Chapter 1

Background / Rationale

Active surveillance is a key prerequisite to outbreak prevention and containment recrudescence.

1.1 INTRODUCTION

Practically on a daily basis reports are published in the scientific and popular press reporting on one or other outbreak of an infectious disease of zoonotic and/or antrhoponotic origin. Added to this, it would appear that there are many newly emerging and re-emerging zoonotic and antrhoponotic infectious conditions in the world. The recent outbreak of Avian Influenza (H5N1 bird 'flu virus) is a good example of such an incident. These incidents have a direct influence on the health of the peoples of the world; some of them very serious resulting in the death of hundreds, thousands, and even millions as is the case with HIV/AIDS with its devastating economic implications. With international travel as well developed as it is today, no single nation can feel itself isolated and protected against the occurrence of any of these conditions.

With these few introductory remarks, it would appear that looking at a way to curb the incidence and spread of zoonotic and anthroponotic events is a necessity. This research will, therefore, investigate the contribution of active surveillance as a means to effect protection to the peoples of the world.

Active surveillance is defined by Lilienfeld and Stolley (1994:105-105) as regular periodic collection of case reports from health providers or facilities. It differs from passive surveillance, which relies upon case reporting at the discretion of the health care providers. Active surveillance is not reactive but proactive. A surveillance system collects data on an ongoing basis, analyses and disseminates the data, and provides for the implementation of a response.

Active surveillance can then be said to be an inclusive dynamic process comprising all or some of the following activities and or actions, either collectively or singularly as required by specific circumstances. It comprises: the seeking of data from participants in the surveillance system on a regular basis; the active solicitation of case reports from health care providers or health care facilities; the selective slaughter or eradication of identified animals and vectors to break the chain of infection; the seeking of reports from all participants in the surveillance system on a regular basis, rather than waiting for reports to arrive; and the regular analysis of information obtained from surveillance systems and case fatality rates (Word Bank, 2002:1-3; Lilienfeld & Stolley, 1994:105; Johara et al, 2001: 439-441; Wegner, 2004).

One characteristic of an active surveillance system is regular periodic collection of case reports from health care providers or facilities. An advantage of the system is that data are more accurate than other types of surveillance systems. The main disadvantage of an active surveillance system is its expense (Lilienfeld and Stolley1994:104-105). This is

important information to know because many countries who need to implement active surveillance systems can afford it least of all. Its introduction is, however, essential as it has implications of possibly saving lives by reducing case fatality rates, incidence rates and prevalence rates.

A key research finding by Takahashi, H, Kaku, K, Tanaka, T and Uchida, Y (February 2003) was that each country has different priorities when it comes to disease. These are totally dependent on the geographical location, the kind of disease, and the budget of the researchers (Takahashi *et al* 2003:130-134). This research was done by Takahashi *et al,* who sent questionnaires to appropriate people recommended by the World Health Organization (WHO), a division of the United Nations (UN) concerned with health (Slee's 2001:619), in Canada, America, China, Korea, Taiwan, Philippines, Singapore, Australia, New Zealand and Germany. There were questionnaires A and B prepared in English. Although copies of questionnaire A and B were not available to include as annexures, sufficient information is provided for the reader to duplicate the questionnaires. Questionnaire A requested information about any vector surveillance systems available to prevent or control zoonosis within the country. Several diseases included in questionnaire A were:

- Yellow fever
- Dengue
- Japanese B encephalitis and any other diseases that are transmitted by mosquito

- Lassa fever
- Hantavirus
- Haemorrhagic fever with renal syndrome
- Crimean Congo haemorrhagic fever
- Lime disease and any other diseases that are transmitted by flea, pest and rabies

Questionnaire B included a request for details of diseases that were included in questionnaire A, such as:

- What kind of vectors were the targets for surveillance?
- Where are the main facilities?
- How much was budgeted for maintaining the facilities?
- How often did surveillance occur?
- Where did the surveillance occur?

