			
1	0	0	1
3	0	1	0
4	0	1	0
6	0	0	1
11	0	0	1
12	0	0	1
15	0	1	0
16	0	1	0
24	0	1	0
26	0	0	1
29	0	1	0
30	0	1	0
31	0	1	0
32	1	0	0
34	0	1	0
35	1	0	0
36	1	0	0
37	1	0	0
38	0	1	0
39	0	1	0
41	0	0	1
43	0	1	0
44	0	1	0
46	1	0	0
47	0	1	0
50	0	1	0
51	0	0	1
55	0	0	1
56	0	1	0
58	0	1	0
59	1	0	0
61	0	1	0
64	1	0	0
65	0	1	0
66	0	0	1

67	0	1	0
69	0	1	0
70	0	1	0
71	1	0	0
72	1	0	0
81	0	1	0
82	0	1	0
85	0	1	0
86	0	1	0
90	0	1	0
94	0	1	0
97	0	1	0
201	0	1	0
202	0	1	0
501	0	1	0
502	0	1	0
701	0	1	0
702	0	1	0
801	0	1	0
802	0	1	0
841	1	0	0
901	0	1	0
902	0	1	0
1001	0	0	1
1002	0	0	1
1301	0	1	0
1302	0	0	1
1401	0	0	1
1402	0	1	0
1701	0	1	0
1702	0	1	0
1801	0	0	1
1802	0	1	0
1804	0	1	0
1901	0	1	0
1902	0	1	0
2001	0	1	0
2002	0	1	0
2101	0	1	0
2102	0	1	0
2201	0	1	0
2202	0	1	0
2301	0	1	0
2302	0	1	0
2501	1	0	0
2502	0	1	0
2701	0	1	0

2702	0	1	0
2801	1	0	0
2802	0	1	0
3301	1	0	0
3302	1	0	0
4001	0	0	1
4002	0	1	0
4201	0	1	0
4202	0	1	0
4801	0	1	0
4802	1	0	0
4901	1	0	0
4902	1	0	0
5201	0	1	0
5202	0	1	0
5301	0	1	0
5302	0	0	1
5401	0	1	0
5701	0	1	0
6001	0	1	0
6002	0	1	0
6201	0	0	1
6301	0	1	0
6302	0	1	0
6801	1	0	0
6802	1	0	0
6804	0	0	1
7301	0	1	0
7302	1	0	0
7304	1	0	0
7308	0	1	0
7401	1	0	0
7403	1	0	0
7404	1	0	0
7405	1	0	0
7406	1	0	0
7407	1	0	0
7409	1	0	0
7502	0	1	0
7503	1	0	0
7504	1	0	0
7601	1	0	0
7603	1	0	0
7604	0	1	0
7605	1	0	0
7703	1	0	0
7707	1	0	0

7708	1	0	0
7709	0	1	0
7803	1	0	0
7804	1	0	0
7806	1	0	0
7807	0	1	0
7808	1	0	0
7809	1	0	0
7901	0	1	0
7903	1	0	0
8001	0	1	0
8002	0	1	0
8301	0	1	0
8302	0	1	0
8402	1	0	0
8701	1	0	0
8702	0	1	0
8802	1	0	0
8803	1	0	0
8804	1	0	0
8903	1	0	0
8904	1	0	0
9101	0	1	0
9102	1	0	0
9201	0	1	0
9203	0	1	0
9204	1	0	0
9301	0	1	0
9302	0	1	0
9501	1	0	0
9503	1	0	0
9504	0	1	0
9505	0	1	0
9507	0	1	0
9508	0	1	0
9509	0	1	0
9601	0	1	0
9602	1	0	0
9603	0	1	0
9604	1	0	0
9801	1	0	0
9802	1	0	0
9803	1	0	0
9804	1	0	0
9806	1	0	0
9807	1	0	0
9808	1	0	0

9809	1	0	0
9901	0	1	0
9902	1	0	0
9903	1	0	0
9904	1	0	0
9905	1	0	0
9906	1	0	0
9907	1	0	0
Total	69	97	18

* priority 1=high priority (meaning: areas showing high need)
priority 2=medium priority (meaning: medium/moderate need)
priority 3=low priority (meaning: low need

4.8 Summary Tables for PCSI, CNS, Priority Scores by Census Tract Grouping

In chapter 1 of this study, the researcher's rationale for this study was stated as follows: to attempt to answer the question:

- for the District, can the variables - percent of residents at or below the federal poverty level (poverty%), percent of births which are of birth-weight (low birth-weight%), and specialties and location of District physicians - be used to generate three primary care indices (PCSI, CNS, PCSI) and primary care visits shortages which, organised by Census Tract Groupings (CTG), differ significantly by CTG?

In this current chapter, chapter 4, study findings have been presented thus far for the variables poverty%, low birth-weight%, PCSI, CNS, PCSI, primary care visits shortage areas and Census Tract Groupings (CTGs). In this section, summary Tables for PCSI, CNS and Priority Scores (PCPS) are presented by Census Tract Grouping.

A series of additional findings are presented in Tables 4.36 to 4.48 in this section to summarise the PCSI, CNS, and priority scores, by Census Tract Grouping, for the District in 2004. Numbers in the tables below are counts and they refer to the counts (total numbers) of census tracts in each CTG that fall into a particular primary care priority category. For example, Table 4.36 shows that CTG 1 had 2 census tracts that were of priority 1 (high priority) while CTG 2 had 5 priority 1 (high priority) census tracts.

The total number of census tracts for Year 2004 is shown as 184 and not 188, because four census tracts which had zero or near zero resident populations. For example, park areas/green spaces, lakes, cemeteries, etc. were excluded from Table 4.36 through Table 45. Tables in this section are as follows, in order:

- CNS by CTG
- PCSI by CTG
- Priority scores (PCPS) by CTG
- Frequencies for CNS, PCSI, priority scores
- Crosstabulations of CNS by CTG, PCSI by CTG, priority scores by CTG

In chapter 3 (Methods), CNS categories were described as follows:

CNS category 1 = very high need

CNS category 2 =high need

CNS category 3 =medium need

CNS category 4 =low need

Table 4.36 thus shows that when broken down by CTGs, there were *34 census tracts that were very high need*, *50 that were high need, 59 of medium need and 41 of low need.* Table 4.36 below shows that CTG 7 and CTG 8 had the highest number of very high need census tracts, 11 and 6 respectively, while the low poverty% CTG 3 area had the highest number (15) of very low need census tracts in the District, for the study period.

TABLE 4.36: CNS BY CENSUS TRACT GROUPINGS DISTRICT OF COLUMBIA

		cns categories				Total
		1.00	2.00	3.00	4.00	
CTG	1	2	5	6	4	17
	2	5	1	6	3	15
	3	0	1	7	15	23
	4	0	2	11	5	18
	5	1	3	10	2	16
	6	2	5	3	4	14
	7	6	7	1	2	16
	8	11	7	1	1	20
	9	0	3	6	5	14
	10	5	8	3	0	16
	11	2	8	5	0	15
Total		**34**	**50**	**59**	**41**	**184**

In chapter 3 (Methods), PCSI categories were described as follows:

Low PCSI values mean that the supply of physicians was low in the community

High PCSI values mean that the supply of physicians was high in the community

PCSI category 1 = very low numbers of available physicians

PCSI category 2 = low numbers of available physicians

PCSI category 3 = medium numbers of available physicians

PCSI category 4 = medium high numbers of available physicians

PCSI category 5 = high numbers of available physicians

Thus the finding in Table 4.37 below is that of the 188 census tract areas, 100 had very low numbers of available physicians, 25 had low numbers of available physicians, 8 had medium numbers of physicians, 9 had medium high numbers of physicians and 42 had high numbers of practising physicians. PCSI values broken down by CTG showed that the PCSI values ranged from a high of 23 in CTG 3 9the wealthiest area of the District) to a low of 14 (in CTG 6), 14 (in CTG 9), 15 (in CTG 7) and 16 (in CTG 7).

TABLE 4.37: PCSI BY CENSUS TRACT GROUPINGS DISTRICT OF COLUMBIA

		pcsi categories					
		1.00	**2.00**	**3.00**	**4.00**	**5.00**	**Total**
CTG	1	10	1	2	1	3	17
	2	6	1	1	2	5	15
	3	7	3	2	2	9	23
	4	5	6	0	0	7	18
	5	10	3	1	0	2	16
	6	8	0	0	1	5	14
	7	11	3	2	0	0	16
	8	18	1	0	0	1	20
	9	3	3	0	1	7	14
	10	13	1	0	0	2	16
	11	9	3	0	2	1	15
Total		**100**	**25**	**8**	**9**	**42**	**184**

Table 4.38 below resents study findings by primary care priority scores, which is obtained by cross-tabulating PCSI values by CNS values. In chapter 3 (Methods), CNS scores, PCSI values and thus primary care priority scores (PCSI) were described as follows:

CNS standardised values:
Low values = high community need;
high value = low community need
PCSI standardised values:
low value = low physicians = high community need
high value = high physicians = low community need;
therefore:
cross-tabulating PCSI by CNS produced the following:
CNS categorical values 1, 2 and PCSI categorical values 1, 2
= HIGH primary care priority score
(PCSI=1=HIGH priority),
and CNS values 4, 5 and PCSI values 4, 5
= LOW primary care priority score

(PCPS = 3 = low priority).
PCPS value 2=medium or moderate primary care priority.

Table 4.38 below thus shows the study finding that of the 188 census tract areas in the District, 69 were high priority score areas (high priority), 97 were medium priority areas and 18 were low priority areas in the District.

Overall, Tables 4.38 to 4.48 show that findings of PCSI, CNS and PCSI indicate that there were significant differences when the primary care indices (PCSI, CNS and PCSI) are broken down by CTG.

Table 4.38 below shows that CTG 7, CTG 8, CTG 10 and CTG 11 had the highest numbers of high priority score census tracts, 11 and 6 respectively, while the low poverty% CTG 3 area had the highest number (8) of low priority score census tracts in the District, for the study period.

TABLE 4.38: PRIORITY SCORES BY CENSUS TRACT GROUPINGS, DISTRICT OF COLUMBIA

Counts

		Priority score			**Total**
		1.00= high	**2.00= medium**	**3.00= low**	
CTG	1	5	10	2	17
	2	3	11	1	15
	3	0	15	8	23
	4	1	15	2	18
	5	4	12	0	16
	6	5	7	2	14
	7	12	4	0	16
	8	17	3	0	20
	9	2	9	3	14
	10	11	5	0	16
	11	9	6	0	15
Total		**69**	**97**	**18**	**184**

Table 4.39 below shows that *54.3%* of all census tracts in the District were high priority score census tracts while only 22.8% of the census tracts were low priority census tracts.

TABLE 4.39: FREQUENCIES: PCSI CATEGORIES DISTRICT OF COLUMBIA

		Frequency	**Percent**	Cumulative Percent
Valid	1.00=high priority	100	54.3	54.3
	2.00	25	13.6	67.9
	3.00	8	4.3	72.3
	4.00	9	4.9	77.2
	5.00=lowest priority	42	22.8	100.0
	Total	**184**	**100.0**	

Table 4.40 below shows that *18.5%* of all census tracts in the District were high need (low CNS) census tracts while 22.3% of the census tracts were low need (high CNS) census tracts.

TABLE 4.40: FREQUENCIES: CNS CATEGORIES DISTRICT OF COLUMBIA

		Frequency	Percent	Cumulative Percent
Valid	1.00=high need	34	18.5	18.5
	2.00	50	27.2	45.7
	3.00	59	32.1	77.7
	4.00=low need	41	22.3	100.0
	Total	**184**	**100.0**	

TABLE 4.41: FREQUENCIES: PRIORITY SCORES DISTRICT OF COLUMBIA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	69	37.5	37.5	37.5
	2.00	97	52.7	52.7	90.2
	3.00	18	9.8	9.8	100.0
	Total	**184**	**100.0**	**100.0**	

Table 4.42 and Table 4.43 below show CNS categories by CTG and PCSI categories by CTG. These distributions differ by CTG and from the citywide totals, thus lending some credence to rejecting the respective null hypothesis for CNS and PCSI in this study.

Table 4.42: Crosstabulations: CNS categories by CTGs District of Columbia

		cns categories				
		1.00	**2.00**	**3.00**	**4.00**	**Total**
CTG	1	2	5	6	4	17
	2	5	1	6	3	15
	3	0	1	7	15	23
	4	0	2	11	5	18
	5	1	3	10	2	16
	6	2	5	3	4	14
	7	6	7	1	2	16
	8	11	7	1	1	20
	9	0	3	6	5	14
	10	5	8	3	0	16
	11	2	8	5	0	15
Total		**34**	**50**	**59**	**41**	**184**

TABLE 4.43: CROSSTABULATIONS: PCSI CATEGORIES BY CTG, DISTRICT OF COLUMBIA

		pcsi categories					
		1.00	**2.00**	**3.00**	**4.00**	**5.00**	**Total**
CTG	1	10	1	2	1	3	17
	2	6	1	1	2	5	15
	3	7	3	2	2	9	23
	4	5	6	0	0	7	18
	5	10	3	1	0	2	16
	6	8	0	0	1	5	14
	7	11	3	2	0	0	16
	8	18	1	0	0	1	20
	9	3	3	0	1	7	14
	10	13	1	0	0	2	16
	11	9	3	0	2	1	15
Total		**100**	**25**	**8**	**9**	**42**	**184**

Table 4.44 below shows that 69 census tracts had a priority 1 (high priority), 97 had priority 2, and 18 had a priority 3 (low priority). CTG 8, 7 and 11 had the most numbers of census tracts with priority 1 while CTG 3 had the most census tracts with priority 3.

TABLE 4.44: CROSSTABULATIONS: PRIORITY SCORES BY CTGS DISTRICT OF COLUMBIA

Counts

		Priority score			**Total**
		1.00	**2.00**	**3.00**	
CTG	1	5	10	2	17
	2	3	11	1	15
	3	0	15	8	23
	4	1	15	2	18
	5	4	12	0	16
	6	5	7	2	14
	7	12	4	0	16
	8	17	3	0	20
	9	2	9	3	14
	10	11	5	0	16
	11	9	6	0	15
Total		**69**	**97**	**18**	**184**

Table 4.45: Cross-tabulations: PCSI categories by CNS categories District of Columbia

Counts

		cns categories				**Total**
		1.00	**2.00**	**3.00**	**4.00**	
pcsi categories	1.00	26	35	24	15	100
	2.00	3	5	13	4	25
	3.00	1	1	2	4	8
	4.00	1	2	3	3	9
	5.00	3	7	17	15	42
Total		**34**	**50**	**59**	**41**	**184**

4.9 Presentation of selected findings by DC Wards: Summary of PCSI, CNS, Priority Scores by DC Wards

As described in chapter 3 (Methods), in the District of Columbia, most official (i.e., governmental) sources of health care data and reports use the legislative and political Ward jurisdictions in data and tabular presentations. As of the writing of these study findings by the researcher (in 2014), such usage of DC Wards is still mostly the case. There are eight (8) wards in the District of Columbia. In contradistinction to most of the sections of this study, the following section of this DCPC study presents some study findings by DC Ward (political and legislative jurisdictions) so that some limited Ward-specific data from this DCPC study may be available to District policymakers and planners – who are used to looking at District data by Wards – to be used for community-based health planning activities. In these tables by DC Wards, the numbers in each table refer to the numbers of component census tracts (in each ward) that met a certain criteria in this DCPC study. For example, Table 4.46 below shows that in the District in 2004, Wards 7 and 8 had the highest number of census tracts (7 and 15) that belonged in CNS category 1 (high need) for primary care, while Wards 3 and 4 had zero census tracts in the highest need CNS category (with CNS of 1.0).

TABLE 4.46: CNS CATEGORIES BY WARDS DISTRICT OF COLUMBIA

Number of DC census tracts with:

		CNS category				
		1.00 (high)	**2.00**	**3.00**	**4.00 (low)**	**Total**
WARD	1	1	6	7	4	18
	2	1	4	8	6	19
	3	0	0	6	13	19
	4	0	2	13	7	22
	5	4	10	10	1	25
	6	6	7	11	7	31
	7	7	13	3	2	25
	8	15	8	1	1	25
Total		**34**	**50**	**59**	**41**	**184**

TABLE 4.47: PCSI CATEGORIES BY WARDS, DISTRICT OF COLUMBIA

Number of DC census tracts with:

		PCSI category					Total
		1.00	**2.00**	**3.00**	**4.00**	**5.00**	
WARD	1	11	2	2	1	2	18
	2	4	3	0	1	11	19
	3	6	3	1	2	7	19
	4	8	6	1	0	7	22
	5	15	5	1	0	4	25
	6	16	1	1	4	9	31
	7	20	3	1	0	1	25
	8	20	2	1	1	1	25
Total		**100**	**25**	**8**	**9**	**42**	**184**

TABLE 4.48: PRIORITY SCORES CATEGORIES BY WARDS DISTRICT OF COLUMBIA, 2004

		Priority Scores (PCPS)			Total
		1.00 (high)	**2.00 (med)**	**3.00 (low)**	
WARD	1	5	12	1	18
	2	3	11	5	19
	3	0	12	7	19
	4	1	19	2	22
	5	12	13	0	25
	6	9	19	3	31
	7	19	6	0	25
	8	20	5	0	25
Total		**69**	**97**	**18**	**184**

Based on the findings of this study and looking at Tables 4.46, 4.47 and 4.48, it can be seen that apart from the two Wards that are exactly and geographically the same as their CTG counterparts (that is, Ward 3 is, geographically and by definition, the same as CTG 3, and Ward 8 is, geographically and by definition, the same as CTG 8), there is not much in common between the District of Columbia's politically mapped Wards and the District of Columbia Census Tract Groupings as defined and used in this study. There are significant differences between DC Wards and DC CTGs when analysing primary care need and demand indices, supply and location of physicians, primary care visits and primary care visits shortage areas.

The tables above show that, in year 2004, Ward 3 (CTG 3) was one of the Wards with the lowest number of priority 1 census tracts (zero) and Ward 8 (CTG 8) was one of the Wards with the largest number of priority 1, high need, census tracts (20).

In year 2004, five CTGs (CTG 1, 7, 8, 10, and 11) had excess demand, that is, more visits were demanded than were satisfied. They had unmet demand or unsatisfied demand for primary care visits in those respective small areas within the District.

Earlier in this chapter an examination of the twenty-year trend from 1985 to 2004 showed that in the District of Columbia, the *unsatisfied primary care visits needed* total was larger in year 2004 than it was in year 1985, for five CTGs (CTG 1, 3, 7, 8, and 9). Ward 3 (CTG 3) appears to be one of the areas which is experiencing low but increasing levels of unmet primary care visits over time.

In summary, this study uncovered sufficient and necessary data and evidence to enable the research question to be answered. In chapter 1 of this study, the rationale for this study was stated as follows: to attempt to answer the question: for the District, can the variables - percent of residents at or below the federal poverty level, percent of births which are of birth-weight types, specialties and location of District physicians - be used to generate three primary care indices (PCSI, CNS, PCSI) and primary care visits shortages which, organised by Census Tract Groupings (CTG), differ significantly by CTG?

4.9.1 Findings: DCPC linked to Department of Human Services ACEDS public assistance database (ACEDS was replaced in 2014 by DCLink/ DCAS - District of Columbia Access System)

This DCPC study used Census Tract Groupings (CTG) to present data on need and demand estimates for primary care in the District. CTGs as designed by the researcher approximate the federal rational health service areas while the District's traditional political and legislative boundaries using Wards do not. While this study is aimed at encouraging policy makers to seriously consider using CTGs for public policy development, implementation and evaluation purposes, most public policy initiatives are currently based on DC Wards. It is therefore useful to draw a comparison between CTG and Wards and to present some of this study's findings by Ward.

This study derived primary care indices – CNS, PCSI and PCPS – for census tracts and CTG in the District, for the period 1985 to 2004. A significant portion of the findings of this DCPC study was supported, complemented and corroborated, in large part, by evaluating them against other public, authoritative, independently derived studies and data. One such public database is the District's Automated Client Eligibility Determination System, also known as ACEDS.

ACEDS, which has transitioned into the new District of Columbia Access System (or DCAS), was maintained and managed by the District of Columbia Department of Human Services. It was a database of District residents who are eligible for public assistance programs such as TANF, Medicaid, Food stamps, etc. The ACEDS database was a repository of records pertaining to federally-certified poor and working poor families and individuals. All or most of these families and individuals (in the ACEDS database) in the District are beneficiaries of public primary care services provided largely but not completely by public and private or quasi-public health centers, neighborhood health clinics and publicly-funded local and federal health insurance programs such as Medicaid, Child Health Programs, etc.

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A large portion (majority) of the District residents in the Department of Human Services' ACEDS database are residents of CTG 7 and CTG 8, the communities in the District with the highest poverty rates and the highest percentages of births with low birth-weight. As stated before, CTG 7 has the same geographical boundaries as Ward 7 and CTG 8 has the same boundaries as CTG 8. Due to their high poverty and low birth-weight percentages, it follows therefore, that primary care indices for CTG 7 and 8 (Wards 7 and 8), are expected to closely match areas of highest need in the District, that is CTG 7 and CTG 8 (respectively, DC Wards 7 and 8).

4.9.2 Selected profiles of high poverty residents of DC Ward 7 (CTG 7) and Ward 8 (CTG 8) based on public assistance (ACEDS, 2005) and DCPC (2004) aggregated databases

The researcher analysed the District's 2005 non-identifiable, aggregated public assistance data (available to researcher from the District's Department of Human Services) in order to develop comparisons between 2004 poverty% CTGs and physician locations in the District. The Automated Client Eligibility System (ACEDS) database maintains clients eligibility data for 17 specific programs funded cooperatively by the District and the federal government. The ACEDS programs (and their two-letter program abbreviations) are as follows:

- AF-Temporary Assistance to Needy Families (TANF)
- AR-TANF Medicaid
- AX-DC Healthy Families
- AZ-AZT Prescription Assistance
- BU-Burial Assistance
- FS-Food Stamps
- GC-Child General Public Assistance
- GS-Disability General Public Assistance
- LT-Long Term Care Assistance
- MC-Medical Charities

- QM-Medicare
- E-Refugee Assistance
- RR-Refugee Medicaid
- SR-SSI Medicaid

Others DC/DHS/ACEDS programs (with smaller client counts per year) include:

- RP-Repatriation Assistance
- EA-Emergency Assistance
- GU- General Public Assistance/Income

Total client counts and program profiles for ACEDS individuals and families in the District of Columbia for 2005 are summarised in the Table 4.49 below. It shows that most high poverty recipients of the District's public assistance programs received Food Stamps (44.5 percent) and/or SSI Medicaid (36.7 percent).

The next two most-heavily utilized public assistance programs, citywide, were for TANF recipients (17.9%) and TANF Medicaid recipients (16.5%) (Table 4.49).

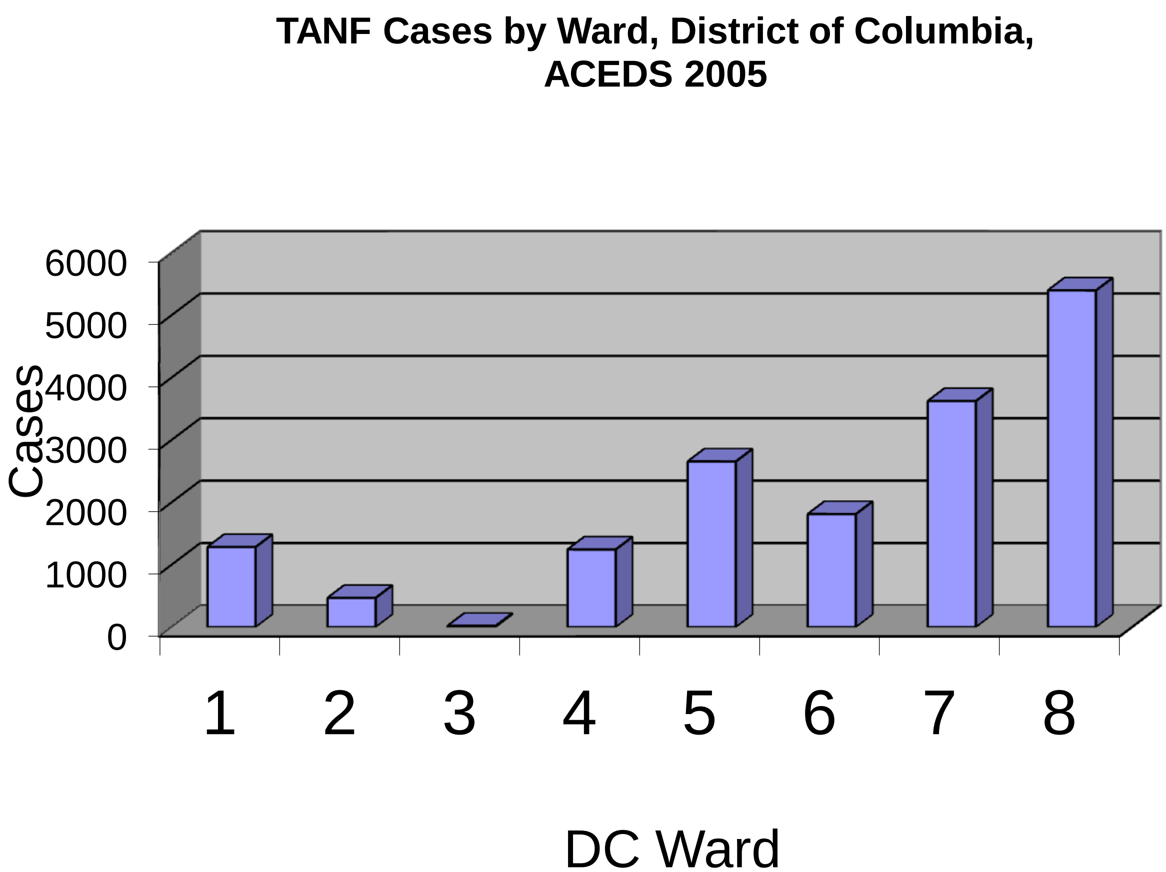
Table 4.50 below shows that TANF cases in the District, when calculated by DC Ward, had the most recipients in DC Ward 7 and DC Sward 8, the two highest poverty% Wards in the District which correspond exactly to the researcher's CTG 7 and CTG 8, respectively. Table 4.51 presents findings for TANF Medicaid recipients and the findings are similar, with DC wards 7 and 8 (i.e. DC CTG 7 and 8) respectively having the largest numbers of recipients in the District, in year 2005.

TABLE 4.49: CLIENT COUNTS AND PROGRAM PROFILES FOR ACEDS INDIVIDUALS AND FAMILIES, DISTRICT OF COLUMBIA , YEAR 2005

District of Columbia Government			
Department of Human Services			
DHS/IMA Automated Client Eligibility Determination (ACEDS) Cases, Feb 2005			
Program	**#Cases**	**% of Total**	
FS	40983	44.5	Food Stamps
SR*	33776	36.7	SSI Medicaid
AF	16502	17.9	TANF (Temporary Assistance To Needy Families)
AR*	15219	16.5	TANF Medicaid
AX*	8689	9.4	DC Healthy Families
LT*	3603	3.9	Long Term Care
GS	1378	1.5	Disability Gen. Public Assistance
QM*	1354	1.5	Qualified Medicare
AZ*	943	1.0	AZT Drug Prescription Benefit
MC*	657	0.7	Medical Charities Program
GC	462	0.5	Child Gen Public Assistance
RR*	121	0.1	Refugee Medicaid
RE	106	0.1	Refugee Assistance
Total			
Cases,			
Feb 2005	**92,000**	**plus**	
* Medicaid is a collection of seven different programs			
Not shown (small numbers)			
BU			Burial Assistance
RP			Repatriation Assistance
EA			Emergency Assistance
GU			Inc GPA

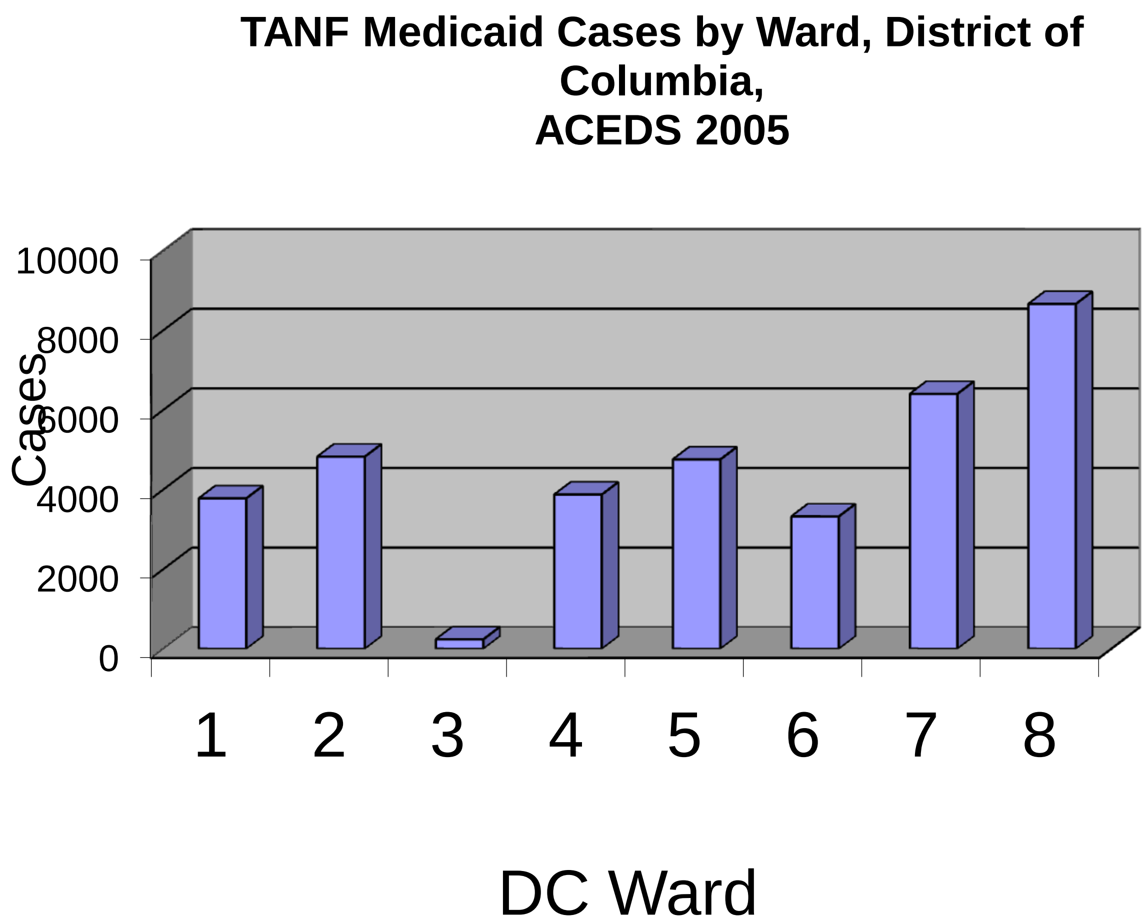
Source: J. Andoh

TABLE 4.50: TANF PROGRAM PARTICIPANTS (CASES), BY DC WARD DISTRICT OF COLUMBIA, 2005



Source: J. Andoh

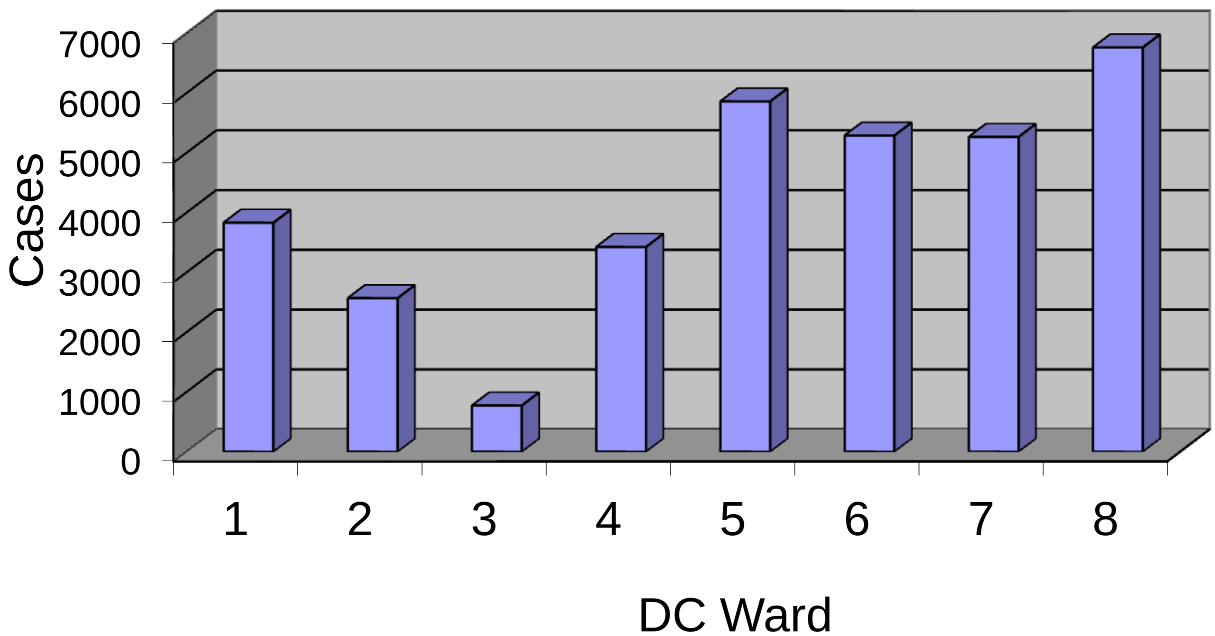
TABLE 4.51: **TANF MEDICAID CASES, BY DC WARD DISTRICT OF COLUMBIA, 2005**



Source: J. Andoh

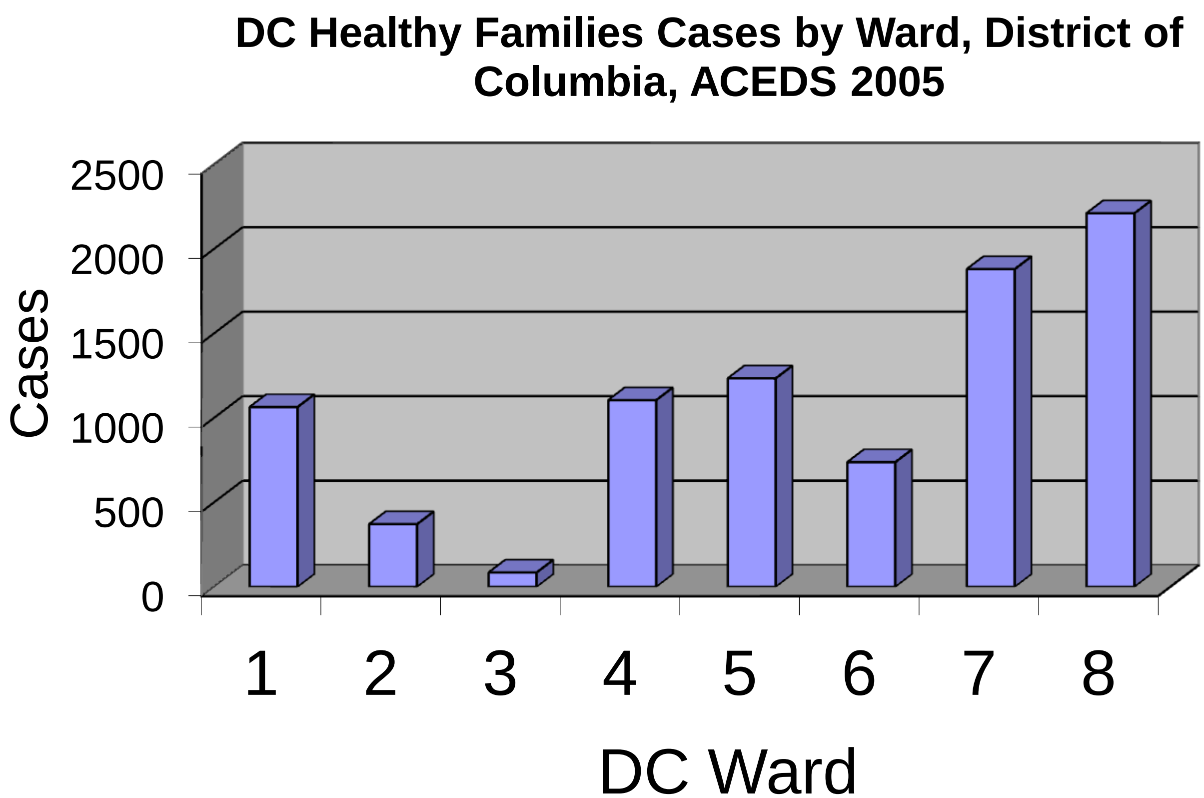
TABLE 4.52: SSI MEDICAID CASES, BY DC WARD DISTRICT OF COLUMBIA, 2005

SSI Medicaid Cases by Ward, District of Columbia, ACEDS, 2005



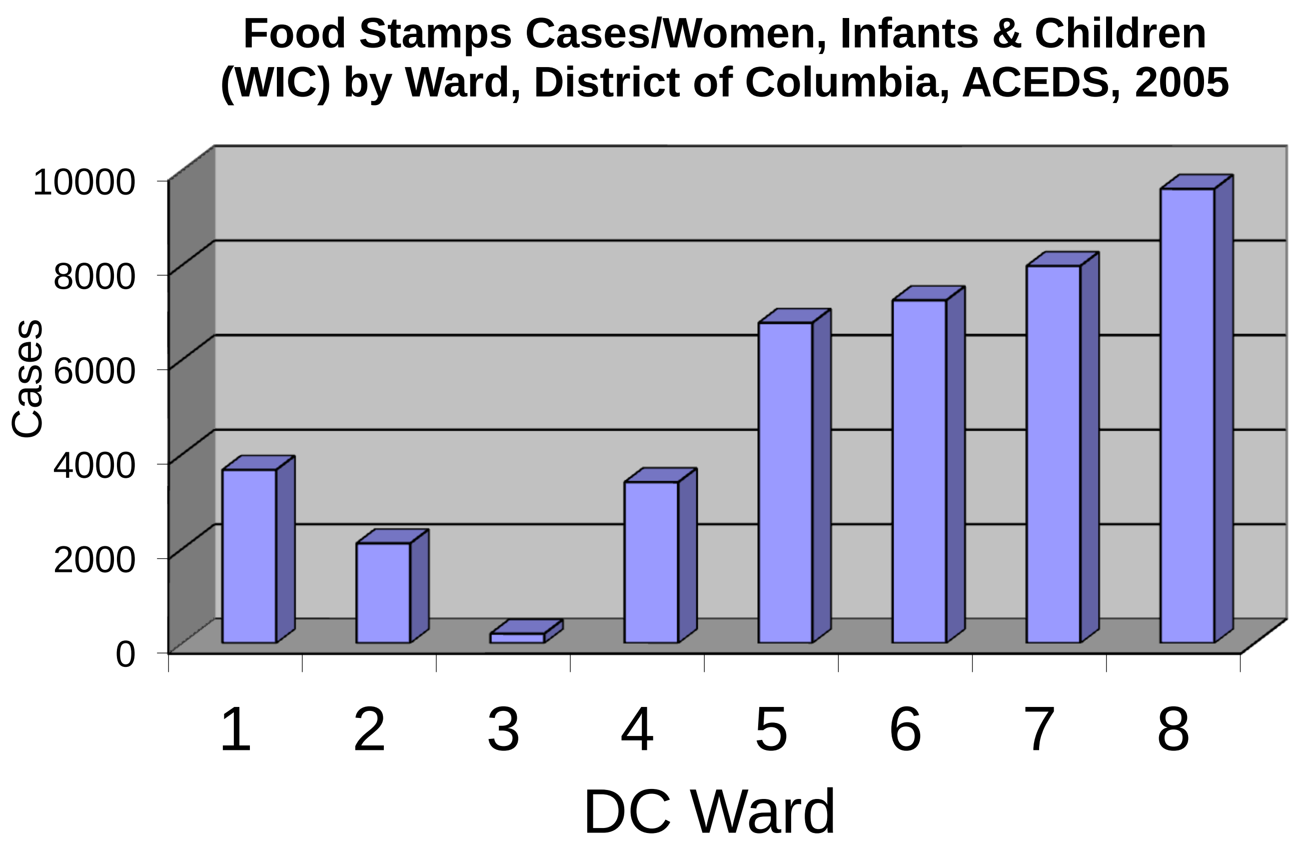
Source: J. Andoh

TABLE 4.53: **DC HEALTHY FAMILIES, PROGRAM PARTICIPANTS (CASES), BY DC WARD**
DISTRICT OF COLUMBIA, 2005



Source: J. Andoh

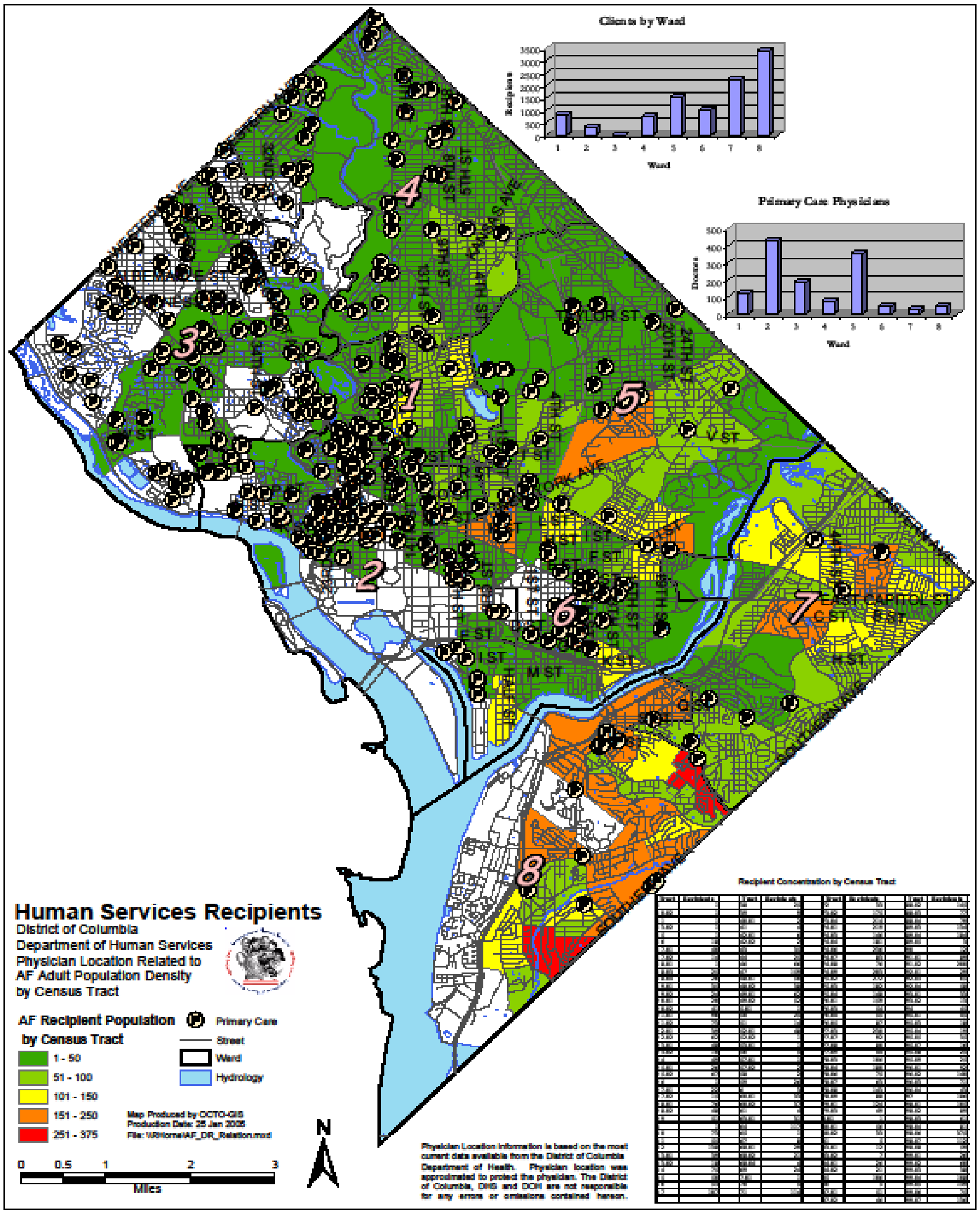
TABLE 4.54: **FOOD STAMPS/WIC PROGRAM PARTICIPANTS (CASES), BY DC WARD, DISTRICT OF COLUMBIA, 2005**



Source: J. Andoh

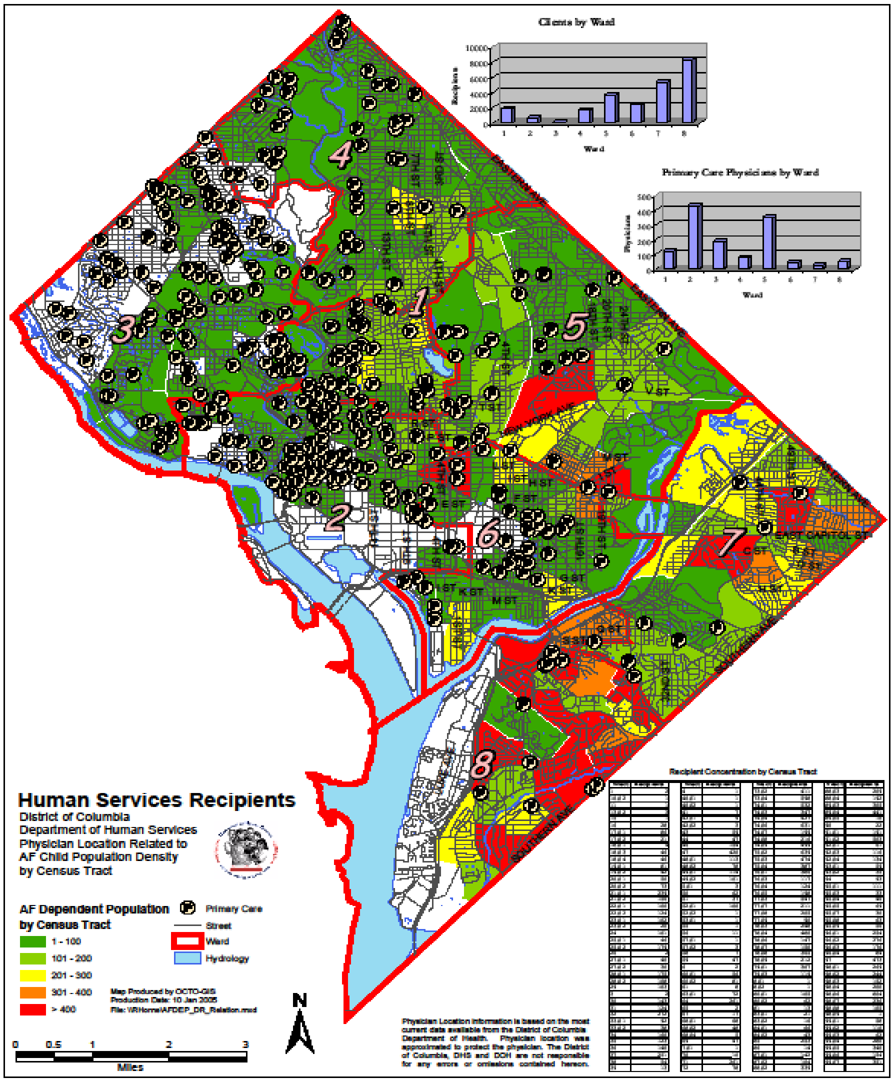
MAPS OF DCPC STUDY FINDINGS WITH OVERLAY DATA FROM DC HUMAN SERVICES ACEDS(DCLink/DCAS/ DC HEALTH INSURANCE EXCHANGE) SYSTEM

4.16 Map and census tracts data of DCPC primary care 2004 physicians combined with public assistance (ACEDS) Adult clients, District of Columbia 2005



Source: J. Andoh

4.16(ii) **Map and census tracts data of DCPC primary care physicians 2004 combined with public assistance (ACEDS) Children, District of Columbia 2005**



Source: J. Andoh

DCPC findings: TANF (AF) Program participants (cases), by DC census tracts, District of Columbia for 2005

1. In this section, poverty and primary care data findings for the District are presented for recipients of District's high-poverty public welfare recipients by CTG areas. Temporary Assistance for Needy Families (TANF) is one of the United States of America's federal assistance programs implemented by the US state and local governments. The rationale for this study was to attempt to answer the question: for the District, can the variables - percent of residents at or below the federal poverty level, percent of births which are of birth-weight types, specialties and location of District physicians - be used to generate three primary care indices (PCSI, CNS, PCSI) and primary care visits shortages which, organised by Census Tract Groupings (CTG), differ significantly by CTG?

   Findings presented thus far in this chapter (chapter 4: Analysis, presentation, and description of findings) appear to provide sufficient and necessary evidence and data to support answering the study question in the affirmative. Findings summarised in this section will show that for the District, the variables percent of residents at or below the federal poverty level, percent of births which are of birth-weight types, specialties and location of District physicians can be used to generate three primary care indices (PCSI, CNS, PCSI) and primary care visits shortages which, organised by Census Tract Groupings (CTG), differ significantly by CTG.

   The six null hypotheses for this study include the following four hypothesis whose data and findings are summarised in this section: $H_{01,}$ $H_{03,}$ H_{04} and H_{05}:

   H_{01}: The distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia.

H_{03}: The unsatisfied visits (or “visits gap”) in primary care, which is calculated *from study variables PCSI and CNS,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{04}: The quantitative measure of “need” for primary care - “composite need score (CNS)” - which is calculated the from *study variables poverty rate % and low birth-weight%,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care “visits gap” by census tract or Census Tract Grouping in the District of Columbia.

To further elaborate on the above study hypotheses which concern District communities with high rates of poverty and high rates of low birth-weight, this study analysed physician distributions in these areas with particular emphasis on availability and location of primary care physicians in high poverty and high low birth-weight areas. The study analysed whether there appeared to be a correlation between District areas with high poverty rates and high low birth-weight rates and the availability and location of physicians in general and primary care physicians in particular. The postulated relationship – that District areas with higher poverty rates, high low birth-weight rates also tended to be areas with lower availability and poorer distributions of primary care physicians – was found to exist. These District communities tended to be areas with higher proportions of the population receiving public welfare services such as TANF, Medicaid, Food stamps and General Public Assistance. Data tables are presented in this finding showing the relationship between District public welfare services recipients (or residents with higher rates of poverty) and primary care physicians availability.

The DCPC results for year 2004 were found to be in substantial congruence with data for 2005, 2010 and 2013 from the District’s governmental public assistance and Medicaid populations (per ACEDS/DC-Link/DCAS) who received services from the DC

Government's Department of Human Services. Additionally, a study by the private-sector DC Board of Medicine in 2013 agreed with and supported several of the DCPC findings concerning the abundance of total DC physicians and the paucity of primary care practitioners in the District (DC BOM 2012:1-5).

ACEDS is the name of the District's computerized system for determining eligibility of District residents for, and enrolling residents in, publicly-funded assistance and welfare services such as TANF services. The newer name for ACEDS is DCAS, District of Columbia Access System. Data tables and maps for years 2004 and 2005 from the District Government's ACEDS/DCAS system corroborate this DCPC study postulating a relationship between high poverty areas and primary care shortage areas.