- What was the total number of surveillances conducted (e.g. total number of individual vectors)?

- How prepared was the facility in event of an outbreak?

- What kind of equipment was available for checking pathogenicities?

  (Takahashi *et al* 2003:130-134).

Ten (10) quarantine stations and branches were visited by Takahashi *et al* in Japan to gather information about their surveillance systems in an effort to determine their effectiveness and contributions in preventing or limiting the spread of infectious conditions. Japan's vector surveillance focuses on Dengue virus, while Australia's vector surveillance focuses on Australian Cerebritis. In America, Colorado tick fever and lime disease are the country's focus based on the research of Takahashi *et al* (February 2003).

The conclusions of this research state the importance of zoonosis, vector surveillance, and diseases, and detail the differences of how each country's surveillance system works. Additionally, information was gathered about Japan's surveillance structures and a recommendation was made that it should be put to good use. This article needed to be translated since it was in Japanese. Accuracy in translation, credibility and reliability was assured when a Japanese college student was recommended by the Daytona Beach Community College Library Director to translate this research article.

The Institute of Medicine (IOM), a body formed by the National Academy of Sciences (NAS) in 1970 to secure the services of eminent members of appointed professions for the examination of policy matters pertaining to the public health (Slee's 2001:326-327), located in Washington, DC, warned of a general 'mood of complacency' in the scientific community toward the dangers of emerging infectious diseases. The IOM's recommendations, directed at the Centers for Disease Control and Prevention (CDC), an agency within the Department of Health and Human Services (DHHS), which is responsible for monitoring and studying diseases that are controllable by public health measures (Slee's 2001:107-109), called for an enhancement of both the United States of America and international disease surveillance (IOM 2003:1-8; Stone 1992:540). The Department of Health and Human Services is a department of the executive branch of the federal government of the United States of America and is responsible for federal health programs in the civilian sector (Slee's 2001:190-191).

Microbes are forever mutating with new resistance factors. For example, in cases of:

- HIV/AIDS

- Tuberculosis

- MRSA (methicillin®-resistant *Staphylococcus aureus*) (Dorland's Medical Dictionary 2003:1178)

- Mad cow disease, caused by prions, which are protein particles that lack nucleic acid and cause various neurodegenerative diseases like scrapie and Creutzfeldt-Jakob disease (Merriam-Webster's Medical Dictionary 1995:557; Dorland's Medical Dictionary 2003:1506)

Overuse of antibiotics is the cause of the new mutating microbes with resistant factors, which are difficult to treat. Doctors are now keenly aware of the impact of over prescribing antibiotics.

For several years the medical community had thought it won the battle over infectious diseases and did nothing to prepare for any new emerging ones, hence the warning by The Institute of Medicine. This is important information to know because it is the impetus to the development of new vaccines, immunisations and new surveillance systems.

The Infectious Disease Pathology Activity (IDPA), a resource of the CDC, is a branch of the Division of Viral and Rickettsial Diseases (NCID) and serves as a scientific and technical resource to the National Centre for Infectious Diseases (NCID)(DVRD [Sa]:1-2). The National Centre for Infectious Diseases is a division within CDC responsible for the prevention and control of infectious diseases in the United States of America and around the world (Slee's 2001 108). The Infectious Disease Pathology Activity (IDPA) assists with outbreak investigations, disease diagnosis, and surveillance, and studies the pathogenesis

of infectious diseases (Shieh *et al* 2001:1020). The information about IDPA is important to this research because it is an example of an established active surveillance system that began in October 1997 to protect the public health against emerging infectious diseases. IDPA also provides its services to state and local health departments as well as internationally. IDPA provides reference and diagnostic support to and is recognised and accepted by local and state health departments, other Federal agencies, and national and international organisations (DVRD [Sa]:1-2).