Tables 4.55-4.59 below show the following study findings: that the census tract areas - which, as per findings of this DCPC study, constitute the CTG areas (higher poverty/higher low birth-weight areas) of highest need for primary care services - are simultaneously the same areas and communities of the District of Columbia which have the largest populations of children and adults who live in or near poverty levels and also receive and are dependent on, public assistance services including Temporary Assistance for Needy Families (TANF) and Medicaid. The relationship, found in this study to exist between high poverty/high public assistance areas of the District and CTG areas with the highest need for unsatisfied primary care visits, was found to exist for the following public assistance programs and their recipients offered to District residents:

- TANF (AF) Program participants (cases)
- DC Healthy Families Program participants
- TANF Medicaid (AX) Program participants
- Food Stamps/WIC Program participants

Tables 4.55 to 4.59 below show that District census tracts with higher percentages of overall higher public welfare recipients (living in high poverty) also had higher numbers of children recipients of Food Stamps, higher recipients of adults and children receiving Medicaid and higher percentages receiving TANF benefits.

Table 4.55: TANF (AF) Program participants (cases), by DC census tracts District of Columbia for 2005

TANF - AF Cases by Census Tract, District of Columbia, 2005										
Tract	Cases		Tract	Cases		Tract	Cases		Tract	Cases
1	1		39	10		72	44		88.02	224
10.02	1		4	2		73.02	266		88.03	115
11	1		40.01	1		73.04	359		88.04	149
13.01	1		40.02	2		74.01	375		89.03	230
13.02	2		41	7		74.03	227		89.04	318
14.01	1		42.01	7		74.04	274		89.05	5
16	25		42.02	2		74.06	351		9.01	1
17.01	57		43	43		74.07	151		90	19
17.02	25		44	36		74.08	134		91.01	153
18.01	3		46	121		74.09	312		91.02	326
18.03	33		47	260		75.02	385		92.01	61
18.04	42		48.01	78		75.03	253		92.03	93
19.01	62		48.02	63		75.04	241		92.04	94
19.02	37		49.01	85		76.01	281		93.01	61
20.01	46		49.02	79		76.03	97		93.02	33
20.02	51		5.01	1		76.04	106		94	80
21.01	138		50	39		76.05	122		95.01	71
21.02	115		51	30		77.03	329		95.03	27
22.01	74		52.01	69		77.07	151		95.04	33
22.02	110		53.01	1		77.08	150		95.05	63
23.01	79		54.02	1		77.09	73		95.07	22
23.02	18		55	3		78.03	169		95.08	49
24	104		56	6		78.04	296		95.09	46
25.01	40		57.01	1		78.06	107		96.01	174
25.02	111		57.02	2		78.07	114		96.02	187

26	6	58	4	78.08	227	96.03	121
27.01	30	59	32	78.09	140	96.04	66
27.02	18	6	4	79.01	213	97	279
28.01	111	60.01	53	79.03	82	98.01	176
28.02	77	60.02	60	8.01	1	98.02	163
29	70	61	8	8.02	1	98.03	105
3	3	63.01	54	80.01	80	98.04	131
30	102	64	198	80.02	55	98.06	600
31	82	65	2	81	14	98.07	203
32	221	67	11	83.01	21	98.08	88
33.01	65	68.01	57	83.02	11	99.01	45
33.02	45	68.02	36	84.01	47	99.02	104
34	139	68.04	3	84.02	38	99.03	47
35	82	69	41	85	147	99.04	171
36	88	7.01	1	86	138	99.05	231
37	166	70	10	87.01	93	99.06	113
38	42	71	190	87.02	82	99.07	231

Source: J. Andoh

Table 4.56: **DC Healthy Families Program participants (cases), by DC census tracts, District of Columbia for 2005**

DC Healthy Families Cases (AR) by Census Tract, DC, 2005										
Tract	Cases		Tract	Cases		Tract	Cases		Tract	Cases
1	3		36	74		71	75		88.02	90
10.01	2		37	132		72	20		88.03	28
10.02	7		38	69		73.02	95		88.04	69
11	6		39	21		73.04	147		89.03	98
12	3		4	7		74.01	125		89.04	135
13.01	4		40.01	8		74.03	122		89.05	2
13.02	11		40.02	12		74.04	110		9.01	1
14.01	7		41	2		74.06	102		90	5
14.02	1		42.01	9		74.07	101		91.01	54
15	1		42.02	4		74.08	63		91.02	126
16	18		43	39		74.09	148		92.01	42
17.01	38		44	21		75.02	133		92.03	53
17.02	21		46	59		75.03	105		92.04	64
18.01	2		47	80		75.04	94		93.01	26
18.03	84		48.01	42		76.01	127		93.02	25
18.04	63		48.02	53		76.03	58		94	47
19.01	55		49.01	59		76.04	78		95.01	45
19.02	29		49.02	64		76.05	81		95.03	27
2.02	1		5.01	6		77.03	171		95.04	34
20.01	55		5.02	6		77.07	80		95.05	34
20.02	72		50	53		77.08	74		95.07	19
21.01	111		51	8		77.09	36		95.08	31
21.02	68		52.01	35		78.03	100		95.09	24
22.01	48		52.02	1		78.04	101		96.01	74
22.02	75		53.01	7		78.06	62		96.02	147
23.01	43		55	4		78.07	52		96.03	64
23.02	9		56	4		78.08	109		96.04	36
24	66		58	19		78.09	63		97	103
25.01	32		59	6		79.01	86		98.01	58
25.02	162		6	3		79.03	39		98.02	44
26	8		60.01	30		8.01	3		98.03	67
7.01	67		60.02	21		8.02	4		98.04	72
27.02	34		61	7		80.01	33		98.06	235
28.01	87		63.01	23		80.02	30		98.07	81

28.02	63		64	68		81	10		98.08	54
29	96		66	1		82	1		98.09	4
3	9		67	3		83.01	9		99.01	22
30	69		68.01	24		83.02	10		99.02	50
31	73		68.02	18		84.01	40		99.03	40
32	127		68.04	1		84.02	13		99.04	93
33.01	30		69	10		85	59		99.05	111
33.02	26		7.01	5		86	55		99.06	65
34	41		7.02	2		87.01	34		99.07	92
35	51		70	4		87.02	38			

Source: J. Andoh

Table 4.57: **TANF Medicaid (AX) Program participants (cases), by DC census tracts, District of Columbia for 2005**

TANF - Medicaid Cases (AX) by Census Tract										
Tract	Cases		Tract	Cases		Tract	Cases		Tract	Cases
1	8		37	440		7.01	5		87.01	150
10.01	4		38	183		7.02	15		87.02	150
10.02	17		39	60		70	17		88.02	356
11	19		4	25		71	299		88.03	170
12	12		40.01	14		72	72		88.04	254
13.01	30		40.02	18		73.02	430		89.03	393
13.02	25		41	18		73.04	562		89.04	503
14.01	12		42.01	24		74.01	592		89.05	9
14.02	1		42.02	9		74.03	381		9.01	2
15	6		43	139		74.04	442		9.02	3
16	79		44	78		74.06	529		90	30
17.01	143		46	220		74.07	269		91.01	256
17.02	66		47	396		74.08	211		91.02	493
18.01	8		48.01	137		74.09	467		92.01	137
18.03	229		48.02	143		75.02	586		92.03	177
18.04	234		49.01	195		75.03	403		92.04	200
19.01	179		49.02	233		75.04	360		93.01	142
19.02	89		5.01	8		76.01	465		93.02	70
2.02	1		5.02	8		76.03	190		94	157
20.01	166		50	219		76.04	220		95.01	168
20.02	211		51	40		76.05	227		95.03	73
21.01	462		52.01	155		77.03	585		95.04	90
21.02	248		52.02	1		77.07	263		95.05	124
22.01	209		53.01	20		77.08	270		95.07	54
22.02	261		53.02	1		77.09	137		95.08	126
23.01	170		54.02	1		78.03	313		95.09	104
23.02	40		55	24		78.04	454		96.01	304
24	245		56	20		78.06	208		96.02	356
25.01	161		57.01	2		78.07	198		96.03	220
25.02	496		57.02	2		78.08	399		96.04	119
26	30		58	38		78.09	243		97	432
27.01	217		59	330		79.01	347		98.01	270
27.02	101		6	14		79.03	135		98.02	238
28.01	383		60.01	108		8.01	12		98.03	204
28.02	254		60.02	91		8.02	10		98.04	254
29	303		61	3566		80.01	135		98.06	973

3	18		63.01	83		80.02	94		98.07	332
30	241		64	328		81	24		98.08	186
31	246		65	2		82	3		98.09	13
32	498		66	1		83.01	42		99.01	77
33.01	115		67	23		83.02	25		99.02	198
33.02	95		68.01	101		84.01	101		99.03	101
34	228		68.02	70		84.02	64		99.04	280
35	181		68.04	6		85	245		99.05	390
36	266		69	60		86	244		99.06	191
									99.07	355

Source: J. Andoh

Table 4.59: Food Stamps/WIC Program participants (cases), by DC census tracts, District of Columbia for 2005

FS Cases by Census Tract							
Tract	Cases		Tract	Cases		Tract	Cases
1	8		49.02	185		78.09	323
10.01	8		5.01	14		79.01	400
10.02	9		5.02	5		79.03	196
11	60		50	402		8.01	7
12	5		51	71		8.02	4
13.01	14		52.01	205		80.01	161
13.02	17		53.01	26		80.02	143
14.01	9		53.02	2		81	35
15	2		54.01	2		82	5
16	50		54.02	1		83.01	59
17.01	165		55	20		83.02	44
17.02	73		56	50		84.01	153
18.01	5		57.01	5		84.02	230
18.03	118		57.02	2		85	2506
18.04	134		58	494		86	324
19.01	182		59	717		87.01	327
19.02	95		6	8		87.02	233
2.02	1		60.01	211		88.02	535
20.01	121		60.02	103		88.03	343
20.02	176		61	31		88.04	425
21.01	348		62.02	6		89.03	543
21.02	294		63.01	174		89.04	655
22.01	181		64	414		89.05	22
22.02	291		65	21		9.01	3
23.01	190		66	1		9.02	1
23.02	39		67	38		90	86
24	250		68.01	144		91.01	462
25.01	175		68.02	81		91.02	645
25.02	316		68.04	9		92.01	133
26	23		69	109		92.03	232
27.01	125		7.01	7		92.04	323
27.02	164		7.02	7		93.01	137
28.01	298		70	27		93.02	92
28.02	298		71	346		94	221

29	248		72	138		95.01	198
3	14		73.02	515		95.03	91
30	220		73.04	551		95.04	115
31	180		74.01	689		95.05	143
32	439		74.03	382		95.07	71
33.01	174		74.04	458		95.08	114
33.02	118		74.06	537		95.09	100
34	379		74.07	291		96.01	298
35	245		74.08	228		96.02	453
36	286		74.09	455		96.03	332
37	380		75.02	705		96.04	160
38	127		75.03	512		97	466
39	70		75.04	416		98.01	290
4	11		76.01	643		98.02	269
40.01	22		76.03	235		98.03	261
40.02	21		76.04	306		98.04	234
41	20		76.05	292		98.06	1015
42.01	44		77.03	648		98.07	415
42.02	18		77.07	303		98.08	170
43	149		77.08	337		98.09	47
44	125		77.09	211		99.01	107
46	294		78.03	438		99.02	318
47	585		78.04	511		99.03	122
48.01	232		78.06	296		99.04	322
48.02	167		78.07	238		99.05	424
49.01	221		78.08	457		99.06	250

Source: J. Andoh

4.9.4.1 Synopsis of Findings/Results for this DCPC study, 1985 to 2004

Tables 4.60-4.72 below show that study findings by Census Tract Groupings for the three primary care indices PCSI, CNS and PCPS for study periods 1984-1985, 1990-1992 and 2004-2005. District CTG areas with higher poverty% and higher low birth-weight% tended to be CTG areas with highest primary care need estimates, higher need for primary care physicians and higher primary care visits shortage areas.

4.9.4.2 Summary – DCPC Methodology: study indices and poverty%, low birth-weight% and physician distribution

Using study variables poverty%, low birth-weight% and physician distribution, this chapter (chapter 4) has presented data tables on estimates of primary care need, primary care demand and physician availability by Census Tract Groupings for the District. The basic methodology for this DCPC study hinged on studying District primary care physicians availability and location and the derivation of three statistical indices (or indexes) from study variables poverty%, low birth-weight%, primary care indices PCSI, CNS, PCSI, primary care visits and CTGs. Tables 4.60 to 4.72 below present summary findings for the three primary care indices by CTG:

1. PCSI – primary care service index: measure of access to physicians for residents of a small area (census tract)

2. CNS – composite need score: derived from data on populations with incomes below the federal poverty level (POV) and low birth-weight (LBW)

3. PCPS – primary care priority score: PCSI and CNS are statistically combined to create a new index, priority score, which provides an objective basis for need/demand assessment and primary care resource allocation

This section summarises study findings by CTG and recapitulates the study's methodology (DCPC) which extended the criteria and standards specified by the DHHS in the federal Health Manpower Shortage Area (HMSA) designation methodology. DCPC combines physician manpower availability with objective estimates of community need for primary care resources. The study generated primary care profiles for small areas (eleven CTG) in the District based on these indices culled from study variables poverty%, low birth-weight% and physician distributions.

***The highlighted (coloured) CTGs in Tables 4.60 to 4.72** below show District areas which had higher estimated need values (i.e. higher primary care indices) and showed shortages or deficiencies or lower levels of in primary care.*

These highlighted areas have estimated indices which are below the total or average District values for the index shown in each table.

4.9.4.3 The three primary care indices

4.9.4.3.1 Index #1: Formula - Primary Care Service Index (PCSI):

PCSI – primary care service index: measure of access to physicians for residents of a small area (census tract) using study variables poverty%:

$$\text{PCSI} = \frac{\text{Satisfied Visits}}{\text{Total Potential (“poor” + “non-poor”) Visits}}$$

4.9.4.3.1 Summary of findings for Index #1: Primary Care Service Index by CTG

TABLE 4.60: PRIMARY CARE SERVICE INDEX BY CTG

DISTRICT OF COLUMBIA, 2004

		1985	1990	2004
CTG	1	3.04	1.97	0.80*
	2	5.59	2.57	2.40
	3	4.06	0.56*	1.40
	4	1.07	7.04	1.70
	5	4.91	11.54	2.60
	6	1.16	2.69	1.20
	7	0.49*	8.97	0.20*
	8	0.81*	2.19	0.10*
	9	10.60	0.23*	6.10
	10	0.25	1.11	0.60*
	11	0.17*	7.45	4.20
PCSI, TOTAL DC		2.62	3.97	1.80

4.9.4.3.2 Index #2: Formula - Composite Need Score (CNS):

CNS composite need score was standardised to 100

CNS score = Rank (% population with incomes below the federal poverty level (POV))

+

Rank (% low birth-weight (LBW))

Thus, Low CNS score (e.g.1) indicates high need

and High CNS score (e.g. 100) indicates low need, relative to other census tracts (or Census Tract Groupings).

4.9.4.3.3 Summary Findings for Index #2: Composite Need Score:

TABLE 4.61: COMPOSITE NEED SCORES BY CTG

DISTRICT OF COLUMBIA, 2004

CTG	1985	1990	2004	%CHANGE 1985-2004
1	**77.3**	**59.1**	**54.3**	**-23.0**
2	**40.9***	**72.7**	**48***	**7.1**
3	**100.0**	**95.5**	**80.8**	**-19.2**
4	**86.4**	**95.5**	**65.9**	**-20.5**
5	**72.7**	**45.5***	**56**	**-16.7**
6	**63.6**	**72.7**	**56.6**	**-7.0**
7	**31.8***	**18.2***	**39.2***	**7.4**
8	**13.6***	**22.7***	**27.3***	**13.7**
9	**50.0**	**36.4***	**64.3**	**14.3**
10	**31.8***	**36.4***	**36.3***	**4.5**
11	**13.6***	**36.4***	**41.7***	**28.1**
TOTAL, DC. CNS	52.9	53.7	52.5	-0.4

4.9.4.3.4 Index #3: Formula for Primary Care Priority Score (PCPS):

PCPS Primary Care Priority Score:

PCPS is a number (=1 or 2 or 3) obtained by cross-tabulating PCSI and CNS values for a small area (CT or CTG)

PCSI = 1 high need for primary care resources

= 2 moderate need

= 3 low need

The primary care priority score provides an objective basis for making <u>primary care resource allocation</u> decisions.

4.9.4.3.5 Summary of Findings for Index #3: Primary Care Priority Score:

TABLE 4.62: DEFINITION: PCSI CATEGORIES CROSSTABULATED WITH CNS CATEGORIES TO OBTAIN PRIMARY CARE PRIORITY SCORES, BY CTG, DISTRICT OF COLUMBIA, 2004

	PCSI categories				
	1 (very low satisfied visits)	**2 (low satisfied visits)**	**3 (med satisfied visits)**	**4 (med high satisfied visits)**	**5 (high satisfied visits)**
CNS categories					
1 (high need)	**1-HIGH**	**1-HIGH**	**2-MED**	**2-MED**	**2-MED**
2 (med high)	**1-HIGH**	**1-HIGH**	**2-MED**	**2-MED**	**2-MED**
3 (med low)	**2-MED**	**2-MED**	**2-MED**	***3-LOW***	***3-LOW***
4 (low need)	**2-MED**	**2-MED**	**2-MED**	***3-LOW***	***3-LOW***

4.10.1 DC Data Aggregation by Geography - Census Tract Groupings (CTG)

The four variables used to define the 11 CTGs for the District of Columbia are as follows:

- Housing density
- Ethnic mix
- Access to community health facilities, and

- Identity (of the community)

4.10.2 Summary - Results: The eleven CTGs as derived for the District

Table 4.63: The eleven DC Census Tract Groupings (CTG) in the District, DCPC study, 1985-2004

Derivation of the DC Census Tract Groupings (CTG) used in this study

CTG	HOUSING DENSITY	ETHNIC MIX	ACCESS TO NHC	COMMUNITY DENTITY
1	HIGH	HISPANIC & OTHER	ADAMS MORGAN NHC	ADAMS MORGAN, WARD1
2	HIGH	MIXED	SOUTHWEST NHC	SW & ADJACENT
3	LOW	MAJORITY WHITE	NONE	WARD 3
4	LOW	MIXED	NONE	WARD 4
5	LOW-TO-MODERATE	BLACK, AGING	WOODRIDGE NHC	BROOKLAND/MICHIGAN PARK/ FORT TOTTEN
6	TOWNHOUSES	MIXED, BUT PREDOM. BLACK	CENTER 17, ARTHUR CAPPER NHC	CAPITOL HILL, WARD 6
7	MODERATE	BLACK	BENNING RD, EAST-OF-THE-RIVER	EAST-OF-THE-RIVER
8	HIGH	BLACK	ANACOSTIA NHC, CONGRESS HTS NHC	WARD 8/ANACOSTIA
9	HIGH	MIXED	“R” STREET NHC	DUPONT CIRCLE / SHAW
10	MEDIUM	BLACK	HUNT PLACE NHC, BENNING ROAD NHC	UPPER WARD 7, FAR NORTHEAST
11	HIGH	BLACK	WALKER JONES NHC	LOWEST-INCOME PORTIONS OF WARD 2 & 5

4.10.3 Active Physicians in the District, 1985 to 2004

4.10.3.1 Total Physicians licensed by the District of Columbia

The District had a total of 11,068 licensed physicians in 1985 and 9,675 in 2004

a 12.6 percent decrease from 1985 to 2004

The majority of these DC-licensed physicians did not live or practice in the District of Columbia. The study focused on active physicians who practiced medicine in the District.

4.10.3.2 Physicians in DC: comparing DCPC 1985 to 2005 findings with DC findings from 2010 Board of Medicine (DCBOM) Study

- Per this DCPC study and the BOM study, decreasing #s of total physicians and decreasing #s of primary care physicians in the nation's capital is a *LONG-*

TERM TREND.

- In 1985, of the total 11,068 physicians licensed by the District, only 2,543 (primary care physicians plus specialists) actually practiced in the District of Columbia in 1985.

- There were 3,863 actual practising physicians in the District in 1990 and 3,635 in 2004.

- A study released in October 2011 by the DC Board of Medicine showed that 8,940 doctors are licensed to work in the nation's capital but only about 4,000 practice in the District today (DC BOM, 2012). Of the 4,000 total physicians, less than 500 practiced primary care in the District. And, of these few primary care physicians, very few practiced in the high poverty and high low birthweight areas of the District which were identified in this DCPC study. The 2011 study corroborated the findings of this DCPC 1985 to 2004 study.

TABLE 4.64: DCPC STUDY VERSUS DC-BOM STUDY, 2010: COMPARING DC PHYSICIAN COUNTS IN 1985-2004 TO INDEPENDENT DC-BOM PHYSICIAN COUNTS IN 2010

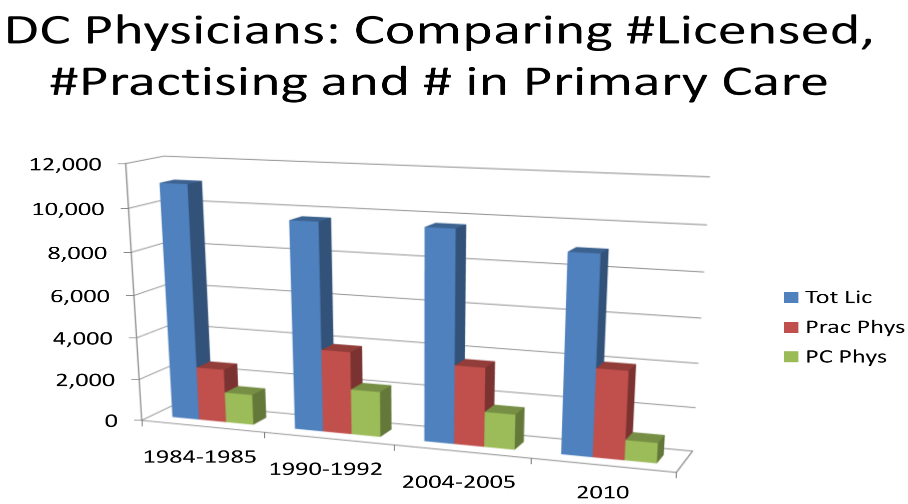
Physicians in DC: 1985 to 2005 compared to DC Board of Medicine Study, 2011

	Total DC Licensed Physicians	Physicians practising in DC	Primary care Physicians	primary care physicians as % of practising physicians
1984-1985	11,068	2,543	1,444	56.8
1990-1992	9,675	3,863	2,120	54.9
2004-2005	9,675	3,635	1,622	44.6
2010* * estimates from DC Board of Medicine, 2010 study	8,940	~4,000	918	22.9

4.10.3.3 DC Physicians overview: 1985 to 2005 versus 2010

TABLE 4.65: COMPARING PHYSICIANS WHO ARE LICENSED BY THE DISTRICT TO PHYSICIANS WHO ACTUALLY PRACTICE MEDICINE IN THE DISTRICT, DCPC STUDY 1985-2004 VERSUS DC-BOM STUDY, 2010

+



4.10.3.4 Changes in DC Physicians Distribution, 1985 to 2005 versus 2010

TABLE 4.66: TRENDS IN COUNTS OF DC PRIMARY CARE PHYSICIANS, DCPC STUDY 1985-2004 VERSUS DC-BOM STUDY, 2010

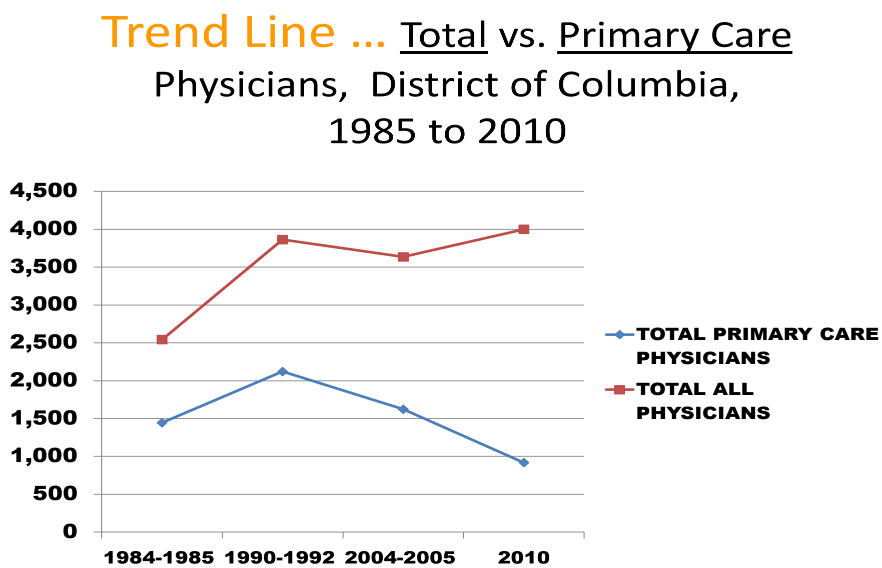
Changes in Number of Primary Care Physicians, District of Columbia, 1985 to 2010

	1984-1985	1990-1992	2004-2005	2010
TOTAL **PRIMARY CARE** PHYSICIANS	1,444	2,120	1,622	918
TOTAL **ALL PHYSICIANS**	2,543	3,863	3,635	4,000

4.10.3.5 Total versus primary Care Physicians, 1985 to 2005 versus 2010

TABLE 4.67: TRENDS IN COUNTS OF DC PRIMARY CARE PHYSICIANS,

DCPC STUDY 1985-2004 VERSUS DC-BOM STUDY, 2010



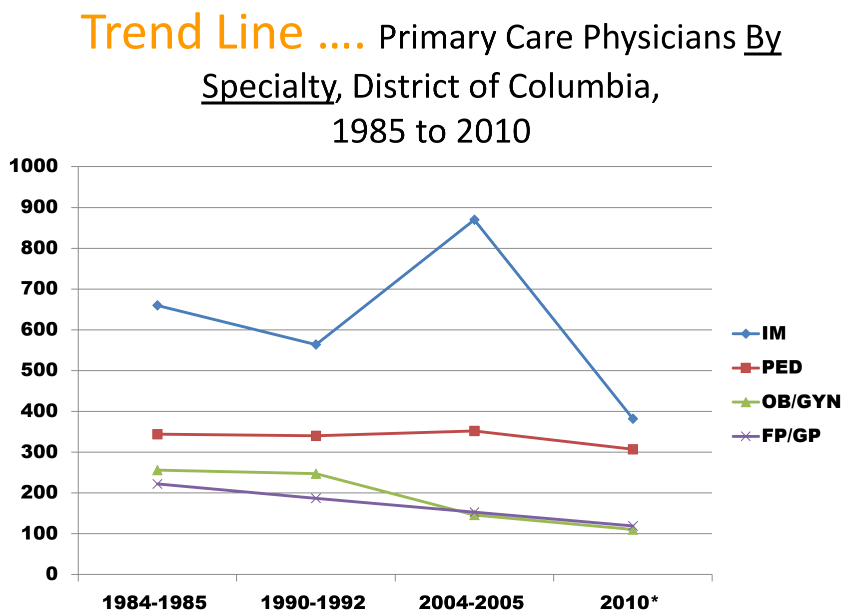
4.10.3.6 DC Physician Trends, By Specialty, 1985 to 2005 versus 2010

TABLE 4.68: PHYSICIAN TRENDS: COMPARING DCPC STUDY 1985-2004 VERSUS DC-BOM STUDY, 2010

	Total DC Licensed Physicians	Physicians practising in DC	Primary care Physicians	primary care physicians as % of practising physicians
1984-1985	11,068	2,543	1,444	56.8
1990-1992	9,675	3,863	2,120	54.9
2004-2005	9,675	3,635	1,622	44.6
2010* •estimates from DC Board of Medicine, 2010 study	8,940	~4,000	918	22.9

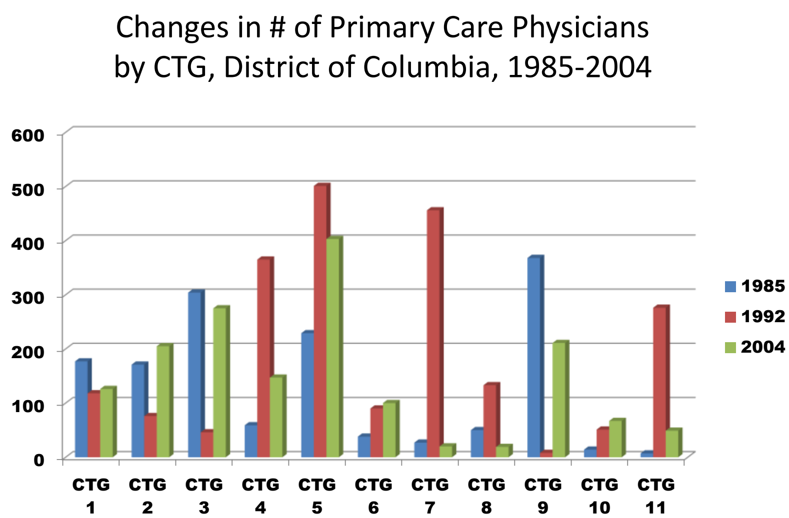
4.10.3.7 Trend: DC Physicians by Specialty, 1985 to 2005 versus 2010

TABLE 4.69: PRIMARY CARE PHYSICIANS BY SPECIALTY: COMPARING DCPC STUDY 1985-2004 VERSUS DC-BOM STUDY, 2010



4.10.3.8 Trends and Changes in CTG numbers of DC Primary Care Physicians, 1985 to 2005

TABLE 4.70: PRIMARY CARE PHYSICIANS BY CTG, DCPC STUDY 1985-2004



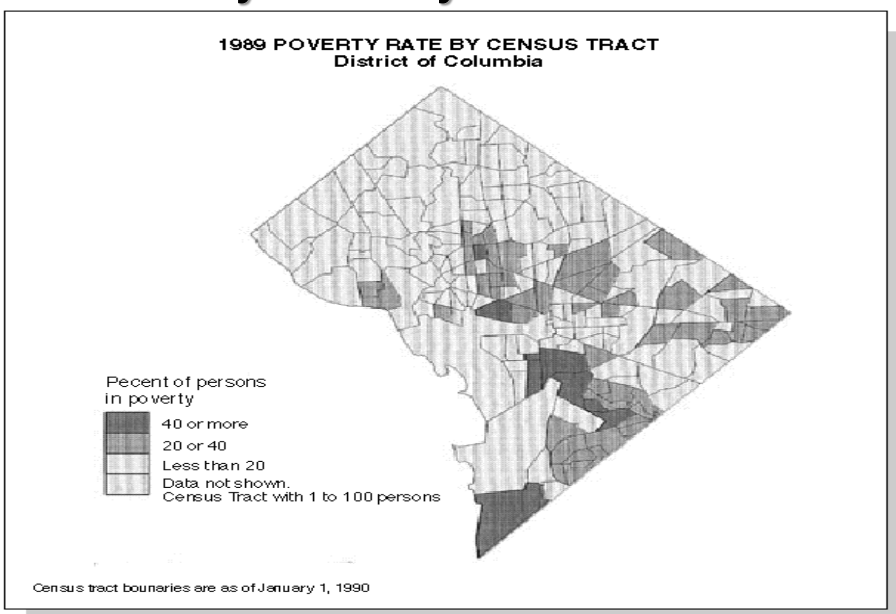
4.11 MEETING PRIMARY CARE NEEDS IN THE DISTRICT

This study has elicited findings which point to the fact that meeting primary care needs in the District has been, and may continue to be, challenging because the rate of poverty – especially poverty among children - is still relatively high in the District when compared to other surrounding jurisdictions.

4.11.1 DC Poverty levels in 1990

TABLE 4.71: POVERTY IN THE DISTRICT, US CENSUS BUREAU, 1990

DC Poverty Rates: By Census Tract Tract



4.11.2 DC Poverty in 2010 (US Census Bureau data, 2010)

TABLE 4.72: COMPARING TRENDS IN DC POVERTY LEVEL, DISTRICT OF COLUMBIA, 1989 VERSUS 2010 (US CENSUS DATA)

1989	Poverty rate	Child poverty rate
DC	33% (188,514)	35%
2010		
DC	19.2% (109,423)	30%
Maryland	9.9%(557,140)	13%
Virginia	11.1%(861,969)	14%

4.12 SUMMARY FINDINGS: TESTING OF THE SIX (6) STUDY HYPOTHESES

Data and findings from the testing of the study hypotheses are presented in this section. The six null hypotheses (#H_{01} = 0 through #H_{06} = 0) which guided the design, implementation and conduct of the study are listed below together with the results of the hypothesis testing conducted in this DCPC study for each one of them.

The research determined whether there was statistical significance, at the 95 percent confidence level, to reject (or fail to accept) the following null hypotheses:

H_{01}: The distributions of active physicians by specialty type and by census tract and Census Tract Grouping in the District of Columbia do not vary significantly.

> Finding for H_{01}: The distributions of active physicians by specialty type and by census tract and Census Tract Grouping in the District of Columbia *vary significantly.*

H_{02}: The primary care service index (PCSI) which is the ratio of primary care visits demanded (“potential demand”) by the population to the primary care visits satisfied or available (“satisfied demand”) does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

> Finding for H_{02}: The primary care service index (PCSI) which is the ratio of primary care visits demanded (“potential demand”) by the population to the primary care visits satisfied or available (“satisfied demand”) *differs significantly* by census tract or Census Tract Grouping in the District of Columbia.

H_{03}: The unsatisfied visits or “visits gap” in primary care does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Finding for H_{03}: The unsatisfied visits or “visits gap” in primary care *differ significantly* by census tract or Census Tract Grouping in the District of Columbia.

H_{04}: The quantitative measure of “need” for primary care - “composite need score” – does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Finding for H_{04}: The quantitative measure of “need” for primary care - “composite need score” – *differs significantly* by census tract or Census Tract Grouping in the District of Columbia.

H_{05}: There are no statistically significant differences among the values of the primary care priority scores (PCPS) calculated by census tract or Census Tract Grouping in the District of Columbia.

Finding for H_{05}: There are *statistically significant differences among the values of the primary care priority scores* (PCPS) calculated by census tract or Census Tract Grouping in the District of Columbia.

H_{06}: The variables - primary care physician distribution, primary care service index, and composite need scores - acting alone or in combination, do not significantly predict the existence of a primary care “visits gap” by census tract or Census Tract Grouping in the District of Columbia.

Finding for H_{06}: The variables - primary care physician distribution, primary care service index, and composite need scores - acting alone or in combination, *significantly predict the existence of a primary care “visits gap”* by census tract or Census Tract Grouping in the District of Columbia.

4.13 SUMMARY DETERMINATION CONCERNING THE RESEARCH OBJECTIVES

The objectives of the research and the finding of this study as they relate to each objectives are outlined in this section. The research objectives are listed together with the study findings/determination:

1 To *identify critical variables* which impact on need and demand of primary care in the District:

This objective was attained since the three primary care indices – PCSI, CNS and PCPS – were defined and able to be calculated using the study data for 1984 to 2004.

2 To *determine an appropriate and rational geographical unit of analysis (CTG)* for describing the need and demand for primary care in the District which can assist planners in more effectively designing appropriate and cost-effective interventions for reducing primary care shortage areas.

ii. This objective was attained because the aggregation of several DC census tracts into one of the eleven Census Tract Groupings (CTG) areas was accomplished in this study. Data and results of DC primary care need and demand estimates are presented in this study by using the Census Tract Groupings the District for 1984 to 2004.

3 To *develop composite indices* for primary care data for the District using the selected sentinel variables and basing them on newly-conceptualized, newly-developed, rational geographic units of urban data analysis (CTG), which can be used to determine primary care need and demand estimates

iii. This objective was attained because sentinel variables for the District –

physician distributions, poverty rates and percent low birthweights – were used in the derivation of the three primary care indices (PCSI, CNS, PCPS) for the District for 1984 to 2004.

4 To *identify and delineate primary care shortage areas* for the District

iv. This objective was attained because primary care shortage areas in the District were identified in this study. This was accomplished by subtracting the calculated value of primary care visits available (due to presence of a certain number of physicians who provided primary care services to residents of that community) from the total (potential) primary care visits demanded by a small community (as determined by its need for services based on prevailing poverty and low birthweight percentages). The difference between potential demand (visits) and satisfied demand (visits) provided values for primary care visits shortages (or excess, as the case may be) for a given CTG. It was determined that for 1984 through 2004, a large portion of the primary care shortage areas in the District existed in CTG 7 and CTG 8, which also happened to be the areas with the highest poverty rates and the highest percentages of low birth-weights.

5. To design a practical model for quantitatively analysing and describing primary care resources and community health status in the District.

This objective was attained because the study has provided data, methods for analysing the data and practical geographic units of analysis (CTG) that can serve as a model for quantitatively analysing and describing primary care resources and outcomes in the District.

4.14 FINDINGS RELATED TO THE RESEARCH QUESTIONS

The following research questions were addressed by this study. Per the study data and findings, the answers to the research questions are also listed based on the data tables and analysis presented in this chapter.

5. Can the study *identify the critical variables* which can be shown to have an impact on need and demand estimates for primary care in the District?

   Study Finding: Sentinel variables were identified and shown to have an impact on need and demand estimates for primary care in the District.

6. Is it possible to *determine an appropriate and rational geographical unit of analysis (CTG)* which can be used to describe need and demand for primary care in the District and thus assist planners in more effectively designing appropriate, community-based interventions for reducing primary care shortage areas?

   Study Finding: It was possible via this study to determine appropriate and rational geographic units of analysis – the eleven CTG areas for the District.

7. Is it feasible to use the collected study data to *develop composite indices* for primary care need and demand estimates for the District using the identified sentinel variables?

   Study Finding: It was feasible to use study data to develop composite indices for primary care need and demand estimates for the District using the identified sentinel variables, poverty%, low birth-weight% and physician distributions.

8 Is it feasible and practical to *<u>identify and delineate primary care shortage areas</u>* for the District by obtaining the (numerical) differences between the primary care need and demand indices?

Study Finding: It is feasible and practical to identify and delineate primary care shortage areas for the District. These are District areas where this study showed that primary care need estimates exceeded primary care availability.

9 Can a quantitative model for analysing and describing primary care in the District be described and presented in a manner which makes it amenable to effective use by the District's health planners and health services providers?

Study Finding: a quantitative model for analysing and describing primary care in the District was described and presented in this study in a manner which makes it amenable to effective use by the District's health planners and health services providers.

4.15 CHAPTER SUMMARY

This chapter has covered in detail the presentation and analysis of the data on primary care need and demand estimates for the District of Columbia for the period 1984 to 2005. The six research questions initially stated in chapter 1 of this study were presented, analysed and summarised in this chapter. Per the study data and findings, the answers to the research questions were listed based on the methodology described in chapter 3 and the data tables and analysis presented in this chapter. Findings from this study were presented and substantiated and corroborated by references to published literature describing findings of other studies such as the DC Board of Medicine's study of physicians in the District in 2010 and 2013. The next chapter presents and discusses conclusions and recommendations based on the findings of this study as presented in this chapter.

CHAPTER 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter will present summaries and conclusions culled from the data and findings of this study. It will also present recommendations for addressing some of the primary care needs of the District of Columbia as identified in the findings of this study. Additionally, it will delineate areas for further study. This study investigated the quantitative estimation of primary care need and demand indices for small area analysis of communities in the nation's capital, the District of Columbia, from 1985 to 2004. The study findings about the study variables – poverty%, low birth-weight%, physicians supply and distribution, primary care indices (PCSI, CNS, PCPS), visits shortages and CTGs - have not been generalized, neither are they to be interpreted beyond that which the study data supports.

This researcher has made a contribution to the literature by filling a need for delineating primary care analysis areas which are rational service areas for the District of Columbia. The researcher has also demonstrated a viable urban primary care need and demand estimation approach. This was achieved by examining health disparities not merely in racial/ethnic or urban/rural terms, but in terms of physician location disparities, poverty and low birth-weight disparities and primary care shortage area disparities for communities in one city, specifically, the District of Columbia, circa 1985 to 2004.

Overall, one significant finding of this study is that it corroborates similar findings that primary care in the District of Columbia is characterized by the presence of a rich and skilled physician resource base (DC BOM 2012), relatively poor health status for a significant segment of the population (DCNA 2013), an increasing demand for basic primary health care services (Rand 2009), and a complex and growing need that can be described by using community-based economic, demographic and health-related indicators.

This study, DCPC, also estimates that for 2005 and beyond, additional primary care visits may be required to satisfy the increasing estimated primary care need and demand levels (that is, “unmet need”, “unmet demand” or “unsatisfied visits”) in the general District population. A smaller portion or about 9 percent of the unmet need, according to this study’s findings, is attributable to the "poor" residents who live in the District of Columbia purely on the basis of their being poor and living at or below the federal government’s poverty standard. The major portion of the unmet need is exhibited by the "working poor" in the District, that is, those persons who work and have an income but are too "rich" to qualify for the Medicaid program and too poor to be able to purchase their own basic and/or comprehensive health insurance.

As a result of the study findings a series of primary care-related questions are posed and addressed in this section. The following section poses and discusses these research-derived questions.

5.1.1 Does the study support or reject the research hypotheses?

In Chapter 1, six hypotheses were proposed for this study. These questions will be answered in this chapter. The questions to be answered are as follows:

- H1: The distribution of active physicians by specialty type and by census tracts and Census Tract Groupings in the District of Columbia does not differ significantly.

- H2: The primary care service index (PCSI) which is the ratio of primary care visits demanded (“potential demand”) by the population to the primary care visits satisfied or available (“satisfied demand”) does not differ significantly by census tract/Census Tract Grouping in the District of Columbia.
- H3: The unsatisfied visits or “gap” in primary care does not differ significantly by census tract/Census Tract Grouping in the District of Columbia.

- H4: The quantitative measure of need for primary care used in this study, “composite need score,” does not differ significantly by census tract/Census Tract Grouping in the District of Columbia.

- H5: There are no statistically significant differences in the values of the primary care priority score (PCPS) calculated by census tract or Census Tract Grouping in the District of Columbia, for the eleven Census Tract Groupings.

- H6: The variables - primary care physician distribution, primary care service index, and composite need scores - acting alone or in combination, do not significantly predict the existence of a primary care “gap” by census tract or Census Tract Grouping in the District of Columbia.

5.1.2 Summary of hypotheses testing using One-way Analysis of Variance

In this section, results and conclusions are presented after the six hypotheses originally proposed for this study (in Chapter 1) were evaluated. Statistical techniques - frequency distributions, cross-tabulations, group means Chi square, ANOVA and multiple linear regression - were used to examine the variability of the mean observations between the CTG mean values for the study variables and conclusions were drawn from them. The purpose of hypothesis testing is to help draw conclusions about population parameters based on sample results. From the data findings and tables presented in Chapter 4 the means and standard errors for values of the selected study variables (physicians per 1,000 population, Composite Need Scores (CNS), and Primary Care Service Index (PCSI), primary care priority scores) were shown to differ among the eleven Census Tract Groupings (CTGs). It needs to be determined if the observed differences in means for the study variables can be attributed to mere natural variability of means from the same population or whether it is reasonable to believe that these different observed mean values are statistically significant due to systemic variations that are not random.
One-way ANOVA procedure was used to test the hypotheses that the CTG means of the study variable are equal and have no significant variations. This statistical procedure was used in the hypotheses testing because the following assumptions were made for the study variables:

(1) Each of the CTGs is an independent random sample from the normal population, and (2) In the population, the variances of the study variables (by CTGs) are equal.

The research hypotheses and research questions are answered in the following sections.

5.1.2.1 Hypothesis #1: Physician distribution

H_{01}: The distributions of the *study variable, active physicians*, by specialty type do not differ significantly by census tract and Census Tract Grouping in the District of Columbia.

Summary: The CTG-by-CTG variation is evident in the total numbers of physicians as well as in the physician ratios per 1,000 population for each Census Tract Grouping. The statistical test for the null hypothesis that all the CTGs have the same mean for the number and rate of physicians is based on the F statistic. The calculated F value was compared to the F distribution and the degrees of freedom. The observed *significance level* (Sig.) for physicians per 1,000 population was greater than 0.05; for total number of physicians, greater than 0.05; for primary care physicians, greater than 0.05; and for percent of physicians who are primary care physicians, less than 0.05. *Thus the physician-related variables were not statistically significant except one. The percent primary care physician per CTG was statistically significant (Sig.=0.023, df=10).*

The null hypothesis for $H_{0:1}$ is rejected (not supported). Percent of primary care physicians active in the city varied significantly from CTG to CTG therefore this study rejected the hypothesis of no variation and thus concluded that differences did exist among the eleven CTGs with respect to the percent of active primary care physicians.
Overall, total numbers of physicians active and practicing in the District of Columbia numbered 2,543 in 1985, 3,684 in 1990, and 3,697 in 2004.

- This translated into *physicians per 1,000 population* ratios of 3.98 in 1985, to 6.19 in 1990 and 6.74 in 2004.

- The above physicians per 1,000 population ratios represented a steady decrease in the overall citywide *population per physician* ratio of 239 in 1985, 162 in 1990, and 146 in 2004.

- Overall, the District of Columbia enjoys a relatively abundant population per physician ratio. For the District of Columbia in 2004, the study's finding of the citywide population per physician ratio of 146 was far *higher* than the 3,500 population per physician ratio required by the federal HPSA designation process.

- However, whereas the overall citywide rate showed an excess of physicians, the distribution of the active physicians by specialty type and by census tracts and Census Tract Groupings in the District of Columbia varied significantly, among census tracts and also among the eleven Census Tracts Groupings. From 1985 to 2004, physicians by CTGs decreased by 360 in CTG 9 (the largest decline) to an increase of 420 (CTG 7) the largest increase.

5.1.2.2 Hypothesis #2: Primary Care Service Index (PCSI)

H_{02}: The primary care service index (PCSI) which is calculated from *study variables active physicians, poverty%* and is the ratio of primary care visits demanded by the population to the primary care visits satisfied, does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

<u>Summary:</u> The findings of this study showed that the Primary Care Service Index (PCSI) which is the ratio of primary care visits demanded ("potential demand") by the population of a given small area to the primary care visits satisfied or available ("satisfied demand"), does not differ significantly by Census Tract Grouping in the District of Columbia. The observed significance level (Sig. value) for PCSI is greater than 0.05. Thus the PCSI variable was not statistically significantly different among the eleven CTGs.

- The variability in PCSI mean values for CTGs was not statistically significant (F=1.295, Sig.=0.237, df=10). *The null hypothesis for $H_{0:2}$ is not rejected* (that is, equal PCSI variance may be supported).

- However, when the PCSI values were recoded into a different variable, PCSI categories, and evaluated, the observed variability of the PCSI category variable was *statistically significant (F=9.708, Sig.=0.000, df=10)*. This means that PCSI categories (very high, high, medium, or low) for CTGs in the city do not have variances equal to zero.

- *The null hypothesis of no variation is thus rejected and the conclusion made that differences did exist among the eleven CTGs with respect to the PCSI categories.*

From 1985 to 2004, the change in PCSI values ranged from a low of -3.0 (CTG8) to a high change of 4 (CTG 11). Three CTGs (CTG 1, 7, and 8) exhibited negative values of PCSI which meant that their PCSI values had decreased from twenty years prior. This implies that these three CTGs were better off in 2004 than in 1985. Only two CTGs had positive changes in their PCSI values meaning that they had a lower PCSI value in 2004 at the end of the twenty-year study period, than in 1985 at the beginning of the twenty-year study period. These two CTGs (CTG 10 and 11) were worse off in 2004 than they were in 1985. The majority of CTGs, six of them (CTGs 2, 3, 4, 5, 6, and 9) had no net effect in change of their PCSI values, meaning that they had neither improved nor worsened, when the ratio of satisfied primary care visits is compared to the total potential demanded visits.

5.1.2.3 Hypothesis #3: Unsatisfied visits or "Visits Gap"

H_{03}: The unsatisfied visits (or "visits gap") in primary care, which is calculated *from study variables PCSI and CNS,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Summary: The results for this hypothesis were mixed. The variability in the unsatisfied visits variable was not statistically significant. However, the variability in the variable, potential visits demanded (total visits demanded) was found to be *statistically significant (F=4.396, Sig.=0.000, df=10).*

In this DCPC study, unsatisfied visits is defined as the difference between the potential, visits demanded and the visits available or satisfied. There were no significant variations in unsatisfied visits in 2004. The observed significance level for unsatisfied visits demanded is greater than 0.05. Thus the unsatisfied visits variable was not statistically significantly different among the eleven CTGs (F=1.111, Sig.=0.357, df=10). *The null hypothesis for $H_{0:3}$ is not rejected* (that is, equal *visneed* variance may be supported). The mean values in the District for unsatisfied visits in 2004 did not vary significantly from CTG to CTG therefore we do not reject the hypothesis of no variation and conclude that differences do not exist among the eleven CTGs with respect to visneed, or unsatisfied, needed visits. However, the study estimated the total demand (or potential visits demanded) by CTGs and that variable's variability was found to be statistically significant, as shown earlier.

5.1.2.4 Hypothesis #4: Composite Need Scores (CNS)

H_{04}: The quantitative measure of "need" for primary care - "composite need score (CNS)" - which is calculated the from *study variable low birth-weight%,* does not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

<u>Summary:</u> The observed significance level for CNS was less than 0.05. Thus the variability in the difference in means for the CNS variable was *statistically significant (F=13.503, Sig.=0.000, df=10).*

- The *null hypothesis for $H_{0:1}$ is rejected* (not supported). CNS mean values in the city do vary significantly from CTG to CTG therefore this study rejects the hypothesis of no variation and concludes that differences do exist among the eleven CTGs with respect to the CNS values.

- This DCPC study collected, analysed and presented data that showed that the Composite Need Scores (CNS) for census tracts and Census Tract Groupings in the District of Columbia, which are calculated via a statistical combination of the percent of persons at or below the federal poverty guideline and the percentage of live births that were low birth-weight, are quantitative measures of need for primary care that differed significantly by census tract/Census Tract Grouping in the District of Columbia, in 1985, in 1990, and in 2004.

Composite Need scores for each census tract or census tract grouping ranged from 0 percent (very high need) to 100 percent (very low need).

In 2004, CTGs in the District had the following CNS scores:

- CTG 3: 80.0 percent (lowest need);
- CTG 8: 27.3 percent (highest need);
- DC citywide average CNS score: 52.5 percent.
- Five CTGs had CNS values lower than 50 percent.

For this DCPC study, CNS categories for 2004 ranged from 1 (high need) to 4 (low need). CTG 3 had a CNS category of 4 (low need) while CTG 8 had a CNS category of 2 (high need) Five CTGs had a CNS high need category (of 2) and 5 had a CNS category of 3 (relatively low need).

- The overall trend or change in CNS from 2004 to 1985 showed that six CTGs had a lower CNS in 2004 (higher need) than in 1985.

- Five CTGs also showed improvements in their CNS scores: from a lower CNS value in 1985 to a higher score in 2004.

- Overall, the citywide CNS stayed fairly constant, declining by a mere 0.4 percent.

There was variation in CNS scores among the District of Columbia's CTGs but as many CTGs improved as did not improve their scores. *The null hypothesis of no significant variation among the CTGs is not supported and is therefore rejected.* However, the overall (average) citywide CNS value stayed relatively the same over the twenty years of this study.

5.1.2.5 Hypothesis #5: Primary Care Priority Scores (PCPS)

H_{05}: The primary care priority scores (PCPS) – which is calculated from *study variables PCSI and CNS* - when cross-tabulated by census tract or Census Tract Grouping, do not differ significantly by census tract or Census Tract Grouping in the District of Columbia.

Summary: Statistical combinations of PCSI values and CNS values for each census tract area or Census Tract Grouping yielded the calculated values for the primary care priority scores (PCPS). The observed significance level for PCPS (priority values) was less than 0.05. *Thus the variability in the difference in means for the priority variable was statistically significant (F=10.564, Sig.=0.000, df=10).*

The null hypothesis for $H_{0:5}$ is rejected (not supported), thus:

- Priority scores (PCPS) in the District do vary significantly by CTG therefore we reject the hypothesis of no variation and conclude that statistically significant differences do exist among the eleven CTGs with respect to the PCPS (priority) scores.