Additionally, the CDC has established several international and domestic surveillance networks for public protection against epidemics. If that is the case, then why is it that prevention occurs only after emergence, is driven by crisis, and is reactive? One example of an internationally established system is IDPA. When the SARS outbreak occurred, IDPA became ***more actively involved in diagnostic testing***. An administrator at IDPA in Atlanta, Georgia, said that IDPA is constantly providing information to CDC, state and local health departments and internationally. When an outbreak occurs, IDPA becomes more involved because they do diagnostic testing. This is important information to know because even active surveillance systems can become **' *more active'*** when an outbreak emerges.

As defined by the Institute of Medicine report "Emerging Infections: Microbial Threats to Health in the United States," emerging diseases are:

"…Those whose incidence in humans has increased within the past two decades or threatens to increase in the near future. Emergence may be due to the spread of a new

agent, to the recognition of an infection that has been present in the population but has gone undetected, or to the realisation that an established disease has an infectious origin." (Frankford Hospitals 2005:1).

This research will focus on eight global microbial threats:

- an HIV/AIDS pandemic
- two newly emerging infectious diseases – Monkeypox virus (MPXV) and Severe Acute Respiratory Syndrome (SARS)
- Ebola and Nipah viral endemics
- Dengue fever and West Nile viral epidemics
- Group B Streptococcus, which is anthroponotic

1.1.1 HIV/AIDS

The Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) have reported that 38.6 million adults and 3.2 million children were living with HIV (human immunodeficiency virus) as of the end of 2002 (Basic Statistics

2003:1). More than 278 million people are expected to die from developing AIDS by 2050 (278 mio AIDS 2003:1). The global case fatality rate for HIV/ AIDS is 59%.

Table 1.1 gives some global estimates of the HIV/AIDS epidemic. More correctly, the term epidemic should be replaced with the term pandemic. A pandemic is defined as an epidemic occurring worldwide, or over a very large area, crossing international boundaries, and usually affecting a large number of people (Last 2001:131). The term epidemic is used in some of the tables and has not been changed because that is the way they are referenced. In reference to HIV/AIDS the terms epidemic and pandemic should be considered to be interchangeable. The term pandemic more accurately describes the current status of HIV/AIDS. Since the beginning of the HIV/AIDS pandemic until the end of 2001 there have been 21,800,000 deaths (AIDS Hotline 2003:1). Of that number, 4,300,000 deaths have been children under 15 years old. The total number of orphans caused by the HIV/AIDS pandemic was 14,000,000.

This information is relevant for this research because a key focus of this research is the reduction of case fatality rates to save lives. WHO, in collaboration with its partners, is developing strategies for strengthening surveillance, prevention and control (WHO/CSR 2003e:1). Sub-Saharan Africa remains the global epicentre of HIV/AIDS cases.

Table 1.1 Global Estimates of the HIV/AIDS Epidemic as of Years Ended 2001 and 2003

People newly infected with HIV in 2003		**Estimate**	**Range #**
	Total	**5 million**	**4.2-5.8 million**

	Adults	4.2 million	3.6-4.8 million
	Children <15yrs	700,000	590,000-810,000
AIDS deaths in 2003	**Total**	**3 million**	**2.5-3.5 million**
	Adults	2.5 million	2.1-2.7million
	Children <15 years	500,000	420,000-580,000
Total No. of AIDS deaths since the beginning of the epidemic until the end of 2001	**Total**	**21.8 million**	
	Adults	17.5 million	
	Children <15 years	4.3 million	
Total No. of AIDS orphans since the beginning of the epidemic until the end of 2001	**Total**	**14 million**	

(Worldwide AIDS Stats 2003)

Table 1.2 shows that **Sub-Saharan Africa** has the **most c**ases of newly infected adults and children with HIV during 2003: between 3 000 000 and 3 400 000 cases. South and south-east Asia have the next highest number of HIV cases: between 610 000 and 1,1 million cases.