5.1.2.6 Study findings on primary care priority scores

Findings of this study have shown that there are statistically significant differences in the values of the primary care priority score (PCPS), in 1985, in 1990, and in 2004, calculated by census tract or Census Tract Grouping, in the District of Columbia. Low levels of satisfied visits demand (low PCSI) combined with high need (high CNS) creates high priority scores. Priority scores of 1 are high priority areas for planning and program interventions. From 1985 to 2004, one CTG had a negative priority score change, meaning that its priority in 2004 was lower than in 1985, while two CTGs had positive priority score changes, meaning that their priority scores in 2004 were higher (less urgent) than in 1985. The negative change in PCPS for CTGs have improved and the positive change in PCPS CTGs have worsened. Eight CTGs had the same priority levels in 2004 as pertained in 1984.

The null hypothesis of no significant difference in priorities is supported (not rejected) because the majority of CTGs showed no change in priority levels between 1985 and 2004. However, this is a mixed finding because it also shows that CTGs with high levels of need have not changed, and CTGs with lower levels of need have not significantly changed priorities either. But by examining each study year in cross-section analysis, there is found to exist a wide variation in priority scores among the CTGs (that is, in 1985 priority scores varied as they did in 1990 and 2004).

Results of the One-way ANOVA hypotheses testing for study hypothesis #1 to #5 (and their related variables) are shown in Table 36 below:

TABLE 5.1: SUMMARY: ONE-WAY ANALYSIS OF VARIANCE OF VARIABLES* RELATED TO HYPOTHESES #1 TO #5, DCPC STUDY, DISTRICT OF COLUMBIA, 2004

Variables		Sum of Squares	df	Mean Square	F	Sig.*
PCSI	Between Groups	513.792	10	51.379	1.295	.237
	Within Groups	6862.990	173	39.670		
	Total	7376.782	183			
VISNEED	Between Groups	233206207662.835	10	23320620766.283	1.111	.357
	Within Groups	3632221203314.884	173	20995498285.057		
	Total	3865427410977.718	183			
CNS	Between Groups	45822.468	10	4582.247	13.503	.000*
	Within Groups	58706.887	173	339.346		
	Total	104529.355	183			
PRS	Between Groups	27.625	10	2.763	10.564	.000*
	Within Groups	45.239	173	.261		
	Total	72.864	183			
TOTPHYS	Between Groups	42949.547	10	4294.955	1.034	.417
	Within Groups	714764.038	172	4155.605		

	Total	757713.585	182			
TVISPR	Between Groups	3711929654.751	10	371192965.475	4.561	.000*
	Within Groups	14080257900.500	173	81388773.991		
	Total	17792187555.251	183			
pcsi categories	Between Groups	97.075	10	9.708	4.094	.000*
	Within Groups	410.229	173	2.371		
	Total	507.304	183			
TPHYSPTP	Between Groups	116808.092	10	11680.809	.610	.804
	Within Groups	3311227.647	173	19140.044		
	Total	3428035.739	183			
PCPERC	Between Groups	20809.804	10	2080.980	2.145	.023*
	Within Groups	167847.128	173	970.215		
	Total	188656.933	183			
PCPHYS	Between Groups	8377.943	10	837.794	1.042	.410
	Within Groups	138263.642	172	803.858		
	Total	146641.585	182			
TOTSATDE	Between Groups	227461107368.584	10	22746110736.858	1.057	.398
	Within Groups	3723669826492.588	173	21524103043.310		
	Total	3951130933861.172	183			
PCSATD	Between Groups	187872145403.067	10	18787214540.307	1.058	.398
	Within	3072503483644.151	173	17760135743.608		

	Groups					
	Total	3260375629047.218	183			
POTVDEM	Between Groups	8392857224.275	10	839285722.428	4.396	.000*
	Within Groups	33029668934.235	173	190922941.816		
	Total	41422526158.510	183			

* F is statistically significant, p=0.05

5.1.2.6 Hypothesis #6: Study variables have no utility in the development of predictive linear models for visits needed, by census tracts or CTGs

H_{06}: The study variables primary care physician location, primary care service index (PCSI), and composite need score (CNS), acting alone or in combination, do not significantly predict the existence of a primary care "visits gap" by census tract or Census Tract Grouping in the District of Columbia.

Summary: The results for this hypothesis were mixed. This null hypothesis is not rejected since the F statistic for the multiple linear regression model for predicting visits needed from independent variables (PCSI, CNS, and physicians per 1,000 population) was statistically significant (R-squared=0.186, F change=9.390, Sig. F change=0.000, Durbin-Watson=2.068). However, only a small proportion (R^2=0.186) or 18.6 percent of the variation in the predictor variable is explained by the included independent variable.

- The findings of the hypothesis testing for Hypothesis #6 have shown that the variables - primary care physician distribution, primary care service index, and composite need scores - acting alone or in combination, can predict the existence of a primary care "gap" or "visits gap" by census tract or Census Tract Grouping for the District of Columbia.

The predictive power was limited and not substantial. Transformations of study variables using logarithms and reciprocals did not produce models with greater predictive models.

Multi-collinearity of study variables may be hampering predictive utility. Study and evaluation of additional, non-linear regression models are indicated.

5.2 Does the study support or contradict previous research?

The findings of this study support other research that show a correlation between health status and physician access and availability (Lurie 2002). Some studies have attempted to show that there is a growing health disparity between economically relatively well-off urban and rural poor residents (US GAO 2003; Niewczyck & Lwebuga-Mukasa 2008:22-40; Chandra, Blanchard, Ruder 2013). Some of these studies have resulted in policy changes and programs at the state and national levels which were designed to alleviate some aspects of the perceived or demonstrated need. Since other studies continue to find evidence of persisting need, it might be suggested that such policies and programs may not have done enough to change the situation. Still, not all state and national agencies which fund programs require justification for expenditures in the form of needs assessments.

The state of New York's Department of Health was one of the US states to use a rigorous analysis of primary care needs and resources by smaller areas for a large geographic area. Although the New York State Primary Care Analysis Areas (Vernon 1984:1-23) used counties as the unit of analysis (in contradistinction to this DCPC study which used smaller Census Tract Groupings within a city), New York State's work in primary care needs assessment is seminal and ground-breaking. This current study supports some of the findings of the NYS study linking physician availability to community need estimations.

The state of Kansas through its partnering program and the Joint State Needs Assessment (JSNA) protocols has developed and implemented County-specific data profiles that have shown that community health needs can be ascertained and health disparities identified. Their studies have boosted the impetus for planning intervention through organised data collection, needs assessment and community characteristics identification using health status and socio-demographic characteristics of counties in Kansas. This current study supports some of the findings shown in Kansas' JSNA (Garner 1998:204).

The US federal government Department of Health and Human Services (DHHS) recognized the problem and in 1999, issued Request for Applications (RFA) for about $10 million in grants for Racial and Ethnic Approaches to Community Health (REACH). The REACH program has continued as part of the HHS response to US Presidents' commitment to eliminate racial and ethnic disparities in health.

Health disparities are often presented in racial and ethnic terms and some inequities continue to persist. This is the case for acute, chronic and preventable health care conditions which may be ameliorated by a comprehensive and integrated and widely accessible primary health care system, nationally and locally. For white infants in the US, the infant death rate was 6 per 1,000 in l996; for African Americans it was 14.2 in 1996, and for Native Americans it was 9 in 1995. African Americans have a cancer death rate about 35% higher than that for whites; for African American men it is about 50% higher. The prevalence of diabetes in African Americans is 70% higher than whites, among Hispanics it is nearly double, and among Native Americans it more than twice that for the total population.

This study DCPC has made a contribution to the literature in terms of examining health disparities not in urban/rural terms, but in identifying and quantifying disparities among total populations in communities and smaller areas inside of the same city or urban area. Previous studies have focused, predominantly, on larger states and regions of substantial geographic size. They have generally not focused on cities and urban areas, as this study has attempted to do.

5.3 Is the study conclusive or is further research needed?

Further research is needed in the area of developing and applying quantitative methods that incorporate health resources variables and epidemiological data into primary care needs determination for cities and urban areas. Residents' proximity to physicians and other medical resources, effects of lack of health insurance or underinsurance on the need and demand for primary care, the role of non-physician primary care providers – all of these areas will benefit greatly from additional research.

A considerable amount of research has already been conducted on the problem of primary health care shortages in US metropolitan and rural areas. The US Conference of Mayors has done some work in putting forward an urban health agenda which requires much data analysis and refined needs assessment methodologies (Benbow 2007:11-126).

> The need for primary health care in inner-city areas has been demonstrated by other researchers. However, while the supply of physicians and other health care providers are increasing in many large cities and metropolitan areas, the demand is still great in identifiable and underserved urban communities and rural areas (Williams, Whitcomb, & Harris, 1994: 275:708-12).

Some studies are not conclusive in this arena of predicting urban health needs from social conditions and health care resources. Some indicators would suggest that things may be getting worse rather than better by focusing solely on health resources to the exclusion of other relevant variables. For example, the number of federally designated health professional shortage areas (HPSAs) has actually increased 40% since 1990. As shown by Schroeder & Beachler (1995:1001-1002:) and amply supported by the findings of this DCPC study, the problem is not undersupply of health care providers but mal-distribution of same (per this DCPC study, Hypothesis #1).

To counteract these shortages, US state and federal programs such as financial incentive and loan programs for medical students, national and state health corps programs and recruitment, training and placement programs for health care professionals have helped. They, however, by no means eliminated the problem of primary health care shortages for portions of urban populations.

5.4 What are the implications of this research to the discipline?

Data standardisation and adoption of small area methods for urban health needs assessments are indicated and must be supported and advanced for the good of the discipline. More definitive research is needed because long-term efforts to increase the number of primary care physicians serving rural as well as many underserved urban populations in the US can be argued to have been relatively unsuccessful. This is due to the fact that several factors including economic viability affect physician access and availability (Schroeder & Beachler, 1995:1001-1002).

5.5 Should relative practices be redefined?

Based on some of the findings of this DCPC study juxtaposed on similar findings of other primary care studies (see Literature review, chapter 2), some redefinitions and re-applications of certain physician and health resources needs assessment methods are indicated.

In a related study, Leitner, Gast, Sarvela, Ring & Newell (1996:110-119) demonstrated that in the state of Illinois, there was little or no correlation between need determined by epidemiological indicators and federal HPSA status. The Leitner et al. study suggested that there were some methodological problems associated with claiming need based on physician to population ratios alone.

Additional studies including the elaboration and refinement of this DCPC study are indicated. Further studies can assess need utilizing other significant epidemiological indicators as well as physician to population ratios (LeBlanc 1996:1-17).

The methods used to assess primary care needs as well as the methodological problems association with those models of assessment require closer examination and refinement. Suggestions for assessing needs and examining newer models based upon prevailing costs in cities, access/affordability and economic demand health/population and provider projections are indicated. These may help point the community health planning profession toward a future of standardised, effective, and widely promulgated urban needs assessment methods.

5.6 Do the findings generally or specifically support or reject the hypothesis?

Sections 5.1.2.1 to 5.1.2.6 above have addressed this question in some detail. One finding of this study has been that the ratio of physicians per 1,000 population is not a robust predictor, by itself, of need/demand for primary care in the District of Columbia. The most common or often used model of US health care needs assessment is the ratio of health care providers to the population, often and unfortunately, used in isolation. One of the many reasons for this is data availability: most population figures are readily available through the U.S. Census and does not require a voluminous amount of work. Population figures are available for state, county, metropolitan, township, and census tract level every ten years. The US Census Bureau makes yearly estimates at the state and county level, and these numbers are constantly revised. A more time- and labor-intensive model for assessing need is the “client-demand” model. This DCPC study is an application of one version of this need-demand model. Although data from market and other research may be available, typically this model requires collection of often very time-consuming and/or costly primary data (surveys). In this DCPC study, primary data collection was conducted and used in conjunction with secondary data (see Appendix).

The inadequacy of physician per 1,000 population ratios as a reliable predictor for need, in addition to its shortcomings in the HPSA process as documented by other studies, calls for refined and enhanced primary data collection efforts, especially in an effort to secure more reliable estimates of physician full-time equivalents (FTEs) as proxies for physician availability and access in a community.

5.7 DCPC summary and data perspectives

The nation’s capital, the economic and political city center that is the District of Columbia, has a plentiful supply of practicing physicians juxtaposed upon relatively poor health status for residents and inequitable distribution of health resources distribution. A desire to examine and understand the availability, or lack thereof, of primary care physicians, services, and needs in one of the most important cities in the world – Washington, DC, also known as the District of Columbia - the capital of the United States, prompted this researcher's intellectual curiosity and work on this research.

The DCPC study has made a contribution to the literature by examining health disparities among communities and smaller areas inside of the same city. DCPC has shown that because primary care is local, it requires local planning emphasis and direction. Primary care also has national and international aspects.

Internationally, the Alma-Ata Declaration (WHO 1978; Hixon & Maskarinec 2008) has had its critics including Hall & Taylor (2003). This laudable universal primary care goal was not achieved *in toto,* however, it is abundantly clear that much progress has been made. It had been widely believed by many that a global push was necessary to give the developed and developing countries of the world the required impetus to provide universal primary health care to the millions of citizens. Alma-Ata was more than a re-affirming declaration for developing countries of the world. It also put more focus and emphasis on primary care in countries of the more-developed world. In these United States, arguably with the most advanced, technological and arguably high-quality medical care available, in the early decades of the twenty-first century, primary health care for all is by no means a certainty, not in its capital city or in other major metropolises.

In the past several decades, the nation's capital, Washington, D.C. – the District of Columbia - has made progress in the restructuring and delivery of health services to many of its most needy citizens. The District, however, still exemplifies the problem that faces many metropolises and urban centers as well as many poor rural areas in the U.S. These are cities that are struggling to face the myriad problems inherent in promulgating primary care for all citizens, irrespective of medical problem, social status or ability to pay. The problem is essentially this: how to restructure, finance and provide primary health care services to all citizens in an era of ever-shrinking resources and capacities.

The results of this DCPC analysis of primary care data for Washington, D.C. for 1985 to 2004 have documented the case for universal and accessible primary care for all of the city's residents. Using this study to go back several years, to 1985, has its advantages. It provides critically needed perspective on an issue with longer term implications for its urban residents. This study has shown that the District of Columbia and other major cities do not fare well in comparison to the US as a whole. Change in some areas has come relatively slowly while major progress has been attained in others, thanks to the widely-embraced, US Healthy People 2000, 2010 and 2020 initiatives (Wagener 2000; DHHS 2013).

5.8 Urban health status and socio-demographic considerations are imperative and are indicated

A review of some national and local statistical facts covering the study period of 1984 to 2004 is useful. For example, in the US in 1985, crude mortality rates per 1,000 population for respiratory diseases were as follows: Washington, D.C - 0.6; Baltimore, MD - 4.5; New York, NY - 4.5; Detroit, MI - 4.5; In Washington, DC, in 1999, the crude mortality rate per 1,000 population for influenza and pneumonia (0.387) and chronic obstructive pulmonary diseases (0.308) was a combined 0.7 per 1,000 population, a slight decline (CDC YPLL 1986). US mortality data from Xu, Kochanek, Murphy, & Tejada-Vera (2010) and US population life table estimates obtained from the classic work (Armstrong & Curtim 1987) show that more work needs to be done.

For 2012, the Washington Post reports that the District's infant mortality rate – especially for non-whites - long among the highest in the country, has fallen to a historic low of 8 infant deaths per 1000 live-births . Decades ago, the infant mortality rates for non-whites in 1983 were as follows: Washington, DC - 20.1; Baltimore, MD - 19.8; New York, NY - 20.1; Detroit, MI - 23.0; Atlanta, GA - 22.0; In 2000, Washington DC achieved a low infant mortality rate of 11.9 infant deaths per 1,000 live births versus 6.9 infant deaths per 1,000 live births for the US, a little more than 1.5 times the national rate. The infant mortality rate for DC African-American mothers/Blacks was 15.1 per 1,000 live births in 2003, a significant reduction from the twenty-year high 1983 rate of 20.1 (DC State Health Profile, SCHS, 2003, pp.36-37).

As of 2014, the District's poverty rate has been decreasing but it remains relatively high when compared to surrounding jurisdictions. However, this DCPC study has shown that primary care physician availability continues to be low. In 2012, more than 1 in 4 (26.5 percent) of the District of Columbia's children aged 0-17 was uninsured in 2012. The District's total uninsured rate was 19.2 % in 2002. The percentages of population below poverty level two decades ago were higher, as follows: Washington, DC - 23.9; Baltimore, MD -30.1; New York, NY - 25.1; Detroit, MI - 38.2; Atlanta, GA - 27.5. In 2000, the poverty rate for Washington, DC was 20.0 percent up from 17 percent in 1990. (DC State Health Profile, SCHS, 2003, p. 8). The percentages of the population uninsured were as follows: Washington, DC - 21.8; Baltimore, MD - 20.1; New York, NY - 17.1; Detroit, MI - 16.8; Atlanta, GA - 29.9. In 1999, there were approximately 50,600 adults aged 18-64 in the District of Columbia uninsured. At that time, there were approximately 88,800 adults aged 18-64 who were uninsured, representing approximately 15.5 percent of the DC 2000 population of 572,059, as reported by Lurie & Rand Corporation (2002).

As shown above, the comparability or non-comparability of the health and socio-demographic characteristics of these cities is an important discussion by itself. Judging by the ethno-demographic composition of the cities cited in this section, the similarities between the District and these US cities are quite striking. Whereas this study makes a link between poverty and the need/demand for primary health care, the role of ethnicity and racial differences in exacerbating the income-health access has been studied elsewhere and is not addressed in this study (Goodman, Brownlee, Chang & Fisher 2010).

The DCPC study has findings regarding the "working poor" in the city - those persons in the gray area between poverty and non-poverty status per census guidelines. Rand (2008) has reported that 35.8 percent of DC's uninsured were at or below 100 percent of the poverty level in 1985, meaning that 64.2 percent of the city's uninsured were above 100 percent of the federal poverty level. Persons between 100-200 percent constituted 25.2 percent of the uninsured and persons between 200-300 percent of the poverty level constituted 23.5

percent of the uninsured in the city. Many of the city's poor persons work but have no health insurance; they are the "working poor." (Lurie & Stoto 2002, pp. 8-10).

The special challenge of what to do with the "working poor," particularly the uninsured and underinsured, arises from the DCPC findings. The major policy issue to be openly debated and discussed, in terms of relative numbers, is not what to do about the poor and outright downtrodden, but what to do about "the working poor", those who in spite of being in the labor force, still cannot afford the basic necessities of life, much less paying for health care.

U.S. NCHS data show an increase in the average number of visits made by the poor to doctor offices for primary care (6.6 visits per person per year) as well as an increase for the non-poor (5.4 visits per person per year). This study, District of Columbia Primary Care (DCPC), 1985 to 2004, supports the NCHS-HIS conclusion (1983) about the relative underutilization of primary care by the poor. This DCPC study also sheds additional light on the situation of the poor and the "working poor" with respect to their need and demand for primary health care services in the District of Columbia over the past twenty years, from 1985 to 2004.

5.8.1 Using the DCPC indicators and index variables to interpret the findings

As presented in Chapter 4: Data Analysis, several findings were uncovered in this DCPC study of the District of Columbia, 1985 to 2004, however, in order to correctly interpret these findings, numbers, rates, indicators, indexes (indices) must be distinguished, understood, and used with caution. Understanding and properly summarising the data presented in Chapter 4 of this study requires meticulous attention to the meaning of the indicators, indexes, and other numeric scores which were used in this DCPC work and are described in chapter 1 (Introduction) and chapter 3 (Methods) and are summarised below.

5.8.1 The Primary Care Service Index (PCSI):

An index is a tool which combines key indicators into one number. There are two indexes in the DCPC study – Primary Care service Index (PCSI) and Composite Need Score (CNS). Both represent how a census tract's or Census Tract Grouping's level of "need" for primary care compares to the need in other census tract's or Census Tract Grouping's. The indexes are just a tool, however. They do not tell the whole story. Each index should be used in conjunction with other data, program information, and expert opinion of key stakeholders in the District of Columbia community.

5.8.2 Socio-demographic and health indicators

There were two socio-demographic and health indicators used in this study. They are (i) indicators percentage of persons in a community at or below 100 percent of the federal poverty level (pov%) and (ii) the percentage of live births in a community that were of low birth-weight (lbw%, births less than 5 lbs. 8 oz, or 5.5. lbs or 2,500 grams). An "indicator" is an individual measurement or piece of information related to a census tract's or Census Tract Grouping's population, health, demographics, or need for services. The difference between "indicator" and "index" is that each index is made up of at least two indicators. The Primary Care Service Index (PCSI), for example, has two indicators: (i) volume of satisfied primary care demanded and (ii) total (potential) visits demanded. The indicators serve as the "building blocks" for their respective overall Index score.

Each index (PCSI or CNS) was calculated from numbers, rates, percents, indicator ranks, or indicator (standard) z-Scores. A number, such as the number of primary care physicians in a Census Tract Grouping is the number of occurrences (PC physicians) of the stated characteristic in the CTG in the District. Some of the indicators are based on more than one year of data.

This research was (i) a cross-sectional study of three different time periods (1985, 1990-1992, and 2000-2004) and included (ii) a time-trend analysis of changes observed in the District from 1985 to 2004. In the cross-sectional, year-specific analysis, some indicators are calculated from more than one year of data. For example, percentage of low birth-weight live births was an indicator calculated using multiple years and averaging them. For example, lbw% for 1985 used five year's worthy of data (1978 to 1985 as an average); similarly, Lbw% for 2000 used three years worth of data (1999, 2000, 2001) and averaged them.

In this study, percentages and rates are usually numbers divided by other numbers, for example the poverty percentage is obtained by dividing the numbers of persons in poverty by the total population of the census tract or Census Tract Grouping, multiplied by 100. The percent low birth-weight live births is the number of low birth-weight live births divided by the total number of live-births in the community, multiplied by 100.

5.8.3 Indices, rankings and their interpretation

For both indices, PCSI and CNS, census tracts are ranked from 1 to 188 (or the number of census tracts from the preceding decennial census), and Census Tract Groupings are ranked from 1 to 11, where "1" = largest indicator value and "11" = smallest indicator value. The ranks are converted into percentiles and used to create the two indexes of DCPC. Ranks must be interpreted with caution A rank of "1" can be "favorable" or "unfavorable", depending on the indicator. For example, a rank of "1" for percent of persons below poverty indicates that an area has the highest proportion of persons living in poverty (an "unfavorable" outcome), but a rank of "1" in satisfied visits demand indicates that an area has the highest volume or primary care satisfied visits (a "favorable" outcome).

5.8.4 Standard or z-scores

A z-score is simply a way of standardising the indicator values. For example, if a CTG has a potential visits demand of 20,000 visits and a low birth-weight of 8.0 percent, are these "good" or "bad" values? The meanings of these values are clarified by converting them into z-scores. A z-score, or standardised score, tells a researcher at-a-glance how an area within the District fares relative to others. For the indicators poverty and LBW, a high z-score indicates high need; a low z-score indicates low need, relative to other areas. For the index, PCSI, a high z-score indicates high need; a low z-score indicates low need, relative to other areas. However, for CNS, a high z-score indicates *low* need; a low z-score indicates *high* need, relative to other areas.

Z-scores may indicate “extreme” values. The majority of the z-scores falls between -1.0 and +1.0; scores in this range may be considered to be in the average range. Census Tract Groupings with a standardised score greater than +1.0 tend to be among the Census Tract Groupings most in need for that particular indicator. Similarly, Census Tract Groupings with standardised scores less than -1.0 tend to be among the Census tract Groupings least in need. Furthermore, CTGs with a standardised score greater than +2.0 tend to be considerably more in need than other CTGs in the District. Similarly, CTGs with a standardised score less than -2.0 tend to be considerably less in need than others. CTGs with standardised scores greater than +3.0 and less than -3.0 represent even more extreme differences. If an area in the District has one or more of these “extreme” values, it may be an indication of small number concerns rather than a truly extreme need. Statistics based on small numbers should be interpreted very cautiously. Normal variation in the number of events from one time period to the next can cause extreme variation in corresponding rates or percentages. DCPC followed the following general rules:

1. To avoid problems associated with the statistical instability of small numbers and events, DCPC did not use rates, percentages, ranks, or standardised scores based on less than five events.

2. Statistics based on less than twenty events are to be interpreted with extreme caution.

In general, to understand the DCPC z-scores, the following should be noted: A z-score of 0 means an area is average, a negative z-score means that the area has a below average need, and a positive z-score indicates the area has an above average need. A z-score of 0.0 means that for example, a Census Tract Grouping is average compared to all other Census Tract Groupings in the District of Columbia. A negative z-score indicates that an area is, on average, “less” in need than other Areas, while a positive z-score indicates that the area is likely “more” in need.

5.9 Limitations of the Findings:

There is a need to interpret the DCPC study findings with caution

The large amount of data collected, organised, analysed, and summarised in this study means that calculation errors may unintentionally exist in this report. These findings require careful thorough audits, reviews and corrections as needed. The findings should also be used in conjunction or by comparison with other available data. Until these DCPC findings have undergone thorough and complete reviews by a potential user (planner, policymaker, practitioner, program staff, or general population) caution must be exercised in the use and interpretation of the DCPC data and findings.

To use the DCPC findings as a tool for program planning for a Census Tract Grouping or small area, the following is recommended:

For each index, PCSI or CNS, one must examine the z-scores. If the scores are mostly positive, they indicate that the area tends to be more in need than other areas. Ranges of scores, some positive and some negative, need to be examined with care. If the standardised scores associated with certain indicators are particularly high or low, dominating your Index, even more caution is warranted. Each Index should be used to help determine an area's overall need. Individual indicator information must be used along with other data to help one target populations in need and develop interventions.

5.10 Summary of DCPC study methods and their relevance

DCPC presented empirical data, analyses and findings for three time slices (cross-section of three periods) from 1985 to 2004. Large amounts of data were collected, computerized and analysed for 1985, 1990-1992, and 2000-2004. Preliminary models using multiple linear regression analysis were developed to explore the possibilities of using study findings as a tool for making primary care visits need or gap projections. Most of the calculations in this study were estimates that attempted to paint a picture of how primary care in the District of Columbia looked like at the beginning of this study period in 1984 to the end of the period, year 2004.

DCPC has unearthed some significant findings of interest to a wide range of persons. For the purposes of this study, a "community of interest" - also referred to as the “Five P’s” - is defined and used in this study. This community of interest, for whom this DCPC study should be a planning and resource guide, consists of health care policymakers, planners, practitioners, program staff, and the general population.

5.11 Discussion about Primary care and its various definitions

This study began with a review of current definitions for the term “primary care” as culled from the review of the literature This concluding chapter revisits these definitions to provide a meaningful context for the policy discussions.

There are several definitions of primary care available in medical and health care literature. Some sources such as Hindle, Dierckman, Standridge et. al. limit the term to health care services provided by nonfederal, office-based, private physicians. In 1978, in its report entitled “A Manpower Policy for Primary Health Care: Report of a Study” (IOM, 1978). The IOM defined primary care as "accessible, comprehensive, coordinated and continual care delivered by accountable providers of personal health services." Others such as Mendenhall, Tarlov, Girard et. al. (1979: 275-287) used the term to refer to types of care available as opposed to types of physicians providing that care. A significant segment of health system researchers, planners, and analysts use primary care to refer to the services available in the five primary care specialties - general practitioners, family practitioners, internal medicine, obstetrics-gynecology, and pediatrics. The Mayo Clinic uses a primary care model which defines primary care as “a method of health **care** that takes into consideration a whole person rather than individual organs or systems” (mayoclinic.org 2014).

This study, DCPC, used a broader definition of primary care that is not limited to private physicians or to types of care provided by all physicians. In DCPC, primary care refers to all health care services available at the primary level of the health care system (private physicians, Neighborhood Health Centers, Community Health Clinics, etc.) and some services at the secondary level (Hospital Outpatient Departments, ambulatory visits to Hospital Emergency Rooms).

Using the DCPC definition of primary care thus includes private and non-private physician services in the primary care category. A consequence of this use of the term primary care is that there exists a dichotomy in primary care: public primary care and non-public (or private) primary care. This DCPC study uses the term public primary care to distinguish between the two major sources of care.

The services of all physicians who belong in the five primary care specialties, whether they are private physicians or not, are included in the term primary care, as used in this study. In addition, services available not only through physicians but through other health care institutions such as Neighborhood and Community Health Centers, Hospital Outpatient Departments, and Emergency Rooms, are assumed to be primary care services. Thus a visit made to an internist, whether that internist is a private, office-based, solo- or group-practice physician or one who works in a Neighborhood Health Center, is considered a primary care visit in this study.

This use of the term primary care is thus based on several assumptions:

- (1) that a physician of a particular training and specialty provides a certain type of care;
- (2) that primary care physicians are geographically accessible and available to residents of a defined, small, geographic area such as a census tract or Census Tract Grouping;
- (3) that residents of a small urban community seek the services of primary care physicians who are active and practice nearby.

DCPC assumed a framework and theoretical construct based on the observation that the first entry point for anyone coming into the health care system is a primary care entry point, and that the choice of who to see first or who to get services from is dictated more by what is available and accessible rather than on what is affordable or on what the diagnostic, medical need is. This use of the term primary care or primary care specialty does not preclude the fact that a cardiologist, or any other specialist, can or does provide basic, diagnostic and treatment services, on occasion, to persons who otherwise might have been more appropriately treated by a family physician.

This study's use of the term primary care is more liberal and generalized. DCPC assumes that primary care services and primary care visits are more likely to be available than not, relative to other specialist services. The DCPC methodology for estimating primary care need and demand consequently over-compensates for primary care visits availability. Thus any finding that there is or was a shortage of primary care visits is a conservative estimate. DCPC applies a liberal mathematical methodology that produces a conservative estimate of additional visits to be provided by the health care system to satisfy population needs.

5.12 Conclusions concerning primary care in the District

One DCPC finding can be summarised as follows: Primary care in the District of Columbia is characterized by plentiful physician resources, relatively poor health status, growing demand for services, and a complex web of needs exhibited by the urban population. This section of the study summarises some of the major findings of the District of Columbia Primary Care (DCPC) Study, over the twenty year period from 1985 to 2004. The discussion of possible strategies available to the public and private sectors for dealing with the projected "need gaps" are presented as "Policy Discussion Options" in the section of same title.

5.12.1 Physician Availability in the District

5.12.1.1 The District of Columbia has a rich resource of physician manpower, both for primary care and for specialists.

In 1985 there were 2543 active physicians actually practicing in the District of Columbia. Of this number, 1444 or 56.8 percent were primary care physicians. This translates into an average physician-per-1000 population ratio of 3.98. In 1990, the physician per 1,000 population ratio increased to 6.17 and in 2004 increased again, to a twenty-year high of 6.74.

5.12.1.2 The plentiful availability of physicians in the District of Columbia is a long term trend.

As far back as 1965, the Health Facilities Planning Council for Metropolitan Washington reported that there were 213.3 actively practicing physicians per 100,000 population in the District of Columbia. By 1990, this ratio had increased to 398.0 per 100,000 population. In 2004, DCPC has found that there were 674 physicians per 100,000 District residents, an almost 300 percent increase in physician availability.

5.12.1.3 In 1985, unlike twenty years later, the majority (1,967 or 77.3 percent) of the 2543 active physicians practising in the District of Columbia was enrolled in the D.C. Medicaid program.

However, only about half (1263 or 49.7 percent) were primary care physicians who participated in the Medicaid program.

5.12.1.4 Distribution of physicians, specifically, primary care physician services, is not equitable.

This DCPC study from 1985 to 2004 has shown that there is variability, by physician location, in the availability of primary care physicians who care not just for the poor but are available to other sectors of the District's population. In 1985, in one area of the city only about half of the physicians were accessible to the poor, whereas in another area, almost all the physicians accepted and treated Medicaid patients. Census Tract Grouping (CTG) 2 had 49.4 percent of its physicians who were primary care physicians and were on the District's Medicaid rolls. CTG 11 had the highest percentage, 90.9 percent.

5.12.1.5 Access continues to be a problem for many District residents.

Of all primary care physicians about 1283 or 64.5 percent were on Medicaid rolls. However, only 214 or 10.8 percent of the physicians on the Medicaid rolls devoted a 10 percent or more of their office practice, to seeing and treating the Medicaid population. This group of physicians is referred to in this study as major Medicaid providers.

5.12.1.6 In 1985, at the beginning of the study period, primary care physicians who enrolled in the D.C. Medicaid program did not necessarily actually see or treat Medicaid patients in that year.

Even though there were 1,989 physicians on the Medicaid rolls in the year 1984, only 714 or 36 percent actually saw or treated a Medicaid patient for a primary care condition that year. Of these 741 primary care Medicaid physicians, only 29 percent were “major” Medicaid providers. Further study of this issue is needed in 2004 and beyond.

5.12.1.7 OB-GYN primary care physicians, on average, devoted a greater portion of their practice to treating the poor in Medicaid program.

+About half of all primary care visits made to the major Medicaid providers in the District of Columbia were for obstetrics-gynecology services. These account for 115212 of the 398508 visits made to the major Medicaid providers. Further research on this issue is needed in 2004 and beyond for the District.

5.12.1.8 Visits shortage areas are on the increase

DCPC showed that for 1985, of the 182 census tracts in the District of Columbia, 116 (or 64 percent), had a Primary Care Service Index (PCSI) of less than 1.00. This meant that, for a majority of the small residential communities of Washington, D.C., the demand for primary care physician visits that is satisfied (visits actually made) was less than the demand for primary care that is potentially present in those same communities. In 2004, of the 184 census tracts with resident populations, 142 (or 77.2 percent) were primary care visits shortage areas. This is an increase in the number of small areas with “unsatisfied need” or “visits gap.” Primary care demanded visits exceeded primary care satisfied visits. The unmet visits constitute the “need” gap or visits gap.

5.12.1.9 DCPC’s analytical approach can assist planners in quantifying and describing urban primary care needs in small areas of the District

DCPC Needs Assessment Study used a population-based “need” determination model based on the "Composite Need Score" (CNS) to assess the “potential” need for primary health care services in a small community. For 1990, the study found that the CNS for the District of Columbia was 50.34, in percentage points. On a scale of 1 to 100, a low numeric score represents the presence of a high need for primary health care services, and a high numeric score represents a low level of need.

This study, the "DCPC" or D.C. Primary Care Needs Assessment Study, used an objective, quantitative methodology to estimate the need and demand for primary health care services in the District of Columbia. DCPC can be used as a planning tool not only for health systems analysis and evaluation, but for health services planning and organisation.

It is hoped that through the methods and findings of this study, policymakers, planners, practitioners, program staff and the general population of the nation's capital now have available to them, the data, the analysis, and the quantitative tools that allow fair and equitable resource allocation decisions to be made. The literature states that:

> “Even in countries where information resources have historically been poor, there is an increasing demand to allocate resources systematically and fairly, in line with policy intentions” (Smith 2008).

This thus necessitated, in this DCPC study, the development of an objectively-developed, indices-based primary care resource allocation model for the District of Columbia. This study serves a great need if systems and policies are to be put in place to help satisfy the actual, current demand for primary care services in a given small area of the District.

The goal of DCPC was to present data and analysis that describe the need and demand for primary health care in the District of Columbia. DCPC is also intended to serve as a resource guide for the "5-P's" (the “community of interest”) - health care policymakers, planners, practitioners, program staff, and the general population.

DCPC, a major research effort that developed several data files. The study also resulted in the collection and creation of data and analyses that had not existed in the form used in this study prior to this effort.

Population data from the U.S. Census for 1980, 1990, and 2000 plus population estimates from the D.C. Office of Planning's Demography section for 1985 and 2004 provided the population and socioeconomic data for the entire city as well as for its small areas (census tracts). The study created a method for aggregating data for several neighboring census tracts into one of the eleven Census Tract Groupings (CTGs) developed by and for this study.

Utilization data from both the public and private sectors - Hospital Outpatient Departments, Emergency Rooms, Neighborhood Health Centers, Community Health Clinics - were collected, organised and analysed. U.S normative physician use rates (visits per person per year) for different population age-groups were used to produce estimates of primary care visits to private, office-based physicians in the community.

The data collection and analytical processes can be summarised as follows: Data was gathered and analysed for 1985, 1990-1992, and 2000-2004. Physician manpower distribution in the city by specialty as well as by census tract and Census Tract Grouping (CTG) were developed. Primary care visits made to both public and private sector primary health care delivery settings were assembled, analysed and presented. Quantitative measures of demographic, socio-economic, health-related and other indices of the population's well-being were calculated and used in this study. It is in the spirit of advocating for a population-based planning methodology in the District of Columbia (and similar urban areas) that this study was conducted. The population's needs, and the resources available for satisfying those needs, were studied in detail in this DCPC study.

The study findings and conclusions are summarised in the following section.

5.13 Conclusions: Health status of the District's population

5.13.1 Despite tremendous progress made especially in the last decade or so the population of the District of Columbia continues to exhibit a relatively poor health status compared to other metropolis and the U.S as a whole.

According to Kofie, Mitchell, Ndubuisi, Andoh and Nzeribe (1994) many unhealthful behavioral conditions amenable to prevention and primary care intervention are prevalent among the population of the District of Columbia. These researchers found that being overweight was a significant problem among District residents. Females were more likely to be overweight than males (18.0 percent males, 30.0 percent females0. Age was statistically significant (p=0.000) among those who reported being overweight. The lowest prevalence was reported among young adults (18-24 years old, 16.3 percent) and the highest prevalence was reported among the 40-59 year old group (32.4 percent). Obesity was found to be inversely correlated to income. Low income residents earning less than $15,000 had the highest prevalence of obesity with District residents earning $50,000 and above having a prevalence of 21.5 percent. In 1994, diabetes affected nearly 6 out of every 100 District residents. Nearly 1 in 10 District resident adults aged 18 years and over lacked health care insurance (11 percent).

These facts point to a greater need for enhanced primary care services planning, delivery and systems restructuring. The infant mortality rate (IMR) for the years 1983 through 1988 were 18.2, 21.2, 20.7, 21.0, 19.6, and 23.2 respectively. These figures were approximately double the figures for the U.S. as a whole. In 2002, infant mortality rate for Blacks was about twice that for whites, a condition evident in other major US cities with significant black or minority populations.

5.13.2 A significant gap exists between the life expectancy of District residents compared to the rest of the nation.

This study's findings about low birth-weight% by CTG aligned with life expectancy rates by CTG. The District of Columbia Commission of Public Health's Preventive Health Services Administration stated in 1988, that the life expectancy of the District's Black population was almost eight years shorter than for its White population (67.0 versus 75.8 years). Current 2014 data still shows a significant life expectancy gap and low birth-weight% gap between the District and the US as a whole.

5.13.3 An analysis of the "wellness index" for the District of Columbia shows that only two out of the eight wards in the city have a score equal to or better than the overall average score for the city.

"Wellness index" is a numerical score developed in this DCPC study that combined several years of mortality and morbidity variables to generate a profile of the level of “wellness” or healthiness of the District's population by Census Tract Grouping (CTG). Previous research on District residents' years of potential lives lost entitled “How Healthy Is The District of Columbia” by Andoh, Ndubuisi, Kelley, Saunders, Hester and Kofie (2000) and the District's YPLL study (Tuckson et al 1989) showed that the District does not enjoy high indices of “wellness” and “well-being”. The study's derivation of “Wellness Index” based on a combination of the District's morbidity and mortality variables by Census Tract Grouping is a step in the right direction. The “Wellness Index” is a normalized score – though not intuitive - ranging from 1.0 (excellent health or "wellness") to 100.0 (extremely poor "wellness"). The average wellness score for the District in 1985 was 14.4 and in 2004 was 13.8, with significant variations by census Tract Groupings.

5.14 Conclusions: Demand for Primary Care

5.14.1 Using a study-specific definition of primary care demand (i.e. quantity of primary care visits wanted by the population, constrained by limited financial resources), segments of the population of the District of Columbia, for the years 1985 to 2004, demanded an increasing number of visits from primary care physicians and the overall health care system.

DCPC used normative, empirically measured U.S. average rates and applied them to the District population for 1985, 1990, and 2004. The components of primary care demand used were age-groups of the population (under 15, 15-44, 45-64, and 65+) and incomes (poor, non-poor persons). Applying these age and income factors to normative use rates, the primary care visits demand were calculated for the population of the District of Columbia. This methodology showed that about 911,000 additional primary care visits were demanded of the District's health care system in 1990 and even more was demanded in 2004.

5.14.2 The crisis of primary care in the District of Columbia is largely a crisis of what is happening to the "working poor," not just the unemployed or under-employed poor.

It is estimated that of the additional primary care visits demanded in 1990, only about 83,000 additional visits were demanded by the District's poor, unemployed population. This figure is referred to in DCPC as the "poor gap." The "poor gap" is the visits demanded by the poor less all available Medicaid, Medical Charities, and related visits made by the poor. This "poor gap" measures the amount of primary care demand that the poor should get but do not. For the "working poor" also called the "uninsured, working poor" or "near poor", the gap for 1990 was approximately 54 percent of the total non-poor visits demanded. There seemed to be, in 1985, in 1990 and in 2004, a relatively sound primary health services safety net for poor persons in the District of Columbia but not for the "working poor" or "near poor".

5.14.3 Small area analysis shows that for 1990 and 2004, the majority of the additional primary care visits demanded in the District of Columbia was demanded by persons living in primary care visits "shortage areas".

Of the approximately 2,752,000 visits demanded in all of the 182 census tracts in the District of Columbia in 1985, 1,711,000 were demanded by persons living in primary care shortage areas of the District, areas with PCSI values of less than 1. This represented 115 out of the total 182 census tracts in the District. The figure increased to 147 in 2004.

5.14.4 During the period from 1985 to 1992, the Neighborhood Health Clinics (NHCs) operated by the Ambulatory Health Care Administration of the former D.C. Commission of Public Health provided a critical "lifeline" or "safety net" for a growing number of persons living in the District.

Under tight fiscal constraints, this responsibility has shifted eventually from the District Government to the private Unity Health Care Coalition, Inc. The Coalition's success in meeting the visits gap is yet to be definitively determined given the funding uncertainties.
In 1985, there were 115 census tracts that were primary care shortage areas. After adjusting for the presence of public health clinics in these areas, only 99 census tracts were left as primary care shortage areas. Thus there were 16 census tracts or residential communities in the District of Columbia that were "non-shortage areas" or "excess areas" but, in fact, would have been "shortage areas" were it not for the presence of Neighborhood Health Centers located in these areas. It is hoped that Unity Health Care would provide a similar buffer for 2000 and beyond.

5.14.5 The use of the Federal poverty guidelines to describe poverty and health care relationships in the District of Columbia is adequate only for national comparative purposes but not for local usage.

The unique status of Washington, D.C. as the nation's capital with a rich plethora of resources, both corporate and personal, and its relatively higher-than-average income levels, obscures the nature and extent of the "poor", "the working or near poor" and the medically indigent, in the District of Columbia.

For example, for analytical purposes, raising the poverty guidelines beyond the current 100 percent of the Federal poverty level may decrease the volume of unmet primary care visits demand that burdens the working poor in this city. Using the current definition of poverty, poor persons are persons with incomes at or below 100 percent of the Federal poverty levels, while the "working or near poor" are those persons with incomes between 100 percent and 200 percent of the Federal poverty guidelines. For this latter group of people in the District of Columbia, using population data from the U.S. 1980 and 2010 census, there were about 802,000 primary care visits demanded by "working or near poor" persons two decades ago. Of this number of visits, about 358,000 were for persons in the 15-44 age group and 246,000 for persons in the 45-64 year age-group. These large numbers of unmet primary care visits demanded could have been significantly lowered and access barriers to health care removed, if the poverty levels had been set at a level that absorbed some segments of the "working poor or near poor" residents living in this city. This change is being implemented now as part of the 2010 federal Affordable Care Act which, in part, aims to decrease the numbers of the uninsured.

5.14.6 "Where did the poor go for care?"

DCPC estimated that the burden of providing primary health care services to the "poor" in the District of Columbia twenty years ago was distributed as follows:

If all poor persons in the District constituted a 100 percent sample,

- 66.8 percent went to private sector physicians for care,
- 18.1 percent went to public health clinics and community health centers, - and the remaining 15.1percent used hospital outpatient departments and emergency rooms, sometimes inappropriately.

In 1985, about 673,000 primary care visits were made by "poor" persons residing in the city. In 1990, ("potential") poor visits needed by the eleven Census Tract Groupings were 873,253 (32.5 percent of total) while non-poor visits needed were 1,809,554. In 2004, poor visits demanded by the eleven Census Tract Groupings totaled 4,224,431 (65.4 percent of total) while non-poor visits needed were 2,238,220.

Again, for health planning and analytical purposes, the Census definition of "poor" is found to be limiting. "Working or near poor" should be considered "poor". There is some evidence that it is easier for the "working poor" to spend down their incomes to become poor, than to accumulate wealth to become "non-poor". The issue of where the poor go for care as addressed in DCPC does not include issues of alternative sources of care that people use, in the absence of formal, institutionalized sources of care. Alternative therapies, increasing primary care services via telephone use, web-based diagnostics and access, may be important considerations but are not studied here.

5.15 DCPC DATA FINDINGS AS BASIS FOR DISCUSSION

5.15.1 DCPC's Static/Dynamic Study Implications – comparing findings and meaning from annual data versus trend data

Further study and action strategies may be formulated based on whether one looks at the DCPC study findings discreetly or as part of a trend. Static analysis and dynamic analysis of the findings provide different but complementary perspectives.

DCPC data and study findings were summarised for each of the three study periods. They were also summarised for the twenty-year trend, from 1985 to 2004. Two calculated variables are critical to understanding the summaries for the study years and for the trend. These variables are: *visneed* and *vgap* and they are defined as follows:

- if visneed > 0, then vgap = 1 ==➔ primary care “excess” area;
- if visneed < 0, then vgap = 0 ==➔ primary care “shortage” area.

An examination of visneed and vgap separately for each of the three study years, 1985, 1990, and 2004, as well as for the overall 20-year study period (1985 to 2004) provide some remarkable insights.

The DCPC findings showed that some CTGs, in 2004, were primary care “shortage” areas but were not “shortage areas in 1990 or 1985. Other findings show that the overall trend for some CTGs was that they (the CTGs in question) had a greater need in 2004 than they did in 1990 or 1995. It can be a confusing situation in terms of sorting out what is real and urgent or what can wait or undergo further study. The dilemma is real and is not unlike policy issues faced in policy forums and at governmental and industry board frequently.

The dilemmas in the DCPC summary findings are as follows:

- What is a particular CTG’s status (in 2004, 1990, 1985), versus
- How did the CTG in question get to that situation?

History and context are important. The DCPC summary findings showed that some CTGs have always been “needy,” others have been relatively better off but are experiencing some declines over time; still other CTGs have been improving their primary care resources, visits and needs status; finally, some CTGs have remained fairly stable. Remembering that (visneed = potential visits less satisfied visits), “shortage” area meant that there were more potential visits than were satisfied thus creating a shortage, in 2004, CTGs 1, 7, 8, 10, and 11 were shortage areas. However an examination of the visneed trend from 1985 to 2004 showed that CTGs 1, 3, 7, 8, and 9, were “excess” areas, meaning that in 2004, these CTGs had a larger visneed gap than they had in 1985. This meant that although these areas had *visneed* gaps in 1985 and still had *visneed* gaps in 2004, each of these CTGs had a bigger visneed “gap” in 2004 than they had in 1985.

In other words, these CTGs had greater unmet needs in 2004 than they did in 1985. Put in their proper historical context, this meant that over the study period from 1985 to 2004, CTGs 1, 3, 7, 8, and 9 were experiencing an “increasing gap” in primary care visits needed.

This dynamic analysis of changes over time showed that matters did get worse for these five out of the eleven Census Tract Groupings in the District of Columbia. In 2004, CTGs 7 and 8 had a high priority score (PCPS=1, high, static analysis) thus their status in 2004 showed them to be small areas worthy of being designated “high priority areas for additional primary care services and initiatives.” This dynamic finding (of five deteriorating CTGs over time) must be compared with the finding of the five CTGS which had shortages just in 2004 alone – two different results from two different approaches to DCPC data interpretation.

The static-dynamic implications and scenario is summarised in Table 37 below:

TABLE 5.2: CONCLUSION:
STATIC VERSUS DYNAMIC ANALYSIS OF STUDY FINDINGS, BY CENSUS TRACT GROUPING,
DISTRICT OF COLUMBIA, 2004 VERSUS TREND (1985-2004)

CTG	2004 VISNEED **excess**: Dem>Sat	2004 Unmet demand? Prim Care Shortage?	1985- 2004 VISNEED history/ context (unmet Demand in **'04>than in '85)**	IMPLICATIONS for the "Gap" for the "Gap"	2004 Priority Category	2004 Priority
1	excess	yes	Excess	Increasing gap	3	Low
2					2	
3			Excess	Increasing gap	3	Low
4					3	Low
5					3	Low
6					3	Low
7	excess	yes	Excess	Increasing gap	1	High
8	excess	yes	Excess	Increasing gap	1	High
9			Excess	Increasing gap	3	Low
10	excess	yes			2	
11	excess	yes			2	
TOTAL		No	Excess	Increasing gap	3	Low

Notes:

- "excess" ("excess demand" or "excess unsatisfied visits") is undesirable; because potential demanded visits exceeded available (or satisfied) visits.

- Only CTGs with excess visits are shown above; "non-excess" CTGs are displayed as blank (in the "excess" columns).

Public policy processes and decisions in primary care for the District of Columbia must attempt to address two issues:

(1) Should attention be focused on areas or CTGs that had been "needy" for decades (1985 to 2004) - that is, the CTGs were "needy" in 1985 and were still "needy" in 2004?, or

(2) Should attention be focused on areas or CTGs that had *not* been "needy" in the past (in 1985 and/or 1990) but had disintegrated over time and become "needy" decades later in 2004 (that is, the CTGs were not needy in prior study years, but were needy in later years in 2004)? Or

(3) should both approaches above be implemented and/or other new approaches tried, in an effort to improve community-based access to primary care physicians and improved health status (low birth-weight%)?

Summary of the major findings is provided here to guide the discussion.

Some specific Tables in Chapter 4: Findings summarised the situation for these CTGS for 1985, 1990, and 2004 respectively. They are a good place to begin the policy reviews for the primary care needy areas in the District of Columbia. Other Tables in Chapter 4 provided the time series trend analysis summary for the dynamic changes that require policy and/or programmatic attention and further study. The static analysis and dynamic time trend analyses for the historical period of 1984 to 2004 are summarised in the Tables and Figures below.

5.15.2 Static analysis: 1985 versus 1990 versus 2004

5.15.2.1 Summary primary care priority areas, year 2004:

Priority 1: High priority (high need) areas: CTG 7, 8.

Priority 2: Medium priority (medium need) areas: CTG 2, 10, 11.

Priority 3: Low priority (low need) areas: CTG 1, 3, 4, 5, 6, 9.

TABLE 5.3: CROSSTABULATION OF PCSI BY CNS TO SHOW CTGS AND THEIR PRIORITIES DISTRICT OF COLUMBIA, 2004

CNS category (columns)

	1	**2**	**3**	**4**
PCSI category (rows)				
1		CTG 7,8		
2				
3		CTG 10		
4			CTG 1	
5		CTG 2, 11	CTG 3, 4, 5, 6, 9	

5.15.2.2 Summary priority areas, years 1990-1992:

Priority 1: High priority (high need) : CTG 9.

Priority 2: Medium priority (medium need) : CTG 3, 5, 7, 8, 10, 11.

Priority 3: Low priority (low need) : CTG 1, 2, 4, 6.

TABLE 5.4: CROSSTABULATION OF PCSI BY CNS TO SHOW CTGS AND THEIR PRIORITIES, DISTRICT OF COLUMBIA, 1992

CNS (columns)

	1	**2**	**3**	**4**
PCSI category (rows)				
1		CTG 9		
2				
3				CTG 3
4				
5	CTG 7,8	CTG 5, 10, 11	CTG 1, 2, 6	CTG 4

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5.15.2.3 Summary priority areas, year 1985

Priority 1: High priority (high need) : CTG 9.

Priority 2: Medium priority (medium need) : CTG 3, 5, 7, 8, 10, 11.

Priority 3: Low priority (low need) : CTG 1, 2, 4, 6.

TABLE 5.5: CROSSTABULATION OF PCSI BY CNS TO SHOW CTGS AND THEIR PRIORITIES, DISTRICT OF COLUMBIA, 1985

CNS (columns)

	1	**2**	**3**	**4**
PCSI category (rows)				
1	CTG 11			
2		CTG 7, 10		
3				
4	CTG 8			
5		CTG 2	CTG 5, 6, 9	CTG 1, 3, 4

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15.2.4 Dynamic Analysis: Trend in the changes of Primary Care Priorities

TABLE 5.6: CHANGES IN PRIMARY CARE PRIORITY DESIGNATIONS OVER A TWENTY-YEAR PERIOD DISTRICT OF COLUMBIA, 1985 TO 2004

CTG	1985	1992	2004
1	L	L	L
2	M	L	M
3	L	M	L
4	L	L	L
5	L	M	L
6	L	L	L
7	H	M	H
8	M	M	H
9	L	H	L
10	H	M	M
11	H	M	M
DC, Overall	L	L	L

Priorities shown are as follows: L-low; M-medium; H-high. High priority is high need.

5.15.2.4.1 Addressing the primary care visits gap (Summary)

There was an overall citywide gap in primary care visits demanded as of 2004 in the District of Columbia and there was an overall citywide gap in 1985. The numerical difference between the 2004 citywide gap and the 1985 citywide gap showed that there was a larger gap in 2004 than in 1985. This meant that the unmet demand was increasing. The gap was worsening even as number of total physicians was increasing in DC.

More primary care physicians or services appear to be needed at the CTG level to improve citywide access. Summary of options may include the following:

1. Implement policies to reduce poverty levels
2. Reduce low birth-weight births
3. Increase number and proportion of primary care physicians
4. Expand role of mid-level practitioners such as nurse practitioners, nurse midwives, physician's assistants.
5. Expand current primary care-related (institutional, service) capacities in the public, private, non-profit sectors.
6. Expand cadre of trained workers who conduct health screenings and interventions (workplace, community)
7. Devote more specialist, non-primary care physicians' time/practices to serving primary care needs.
8. Explore use of standards-based voice (phone) and electronic (web, email) pc contacts with residents.

5.16 DISCUSSION

5.16.1 Strategic Issues/Political Implications

Although this study has provided a quantitative basis for the analysis of objective (that is, non-subjective) data on primary care need and demand in an urban setting, it is important to realize that the discussion of primary care is not and cannot be a "numbers" issue only. Efforts to address the primary care visits gap by increasing primary care visits and services especially for the poor and working poor segments of the population must also be weighed against issues of

(i) escalating costs, financing structures, and political and other systemic considerations, as well as

(ii) the use of data which measures some subjective (that is, behavioral and attitudinal) variables about physicians and their placement, location-relocation decisions. It would be useful to know why physicians move into an underserved area or why they move out of it. The issue collecting and analysing data on urban physicians' motivations, attitudes and behaviors is critical and is discussed in the "Recommendations" section of this study.

Even as the case for increasing visits availability is made quantitatively, some cities and states in the US have decreased or are considering options to decrease costs by limiting visits and certain services to the poor or Medicaid-eligible populations. The state of Tennessee offered a case study of this dilemma of addressing the gap and/or containing the costs or health care for the poor. In an article entitled: "States watching Tennessee's health care plan for the poor Proposal limits visits to doctors, prescriptions" written by William M. Welch and Julie Appleby in USA TODAY on July 6, 2004, the issue was highlighted in stark terms.

The state's proposal to control the rising costs of health care for the poor provoked alarm among national advocacy groups. These groups warned that bold new limits on prescriptions, doctor visits and medical treatments in Tennessee could spread elsewhere. Other states including Florida and California have considered ways to contain the growing expenses for Medicaid. Medicaid is a shared state-federal program that provides care for the poorest Americans. Health care for the poor had of late become the most rapidly increasing cost for many states due to budget shortfalls. Some states have saved money by reducing the number of people they serve.

5.16.2 Case Studies: National Implications

The closest precedent for Tennessee's benefit reductions may be Oregon, which in 1989 limited the medical treatments it paid for from the public treasury. The state drew up a list of more than 700 conditions and treatments, then ranked them in order of their benefits. The Legislature set a cutoff, determining which treatments it would pay for.
By limiting services, Oregon claimed that it stretched its money and expanded the number of residents eligible for Medicaid.

Quantitatively estimating the demand and need for primary care, as has been done in this study, is one part of a complex puzzle. Much also depends on the quantity and quality of care/visits deemed not only to be of medical necessity but considered to be a civil and human rights issue. Cases where quality and accessibility go against the drive to contain the continually rising costs of such care are expected to increase.

5.16.3 Other Best Practices – Meeting the Need

Various U.S. states and cities have adopted strategies to mitigate the need or growing demand for primary care services. Some of these practices fall under the rubric of "Best practices in primary care" and they are worthy of emulation and graduated adoption. Because primary care is often the first entry into the health care system for many persons, it is important to tackle the most common primary care conditions and that includes asthma prevention, treatment, follow-up and evaluation. The more primary care services are provided in the community itself, the greater the burden that is lifted from physician offices, hospitals, emergency rooms and clinics.

5.17 STUDY RECOMMENDATIONS

5.17.1 A. Adoption of Census Tract Groupings as units of analysis in the city's community and health planning activities

Recommendations made from the findings of this study are presented in this section. Some of the recommendations offered by this DCPC study appear to align with certain solutions proposed by the American College of Physicians in their 2009 publication entitled: "*Solutions to the challenges facing primary care medicine, Comprehensive Strategies from the American College of Physicians".* (Zerehi, ACOP 2013).

A major recommendation of this DCPC study is that the public and private health sectors should adopt the use of Census Tract Groupings (CTGs) as developed and used in this study for evaluation, analysis, and policy development activities. The CTGs are epidemiologically-derived, rational service areas that are obtained by grouping and aggregating available data by the widely-known and available US census tracts for the District.

The adoption of CTGs would help to standardise data analysis and reporting for public and private planning activities for the city. It would create a verifiable means of collecting, organising, analysing, presenting data for the District of Columbia in the area of health services, community services, housing, and other human services. Another benefit of using the CTG-approach to health systems and services planning is that there is a lot of data that is collected and available by census tracts. Wards are merely political boundaries. Zip-codes are useful sometimes but not much health or epidemiological data are collected, organised, or available by them.

One major goal of this DCPC study was to promote and publicize the use of CTGs as a planning and analysis tool for government, industry, and private, independent research entities working on issues on or about the nation’s capital.

5.17.2 Developing Policy Options for Addressing “the Gap”

The study has implications for several policy issues that need further study, elaboration, discussion, and implementation. One of the important implications of the findings of this study concerns the question of what the possible strategies should be for dealing with the projected need "gap" in primary care services for the poor, "the working poor" and the "non-poor".

In health care, certain DCPC findings may lead us to possibly conclude that the census definition of “poor” may be limiting. The “working poor” should be considered poor for all practical purposes. It is has been shown that it may be easier for the “working poor” to spend down in health care to become “poor,” than to accumulate wealth to become “non-poor.”

To meet the need for primary care in the District of Columbia three policy options need to be considered as follows: (i) public sector responsibilities, (ii) private sector responsibilities, and (iii) health industry responsibilities.

5.17.2.1 Under public sector responsibilities, efforts should be made to:

- expand current capabilities in the public sector. Doing such may address in particular the "working poor visits gap" by

    - approximately doubling hospital outpatient departments' primary care visits capacity
    - approximately doubling the Unity Health Care Coalition's capacity;
    - approximately doubling the District Healthcare Alliance access capacities, and
    - approximately doubling access to care via technological approaches such as web-based consultations, electronic medical records, and rapid data sharing among health centers, facilities and social services programs.

- The public sector's capacity can also be increased to handle the visits gap by possibly revising eligibility and reimbursement regulations for the Medicaid program, reforming/revising current indigent medical care programs, additional public interest (no fee) services, etc.

5.17.2.2 Under private sector responsibilities, efforts should be made to:

- expand the Medicaid program for private, non-public providers;

However, this addresses only the "poor gap."

DCPC's findings for 1985 showed that of 741 private physicians who provided a primary care service to a Medicaid recipient in 1984, only 192 (or 26 percent) were "major" providers with practices located inside the District of Columbia. A "major" Medicaid physician provider was defined by DCPC as a provider for whom Medicaid visits constituted 10 percent or more of the practice's total visits volume.

5.17.2.3 *Under health industry responsibilities, efforts should be made to:*

- expand current capabilities in all primary care sectors, for example, by following increasing national trends that encourage delivery of primary health care:

(a) in the workplace - physicians on-site at offices, factories, etc., may assist in addressing the "non-poor" (working adults') gap;

(b) via telephones, computers (via telemedicine/internet-web delivery), and email messaging/reminder, and other similar systems.

(c) In the health workforce – expand the numbers and capabilities of mid-level practitioners to provide high quality primary care services (for example, nurse midwives, physician assistants, nurse practitioners). This recommendation is supported in the work of Petterson, Liaw, Phillips, Rabin, Meyers & Bazemore (2012) entitled: "Projecting US Primary Care Physician Workforce Needs: 2010-2025" and also in the work (Staiger, Auerbach & Buerhaus 2009).

5.18 *Expanding the "type-of-included-practitioners" umbrella for primary care providers:*

This DCPC study began by defining the limits of not what primary care is in actuality, but the bounds of contributory primary care specialties to be studied in this research effort.

This DCPC study defined primary care as the care provided by physicians comprising the five general primary care disciplines: general practice, family practice, internal medicine, obstetrics-gynecology, and pediatrics. Some specialist primary care specialties were considered under the primary care rubric for purposes of this study. It is possible that a sole reliance on these five specialties to meet the growing need for primary care in urban underserved areas may be insufficient. It is thus a recommendation of this study that public and private policy must work towards expanding the variety of primary care providers that currently exist to include not only physicians of the five primary care specialties, but also mid-level practitioners – nurse midwives, physician assistants, and nurse practitioners – in urban clinics and alternative settings. This is re-emphasizing the public policy option stated in the previous section.

5.18 Bolstering the US federal HPSA designation process

There are two parts to this recommendation:

5.18.1 Heightening role of new physicians in HPSA process

Since primary care delivery structures continue to mostly revolve around medical physicians, maintaining the numbers of new entrants into the profession should be encouraged. Special attention should be paid to the recruitment and retention of interns and residents into underserved urban centers with high need epidemiologic profiles. The HPSA process must re-emphasize the importance of new physicians entering urban underserved areas or moving out of them. This recommendation must include the practice movement patterns of mid-level primary care practitioners. This may bolster the utility of the federal HPSA designations not only for urban centers and underserved facilities, but also for HPSA designations of other manpower categories trained to deliver primary care, as stated in recommendation #1 above.

5.18.2 Including mandatory epidemiological variables in the HPSA process

The HPSA designation criteria and processes have been discussed in this study. Suggestions for improving its utility and epidemiological appropriateness for urban areas must become a center of health research and focus. The incorporation of additional population-based need predictor variables into the HPSA designation process would greatly accelerate the adoption of Recommendation # 2(a) above. Such added epidemiological variables should preferably be required and not optional or bonus items. Examples of such additional variables are multi-year average percentage low birth-weight live-births and rates of uninsured community residents per 1,000 population.

5.18.3 Equalising reimbursements to all physician specialties

Escalating health care costs have the power to derail much progress in efforts in governmental and private initiatives to expand primary care services in urban centers if the issue is not addressed quickly and effectively. This study recommends that third-party payors and reimbursement mechanisms must endeavor to incorporate additional criteria into their reimbursement systems – that all payors should reimburse all physicians (primary care and specialists) at the same reimbursement level for the same type, volume and quality of primary care service delivered.

Some of the above recommendations have been made over the years, in one form or another, by other health care searchers and policy analysts. In 1978, the US Institute of Medicine produced a landmark report (IOM 1978:30) that pioneered these recommendations and others of similar intent. This study is thus seeking a return to the fundamentals of actions that could boost primary care practitioner placement rates nationally and not only in urban areas.

5.19 Need for further study: Attitudinal/Behavioral "Subjective" Scales

This study has been based entirely on the collection, organisation, analysis and presentation of "objective" data on physician distribution and community socioeconomic and health characteristics. Data was collected only on objective variables in the sense that they were descriptive and numerical data on specific conditions that existed in an urban community or small areas.

The data used in this study were not data based on opinions or attitudes. The numbers of primary care physicians in a community in a given year is a verifiable figure. This was also the case with poverty rates and percent low birth-weight live-births. Subjective data or variables were not collected or used in this study. It is the recommendation of this study that subjective data on the opinions and attitudes of primary care practitioners who practice in an urban environment and move into, or out of, an underserved urban area needs to be collected and studied in some detail.

This DCPC study examined "what is or what was." It did not investigate "why it is so or why it was so." It would be particularly beneficial to understand why underserved communities attract or lose primary care practitioners. This is critical for a complete understanding of long-term trends particularly in urban areas that have remained underserved for many years or to understand non-shortage areas that become shortage areas with the passage of time. Attempting to understand physicians' motivations and the economic or other factors that drive their location-relocation decisions into and out of an urban area could conceivably be quite a complicated undertaking. It is however necessary if underserved cities and communities in need within cities are to "stop the bleeding." This is the realm for further primary care research in the urban context.

5.19.2 Need for further study: methodological approaches

The DCPC study's objective was to examine in detail the quantitative determinants of the need and demand for primary care in the District of Columbia. It relied on calculated indexes and indicators culled from objective data such as number and rate of physicians, poverty rates and community's low birth-weight percentages, by census tracts and Census Tract Groupings. DCPC did not use qualitative data indicators or attitudinal variables. This is an area worthy of further research. For 1990-1992, this study used a survey of DC-licensed and DC-based physicians. The aim of the survey was to collect and analyse data on physician locations (by census tract and Census Tract Grouping) and by specialty and to Produce estimates of the District of Columbia's primary care physician full-time equivalents (FTE). This was probably the first time such a physician FTE study had ever been done for the city.

It is recommended that future surveys of DC-based physicians include some subjective and attitudinal questions such as:

- "why did you choose to practice in the District"
- "why are you practicing or not practicing in an underserved area of the District"
- "what public or private (governmental or industry) actions will make you move into or move out of an underserved area?"
- "do you believe that DC has adequate number of physicians,"

- “do you believe that poverty rates are significant in the city?”
- “do you believe that low birth-weight percentages are high in the city?” and so on.

The additional, suggested subjective questions, above, would complement the objective data collected and help provide a more complete picture of primary care resources and factors in the city. The responses of practitioners to these subjective questions may lead researchers to determine if particular factors seemed to impact physician location decisions more than others. Themes could be identified in these responses and a coding scheme could be developed for inter-rater reliability.

The analysis of such data should not rest on *a priori* assumptions. Rather, it is recommended that an evolutionary process be used in the research/data analysis stage wherein the relative importance of location reasons and factors are staged so that each stage is determined by the results of the preceding stage. Such an approach may lead to the development of a road map that combines objective data for a small urban community with subjective scales of reasons for the shortage or excess of practitioners in that community.

Preparatory to the analysis recommended above, psychometric properties of the subjective variables and scales should be conducted on the “attitudinal” survey data set. This is required so that researchers could proceed with confidence that the “subjective” data collected is stable and reliable. A primary care researcher must be assured that the scales are both reliable and valid. For example, scales could be constructed from physicians’ subjective responses to survey questions to create research variable scales for community cohesion, business climate, community needs, community conflict, community resilience, practice income potential, approaching retirement age, etc.

Analysis of a community’s need and demand for primary care (visits) may include analysis of the objective and empirical indicators (as is done in this DCPC study) and the subjective scales (recommended for future study). Summated rating scale could be constructed consisting of a short list of statements, questions, or other items to which a practitioner responds. These items would be statements and respondents indicate the extent to which they agree or disagree with each statement by circling or checking some response on a rating scale. For example, a 7-point scale in which 1 = “strongly disagree” and 7 = “strongly agree” could be used. This scale is called a summative scale (also referred to as a Likert scale) because the researcher sums the response numbers to create an overall score on the scale for that particular physician or respondent.

In analysing the physicians’ subjective responses and scales, *underlying constructs* could be developed statistically. This underlying construct is the hypothetical variable (or reason given by a physician) that one actually wants to measure. The observed variable, on the other hand, consists of the measurements that one actually obtained. For example, the observed variable could be “physicians per 1,000 population” and the underlying construct could be variables “physician’s perception of numbers of available colleagues in the area.” A physician may choose to locate or relocate in a small urban thinking that there exists enough other physicians or practitioners to form a community support network. There could be significant differences between the two measures.

Reliability coefficients would then be determined, the percent of variance in an observed variable that is accounted for by true scores on the underlying construct. One would compute the correlation coefficient between the observed variable and the underlying construct. The square of this correlation coefficient would represent the reliability of the scale. Internal consistency reliability is an acceptable method for estimating scale reliability since in practice it is generally not possible to obtain “true” scores on a scale variable. These suggested additional research approaches are attempts to make better inferences from the objective data collected and analysed in this DCPC study.

This recommended physician attitudes survey would need to be conducted annually or at least on a pre-test and post-test basis to facilitate hypothesis testing. A suite of physician response scales for a community, such as scales for community cohesion, business climate, community needs, community conflict, community resilience, practice income potential, approaching retirement age, etc., could then be hypothesized and tested using the mean or median as the test statistic, as follows:

H_0 : median $_{\text{community cohesion (pre)}}$ < median $_{\text{community cohesion (post)}}$

These new study variables could then be examined, for example, using the standard ANOVA (analysis of variance package in IBM SPSS 20) to detect significant differences when they exist, between the pre-test and the post-test variable values.

Finally, there is a need to understand the DCPC's data and findings in spite of its weaknesses due to the absence of qualitative or subjective data on physician location and relocation decisions into or out of underserved urban areas. This calls for use of principal component analysis on the qualitative scales or variables as a procedure for variable reduction. This may be useful if a sizeable number of physician qualitative responses are obtained and there is a need to develop a smaller set of variables (principal components) that may account for most of the variance in the observed variables. The principal components could then be used as predictor or criterion variables in subsequent analyses, using the eigenvalue-one criterion also known as the Kaiser criterion (Kaiser, 1960). With this approach, the primary care researcher would retain and interpret any component with an eigenvalue of greater than 1.00. This is done because, since each observed variable contributes one unit of variance to the total variance in the data set, any component that displays an eigenvalue greater than 1.00 is accounting for a greater amount of variance than had been contributed by one variable. Conversely, a component with an eigenvalue of less than 1.00 is accounting for less variance than had been contributed by one variable and is not worthy of being retained.

The goal of the above recommended further research activities is to reduce to a core explanatory set, the principal variables or reasons why physicians move into or out of an urban primary care underserved area. Understanding these reasons may provide the proper context for maximizing usage of the findings of this DCPC study for the District of Columbia.

5.20 LIMITATIONS OF THE STUDY

Limitations of this DCPC study were addressed in some detail chapter 4. They are summarised below:

- Since primary care is changing rapidly, the applicability of historical data and analysis to current conditions and processes may limit the generalisability of the findings of this study. It is a study of prior resource configurations and health conditions for the District of Columbia which covers three prior specific time periods (1984-1985, 1990-1994, and 2004-2005) and thus may not describe residents and health resources and outcomes in the future.

- A second limitation of the data was that involved a few selected variables – by design – the three composite primary care need and demand indices culled from study variables physician distributions, poverty levels, low birth-weight live births and CTG. This selective data limitation was necessary for simplicity and provided a narrow and specific focus to the research design.

Further study may be needed to examine additional variables in order to increase the power of predictive models as well as to increase the proportion of variation in the dependent variable (primary care visits "shortage" or "gaps") that may be explained by the independent variables (physician distribution, medical specialty, percent poverty, and percent low birth-weight births). This study may be underestimating the volume of health personnel who are available to areas in need and may be overestimating the volume of the primary care visits shortages in some areas. Support for this lies in the fact that in a study entitled: "Defining Primary Care: Empirical Analysis of the National Ambulatory Medical Care Survey", providers and specialties other than family/general practice, paediatrics and internal medicine made significant contributions to primary care (Franks, Clancy & Nutting 1997: 35(7): 655-668).

5.21 CHAPTER SUMMARY/CONCLUSION

This chapter presented the summary, conclusion and recommendations from this study of primary care need and demand estimates for the District of Columbia. The research analysed data for the District for the period 1985 to 2004. The results for the year 2004-2005 were then compared and contrasted with other studies and data from related or independent data systems or authorities to see if there was any convergence or results comparability with this DCPC study. An independent study by the DC Board of Medicine in 2010 agreed with and supported several of the DCPC findings concerning DC physicians and primary care specialty shortages. Limitations of the study and need for further study as well as issues of reliability, validity and ethics were explored and discussed.

The study, District of Columbia Primary Care Study (or DCPC), has yielded significant data relating the estimation of the need and demand indices for primary care and primary care visits – to physicians practicing in the District of Columbia. In alignment with the study objectives, the results provided quantitative estimates for primary care composite indices (PCSI, CNS and priority scores) and provided estimates of the volumes of primary care visits shortages and the communities (or Census Tract Groupings) within the District that exhibit such shortages. The study has attempted to make a contribution to the literature and practice of primary care in the District by defining and developing rational health service areas called census tract Groupings (CTG).

Of special significance is the fact that this study of primary care in the District over the three study periods of 1984-12985, 1990-1992 and 2004-2005 has laid down a possible framework which may be used, now and in the future, by the “five P’s” - District planners, policymakers, physicians, other providers and the general public - for the adoption of an empirically-based standard which is objective and data-based for analysing, planning and predicting primary care need and demand and defining areas of shortage within the District.

The study offered several recommendations. These recommendations should serve to provide a guide for the development of a comprehensive plan for boosting and maintaining primary care resources, personnel and programs for the District by involving both the private and public sectors locally, regionally and nationally.

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QUANTITATIVE DETERMINANTS OF NEED AND DEMAND FOR PRIMARY HEALTH CARE IN THE DISTRICT OF COLUMBIA

<u>APPENDIX</u>

APPENDIX A to J
&
APPENDIX I to V

APPENDIX
TABLE OF CONTENTS (page 1 of 2)

Quantitative determinants of need and demand for primary care in the District of Columbia

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Quantitative determinants of need and demand for primary care in the District of Columbia

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Appendix A:

HEALTH PROFESSIONALS DATA SURVEY- D.C. PHYSICIANS

ADDENDUM TO ANNUAL PHYSICIANS LICENSE-RENEWAL APPLICATION,
DC CPH/DCRA-HPLA/SHPDA, 1990-1992

To be completed by Physician and submitted to DCRA/HPLA with DC Physician Licensing Application

Last Name: ____________________ First Name: ___________ Middle Initial: __

License #: ______________________

Active in: Direct Patient Care: Yes / No

Active in: Non-Direct Patient Care: Yes / No

Active in: Management/Administration: Yes / No

Active in: Other: ____ (specify)

Not active: Yes / No

==

Primary Practice Street Address, line 1: _______________________________________

Primary Practice Address, line 2: ____

Primary Practice City: __________________________________

Primary Practice State: _________________________________

Primary Practice Zipcode: _______________________________

Primary Specialty: _____________________________________

Hours/Week Worked Onsite, in patient care, at Primary Practice Site: ______

Primary Practice Location/type: (circle "Yes" or "No"):

Hospital Yes / No Hospital Department ________________________

Hospital, ER Yes / No

Hospital, Outpatient Yes / No

Solo Private Office Yes / No

Group Practice	Yes / No	
HMO/PPO/etc	Yes / No	Name ________________city: _______ st: __
Nursing Home	Yes / No	Name________________ city: _______ st: __
Assisted Living facility	Yes / No	Name________________ city: _______ st: __
Public Health	Yes / No	
Government	Yes / No	
Other	Yes / No	Specify ________________ city: _______ st: ___

===

Secondary Street Address, line 1: ____________________________________

Secondary Address, line 2: ____

Secondary Practice City: ______________________________

Secondary Practice State: _____________________________

Secondary Practice Zipcode: ___________________________

Secondary Specialty: _________________________________

Hours/Week Worked Onsite, in patient care, at Secondary Practice Site: ______

Secondary Practice Location/Type: (circle "Yes" or "No"):

Hospital	Yes / No	Hospital Department ____________________
Hospital, ER	Yes / No	
Hospital, Outpatient	Yes / No	
Solo Private Office	Yes / No	
Group Practice	Yes / No	Number of physicians in the practice: __________
HMO/PPO/etc	Yes / No	Name _____________city: _______ st: __
Nursing Home	Yes / No	Name_____________ city: _______ st: __
Assisted Living facility	Yes / No	Name_____________ city: _______ st: __
Public Health	Yes / No	
Government	Yes / No	
Other	Yes / No	Specify ___________

==

Tertiary Practice Street Address, line 1: ______________________________

Tertiary Practice Address, line 2: ______________________________

Tertiary Practice City: ______________________________

Tertiary Practice State: ______________________________

Tertiary Practice Zipcode: ______________________________

Tertiary Specialty: ______________________________

Hours/Week Worked Onsite, in patient care, at Tertiary Practice Site: ______

Tertiary Practice Location/Type: (circle "Yes" or "No"):

Hospital	Yes / No	Hospital Department ____________________
Hospital, ER	Yes / No	
Hospital, Outpatient	Yes / No	
Solo Private Office	Yes / No	
Group Practice	Yes / No	
HMO/PPO/etc	Yes / No	Name ____________ city: _______ st: __
Nursing Home	Yes / No	Name ____________ city: _______ st: __
Assisted Living facility	Yes / No	Name ____________ city: _______ st: __
Public Health	Yes / No	
Government	Yes / No	
Other	Yes/No Specify	______________________________

==

Has Hospital Privileges At Hospital 1: ____________ city: __________ st: ___

Has Hospital Privileges At Hospital 2: ____________ city: __________ st: ___

Has Hospital Privileges At Hospital 2: ____________ city: __________ st: ___

==

Age: ______________ Sex: ______________ Race/Ethnicity: ___________

APPENDIX C:

	A	B	C	D	E	F	G	H	I	J	
1	JacobAndoh_#48089540										
2	**APPENDIX C:**										
3	**data collection instrument 1: cns file 2005 - pop pov lbw lbwpctl cns CTG**										
4											
5	**Data sources:**		1. Vital Statistics Summary, 2000-2005, DC Department of Health, Centre for Health Statistics								
6	**Data sources:**		2. Population and socioeconomic conditions, 2000-2005, DC Office of Planning								
7											
8	**Year 2005**	**Pop**	**CTG**	**ward**	**Povdecimal**	**pov%**	**povrank**	**povpctl**	**lbw%_3yr_avg**	**lbwrank**	**lbwp**
9	example	4,674	3	2	0.052	5.2	161	88	3.2	165	
10	1		3	2							
11	2.01		3	2							
12	2.02		3	2							
13	3		3	3							
14	4		3	3							
15	5.01		3	3							
16	5.02		3	3							
17	6		3	3							
18	7.01		3	3							
19	7.02		3	3							
20	8.01		3	3							
21	8.02		3	3							
22	9.01		3	3							
23	9.02		3	3							
24	10.01		3	3							
25	10.02		3	3							
26	11		3	3							
27	12		3	3							
28	13.01		3	3							
29	13.02		3	3							
30	14.01		3	3							
31	14.02		3	3							
32	15		3	4							
33	16		4	4							
34	17.01		4	4							
35	17.02		4	4							
36	18.01		4	4							
37	18.03		4	4							
38	18.04		4	4							
39	19.01		4	4							
40	19.02		4	4							
41	20.01		4	4							
42	20.02		4	4							
43	21.01		4	4							
44	21.02		4	4							
45	22.01		4	4							
46	22.02		4	4							
47	23.01		5	4							
48	23.02		5	5							
49	24		4	4							
50	25.01		4	4							
51	25.02		4	4							
52	26		4	6							
53	27.01		1	1							
54	27.02		1	1							
55	28.01		1	1							
56	28.02		1	1							
57	29		1	1							
58	30		1	1							
59	31		1	1							
60	32		1	1							
61	33.01		5	5							
62	33.02		11	5							
63	34		1	1							
64	35		1	1							
65	36		1	1							
66	37		1	1							
67	38		1	1							
68	39		1	1							
69	40.01		1	1							
70	40.02		1	1							
71	41		1	2							
72	42.01		9	1							
73	42.02		9	2							
74	43		9	1							
75	44		9	1							
76	46		11	5							
77	47		11	6							
78	48.01		11	2							
79	48.02		11	2							
80	49.01		9	2							
81	49.02		9	2							

APENDIX D:

	A	B	C	D	E	F	G
1	JacobAndoh_#48089540						
2	**APPENDIX D:**						
3	**data collection instrument #2: physicians file 2005 - address ct CTG specialty speccode spectype**						
4							
5	**Data sources:**	1. DC Physicians Licensing database 2005, DC Department of Health, Health Professionals Licensing Administration					
6	**Data sources:**	2. Washington Physicians Directory 2005					
8	ID	ADDRESS PHYSICIAN PRACTICE (PRIMARY)	CENSUS TRACT	C.T.G.	PRIMARY SPECIALTY	SPEC TYPE	SPEC CODE
9	1	3800 RESERVOIR RD NW	2	3	ped	pc	1
10	2						
11	3						
12	4						
13	5						
14	6						
15	7						
16	8						
17	9						
18	10						
19	11						
20	12						
21	13						
22	14						
23	15						
24	16						
25	17						
26	18						
27	19						
28	20						
29	21						
30	22						
31	23						
32	24						
33	25						
34	26						
35	27	etc, etc					

APPENDIX V

Government of the District of Columbia
Department of Health
State Health Planning and
Development Agency
Data Collection, Research and
Analysis Division

TO: Jacob Andoh, MS, MPH, CPM

FROM: Regina Knox Woods, Director RKW 7/23/2012

State Health Planning and Development Agency

DATE: July 23, 2012

SUBJECT: Approved: Request for use of DOH data for primary care research

---

This is to formally notify you that your request to collect data from the District of Columbia Department of Health's agencies and offices for the purpose of conducting research on District of Columbia Primary Care, 1985 to 2004, has been approved.

See the attached approval form.

Be hereby reminded and informed that this approval for data collection from the Department of Health is subject to all of the stipulated conditions and requirement for security and confidentiality which you agreed to and are as stated on the attached approved form.

Additionally, do note that this approval will be declared null and void if use of the data contradicts any DC or federal laws or regulations or the applicant's assurances .

Please contact the Administrators and Office Heads of the DOH State Center for Health Statistics (SCHS) and the Health Professionals Licensing Administration (DOH-HPLA) to begin the data collection process.

Contact my office if you have any questions or concerns concerning this approval or the data release stipulations.

Thank you.

District of Columbia Government
Department of Health
Center for Policy, Planning and Evaluation
State Center for Health Statistics
Vital Records Division

REQUEST FOR USE OF DATA WITH IDENTIFIERS & STATEMENT OF ASSURANCES

For Office Use Only

Data Request Application No.: DOH000512	**Approval Status** *(Signature and date)*
Date Received: 7/03/2012	**Conditional:** SH 7-17-2012
Date Reviewed: 7/17/2012	**Unconditional:** ✓
	Pending:
	Disapproved:

APPROVED

I. ORGANIZATION OR INDIVIDUAL REQUESTING USE OF DATA

Project Director: Jacob Y. Andoh, MS, MPH, CPM

Title: Principal Investigator

Agency/Department:

Street Address: 1702 Doral Court

City/State/Zip: Mitchellville, MD 20721

Telephone: (301)499-5636 **Fax:** (301)499-5636

II. SUMMARY OF STUDY PROTOCOL OR PROJECT ACTIVITIES

Title of Study/Project: DCPC District of Columbia Primary Care

Name & Address of Project Sponsor(s): N/A

Please answer the following questions below:

1. **Institutional Review Board for the Protection of Human Subjects:**

   (a) **Has this project been reviewed and approved pursuant to the D.C. government guidelines for the protection of human subjects as laid out in the 42 U.S.C. § 289 (Health Research Extension Act of 1985 § 2) and; District of Columbia Municipal Regulations (Title 29 DCMR Section 2822).**

   Yes ○ **No** ◉

Note: This request will be disapproved if any proposed use of the data contradicts any DC or federal laws or regulations or the applicant's assurances

(b) If yes, give the date of approval below and attach a copy of the approval application.

If no, state reasons why?

This research will use only CT-aggregated data. No data with identifiers will be needed, requested or used.

2. Type of Data Requested: (Check all that apply)

Birth__ Death__ Fetal Death__ Marriage__ Divorce__

Other ✔ census tracts, poverty%, low birthwt% 1980 to 2004

APPROVED

3. Format of Data Requested: (check all that apply)

Paper Certificates ____ Electronic Data Files ✔

4. Please include the following information in the description of your research plan or project activities *(Please note failure to provide this information may cause the Registrar to disapprove the application)***:**

(a) Statement of the problem addressed by your study/project.

To analyse primary care need and demand by census tracts for the District of Columbia 1985 to 2004

(b) Objectives, including hypotheses to be tested, if any, or research questions to be answered.

Do poverty%, low birthweight% and primay care physician counts differ significantly by census tract and Census Tract Groiuping for the District of Columbia 1985 to 2004?

(c) Provide a brief summary of the analyses or project activities that will be performed, indicating specifically how data obtained from the State Center for Health Statistics (SCHS) will be used. If there has to be contact with individuals whose data are requested, please indicate.

(i) to collect, analyse and present data on need and demand for primary care by census tracts and census tract groupings for the District for the years 1985, 1992 and 2004 (ii) to calculate primary car indices)iii(to identify primary care shortage areas in the District

(d) Describe any data files that will be linked with the SCHS data and specify the source of these data files.

-active and licensed physicians practising medicine in the District of Columbia 1985 1992 and 2004

- source: DC DOH Health Professionals Licensing Administration (HPLA)

(e) Indicate how the results of your study or activities will be released. D.C. Government agencies must submit the results of the study or project for review by the SCHS.

(i) thesis/dissertation manuscript

(ii) peer-reviewed journal article(s)

Note: This request will be disapproved if any proposed use of the data contradicts any DC or federal laws or regulations or the applicant's assurances

III. OTHER DATA USERS AND USES

Please answer the following questions below:

1. (a) **For the purpose of this research or project, as described in section II above, will any of the data with identifiers be used by other organization; for example, other divisions, agencies, consultants, contractors and/or subcontractors?**

   Yes ○ **No** ◉

   (b) **If yes, please indicate the name (if known, otherwise indicate the type of organization) of any other organization and its role in this research project.**

   N/A

   (c) **Describe safety precautions that exist (or will be implemented) to insure that the data will be used solely for the purposes of this research or project.**

   - principal Investigator has sole ppossession and use of the provided data
   - any and all identifiers will be erased, not used and not published

APPROVED

2. (a) **Will any of the data with identifiers be used as a basis for <u>legal, administrative, or other actions</u>, which may directly affect particular individuals or establishments as a result of their specific identification in this project?**

   Yes ○ **No** ◉

   (b) **If yes, please explain:**

   - principal Investigator has sole ppossession and use of the provided data
   - any and all identifiers will be erased, not used and not published

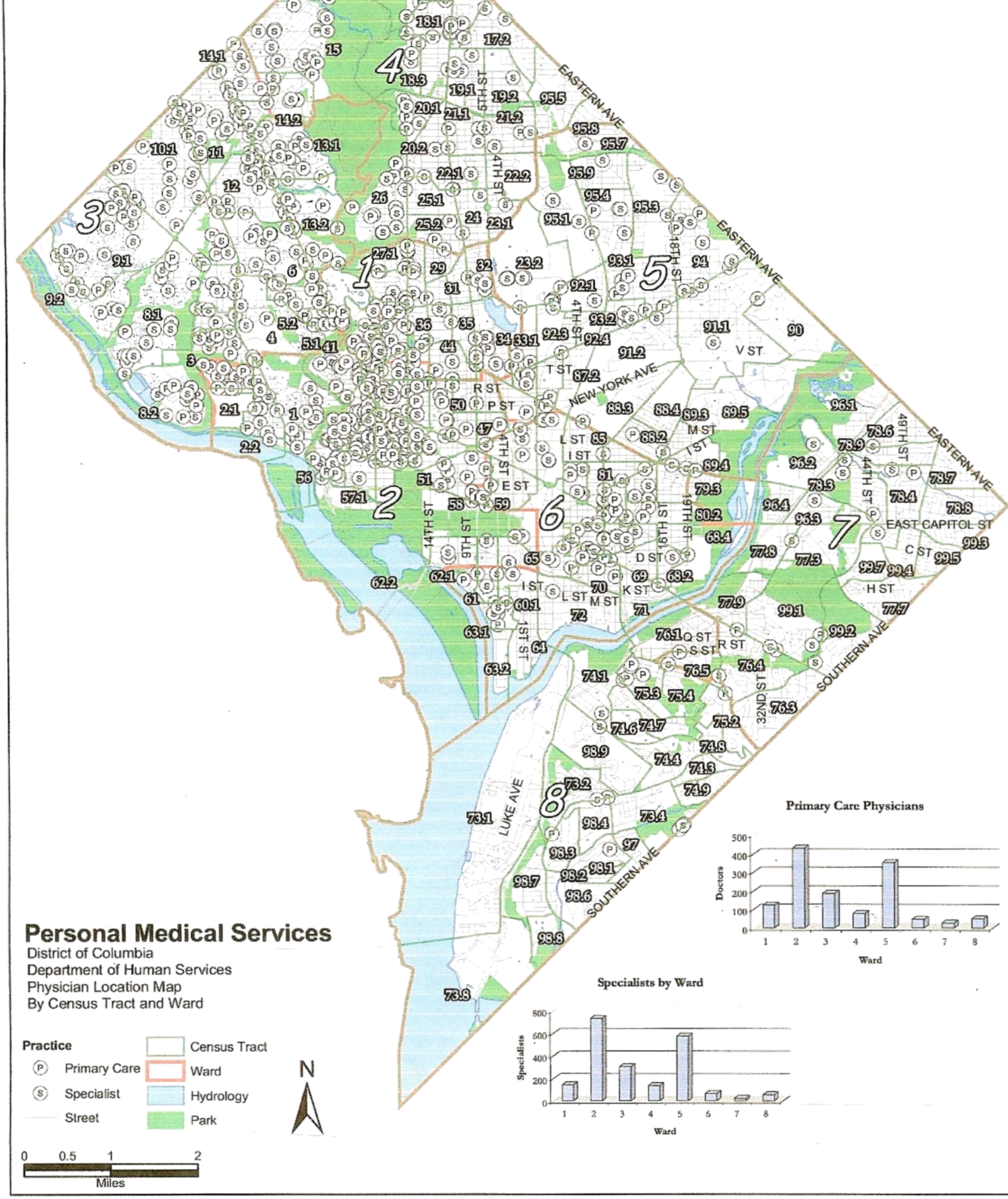
3. (a) **Will the data with identifiers be used either directly or indirectly for any research project other than the one described in section II above?**

   Yes ○ **No** ◉

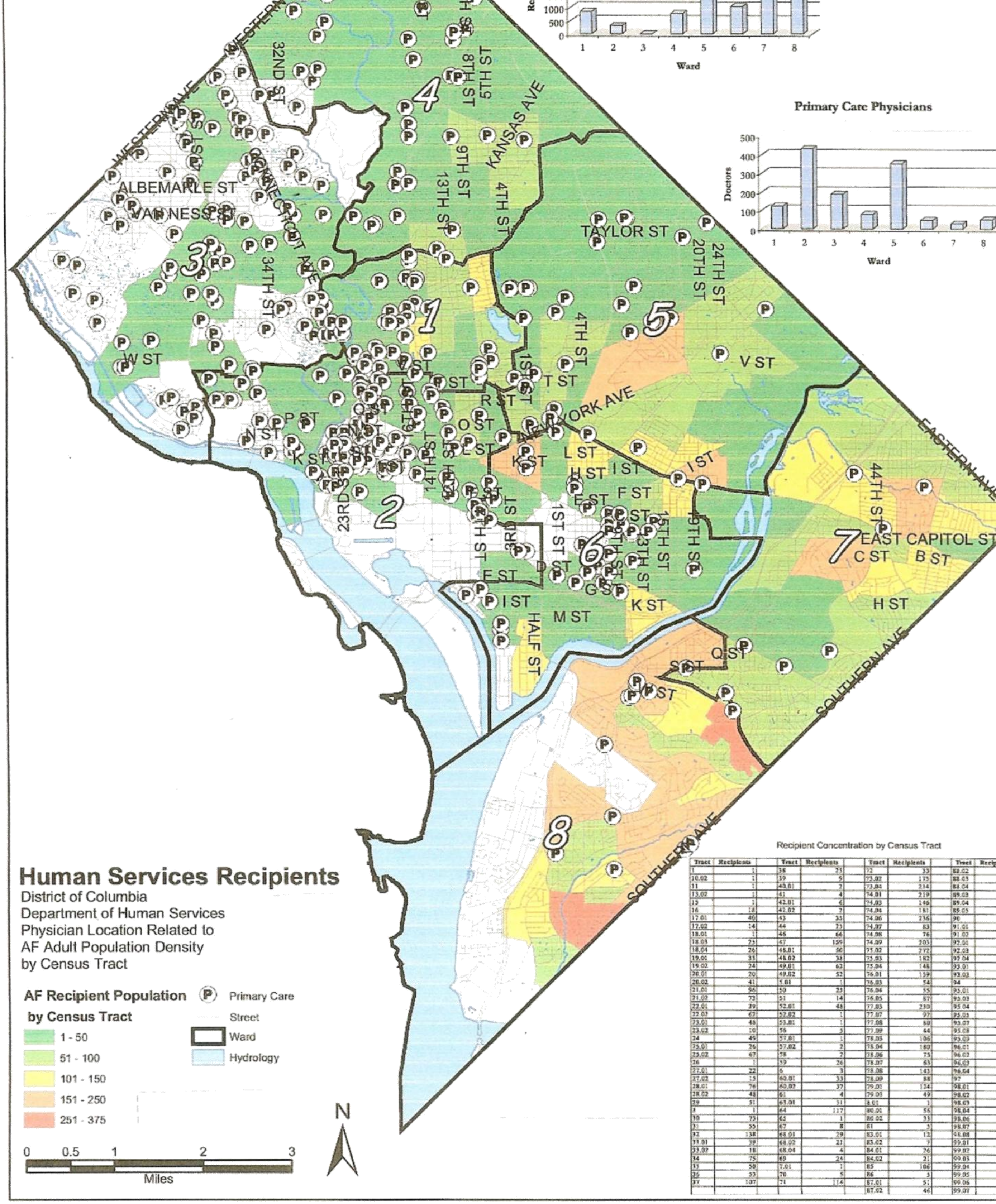
   (b) **If yes, briefly describe the other research project(s) or purpose(s) for which these data will be used. (Attach a separate Request Form) for each research or project, which will be using <u>identifiable</u> data obtained from the Registrar.**

   Not Applicable.

Note: This request will be disapproved if any proposed use of the data contradicts any DC or federal laws or regulations or the applicant's assurances

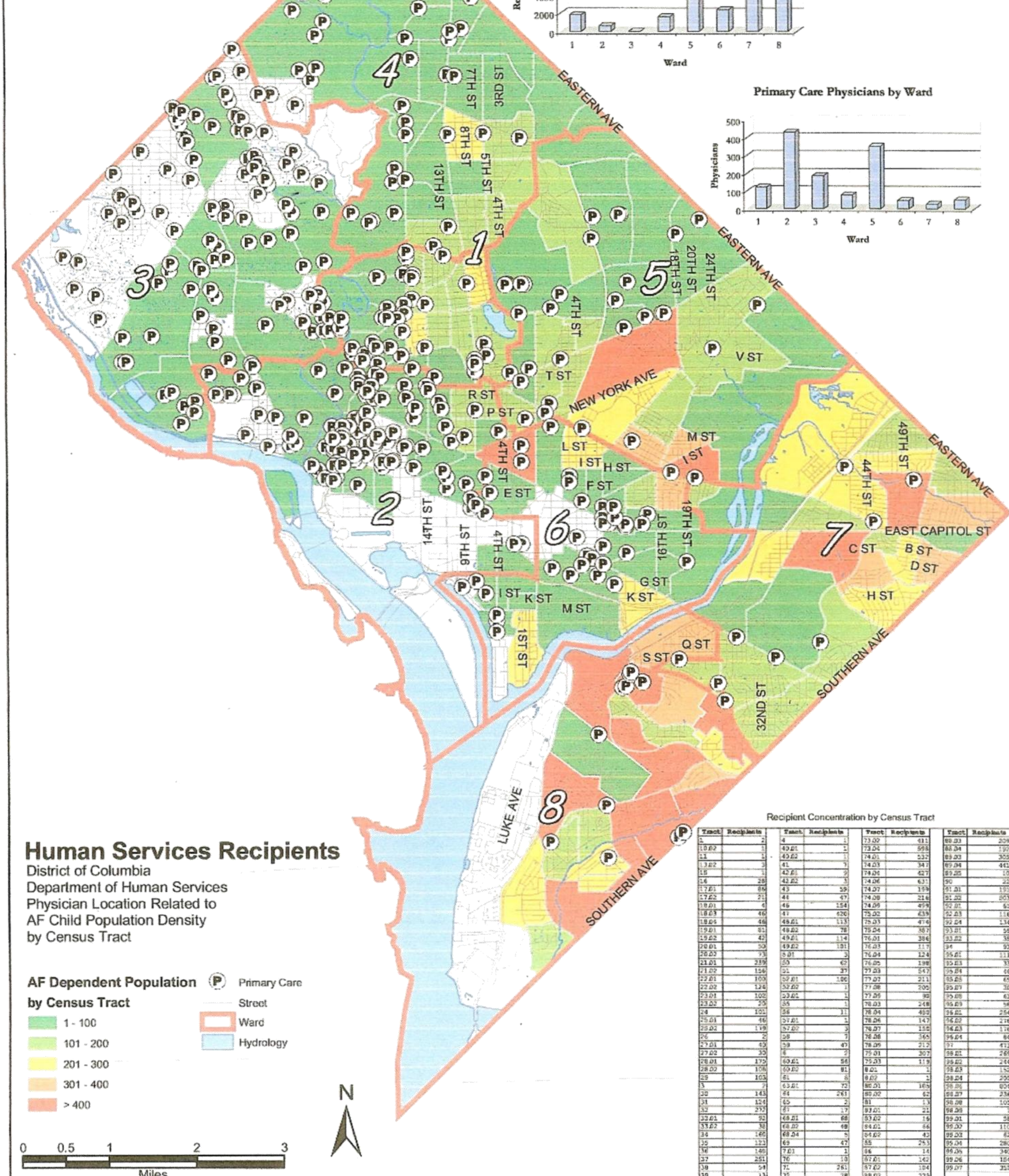


Personal Medical Services
District of Columbia
Department of Human Services
Physician Location Map
By Census Tract and Ward
Practice
Primary Care
Specialist
Street
Census Tract
Ward
Hydrology
Park
N
0 0.5 1 2
Miles
Primary Care Physicians
Doctors
Ward
Specialists by Ward
Specialists
Ward
EASTERN AVE
NEW YORK AVE
EAST CAPITOL ST
SOUTHERN AVE
LUKE AVE



Recipient Concentration by Census Tract

Tract	Recipients		Tract	Recipients		Tract	Recipients		Tract	Recip
1	1		38	25		72	33		88.02	
10.02	1		39	5		73.02	175		88.03	
11	1		40.01	2		73.04	214		88.04	
13.02	1		41	4		74.01	219		89.03	
15	1		42.01	6		74.03	146		89.04	
16	18		42.02	2		74.04	181		89.05	
17.01	40		43	35		74.06	236		90	
17.02	14		44	25		74.07	83		91.01	
18.01	1		46	66		74.08	76		91.02	
18.03	23		47	159		74.09	203		92.01	
18.04	26		48.01	56		75.02	272		92.03	
19.01	35		48.02	38		75.03	182		92.04	
19.02	24		49.01	62		75.04	148		93.01	
20.01	20		49.02	52		76.01	159		93.02	
20.02	41		5.01	1		76.03	54		94	
21.01	96		50	25		76.04	55		95.01	
21.02	73		51	14		76.05	67		95.03	
22.01	39		52.01	48		77.03	230		95.04	
22.02	67		52.02	1		77.07	97		95.05	
23.01	48		53.01	1		77.08	60		95.07	
23.02	10		56	3		77.09	44		95.08	
24	49		57.01	1		78.03	106		95.09	
25.01	26		57.02	2		78.04	180		96.01	
25.02	67		58	2		78.06	75		96.02	
26	1		59	26		78.07	63		96.03	
27.01	22		6	3		78.08	143		96.04	
27.02	15		60.01	33		78.09	88		97	
28.01	76		60.02	37		79.01	124		98.01	
28.02	48		61	4		79.03	49		98.02	
29	31		63.01	31		8.01	1		98.03	
3	1		64	117		80.01	56		98.04	
30	73		65	1		80.02	33		98.06	
31	35		67	8		81	3		98.07	
32	138		68.01	29		83.01	12		98.08	
33.01	39		68.02	21		83.02	7		99.01	
33.02	18		68.04	4		84.01	26		99.02	
34	75		69	24		84.02	21		99.03	
35	50		7.01	1		85	106		99.04	
36	53		70	5		86	3		99.05	
37	107		71	114		87.01	51		99.06	
						87.02	46		99.07	



Recipient Concentration by Census Tract

Tract	Recipients	Tract	Recipients	Tract	Recipients	Tract	Recipients
1	2	4	1	73.02	411	88.03	209
10.02	1	40.01	1	73.04	598	88.04	192
11	1	40.02	1	74.01	532	89.03	305
13.02	3	41	7	74.03	347	89.04	441
15	1	42.01	9	74.04	427	89.05	10
16	28	42.02	3	74.06	631	90	22
17.01	86	43	59	74.07	199	91.01	191
17.02	21	44	47	74.08	216	91.02	503
18.01	6	46	154	74.09	499	92.01	61
18.03	46	47	620	75.02	639	92.03	116
18.04	46	48.01	113	75.03	474	92.04	134
19.01	81	48.02	78	75.04	387	93.01	59
19.02	42	49.01	114	76.01	386	93.02	35
20.01	50	49.02	101	76.03	117	94	93
20.02	73	5.01	3	76.04	124	95.01	111
21.01	239	50	62	76.05	198	95.03	33
21.02	156	51	37	77.03	547	95.04	66
22.01	100	52.01	106	77.07	211	95.05	65
22.02	124	52.02	1	77.08	205	95.07	30
23.01	102	53.01	1	77.09	90	95.08	63
23.02	29	55	1	78.03	248	95.09	56
24	101	56	11	78.04	480	96.01	254
25.01	46	57.01	1	78.06	147	96.02	276
25.02	119	57.02	3	78.07	150	96.03	116
26	2	58	7	78.08	365	96.04	84
27.01	49	59	47	78.09	212	97	471
27.02	30	6	2	79.01	307	98.01	269
28.01	175	60.01	56	79.03	119	98.02	244
28.02	106	60.02	81	8.01	1	98.03	152
29	103	61	6	8.02	1	98.04	200
3	2	63.01	72	80.01	105	98.06	804
30	143	64	261	80.02	62	98.07	236
31	124	65	2	81	13	98.08	105
32	272	67	17	83.01	21	98.09	1
33.01	92	68.01	68	83.02	16	99.01	58
33.02	38	68.02	68	84.01	66	99.02	110
34	160	68.04	5	84.02	43	99.03	62
35	123	69	47	85	253	99.04	280
36	140	7.01	1	86	14	99.05	340
37	251	70	10	87.01	162	99.06	154
38	54	71	261	87.02	104	99.07	351
39	13	72	78	88.02	339		