Table1.2 The number of adults and children infected with HIV during 2003

Region	Newly Infects Adults & Children with HIV during 2003
Sub-Saharan African	**3.0 - 3.4 million**
North African & Middle East	43,000 – 67,000
South & Southeast Asia	610,000 – 1.1 million
East Asia & Pacific	150,000 – 270,000
Latin American	120,000 – 180,000
Caribbean	45,000 – 80,000
Eastern Europe & Central Asia	180,000 – 280,000
Western Europe	30,000 – 40,000
North America	36,000 – 54,000
Australia & New Zealand	700 – 1,000

(World HIV 2003:1)

Table 1.3 gives a more specific global picture of the devastation of the **HIV/AIDS**

Pandemic. The very high case fatality of 61.3% is indicative of an extremely high number of deaths and a very high number of newly infected people. Since 1981, when the AIDS epidemic was first identified in the United States of America, population-based AIDS surveillance had been used to track the progression of the Human Immunodeficiency Virus (HIV) epidemic. As the disease progressed and therapy became more effective the CDC and the Council of State and Territorial Epidemiologist (CSTE) recommended that all states and territories include HIV case surveillance and the reporting of HIV exposed infants. The combined prevalence of those living with the diagnosis of HIV and those living with AIDS provides more information on how to utilize resources for patient care services than does AIDS prevalence alone.

As of 2003, it does not look like the human population is winning the war on HIV/AIDS. Second Generation Surveillance looks at the combination of HIV/AIDS in counting statistics. There appears to be a negative 0.7% difference in case fatality rates from 2002. That actually amounts to 200,000 fewer deaths from the previous year.

Table 1.3 Global Estimates of the HIV/AIDS epidemic, as of year ended 2003

AIDS Deaths	People newly infected with HIV (Incidence)	Number of People living with HIV/AIDS (Prevalence)	CFR (%)	Second Generation HIV Surveillance "SGS"
2.9 million	4.73 million	37.8 million	61.3	

(World HIV 2003:1)

Current evidence indicates that HIV-1 and HIV-2 were introduced into the human population no fewer than seven times via cross species transmission from African primates, specifically *sooty mangabeys* (Hahn and Shaw 2000:607-615). Additionally, incidental infections occurred in a *patas* monkey, a yellow baboon, and a *chacma* baboon (Hahn and Shaw 2000:607-615).

A potential newly emerging infectious disease is the Simian Foamy Virus (SFV). To date, humans infected with SFV have shown no symptoms. At risk are ape hunters (LearnScapes 2004:1-10).

Mothers given zidovudine® prenatally reduced the risk of perinatal transmission of HIV by 66% in the United States (CDC 2000:24-25). Zidovudine® is a pyrimidine nucleoside analogue active against human immunodeficiency virus (PDR 2001:1456). Guidelines recommending HIV counselling and volunteer testing of all pregnant women, including zidovudine® therapy for those infected with HIV, helped reduce paediatric AIDS by 40% (CDC 2000:24-25). This is important information because giving zidovudine® reduces the case fatality rates of HIV/AIDS, further reducing HIV incidence rates and prevalence rates. It helps save lives.

Poorer countries tend to have higher case fatality rates because of several factors:

- lack of resources
- lack of trained medical personnel
- lack of prescription drugs
- lack of health education
- lack of surveillance systems

As of 2002, the case fatality for HIV/AIDS was higher than 2003 with 3.1 million deaths. There were 5 million newly infected people (see table 1.4). The total number of people living with HIV/AIDS was 42 million. From a global perspective this is devastating to the human population, both in the number of lives lost and in the number of people suffering with the disease.

Table 1.4 Global Summary of the HIV/AIDS epidemic with case fatality rates, December 2002

AIDS Deaths	People newly infected with HIV (Incidence)	Number of People living with HIV/AIDS (Prevalence)	CFR (%)	Second Generation HIV Surveillance "SGS"
3.1 million	5 million	42 million	62	

(UNAIDS 2002:1)

Table 1.5 shows the case fatality rate for the United States of America as of the year-end 2000. There were 8,911 deaths with 23,988 new cases. For a country that spends the most money of any country for health care, these are poor statistical results.

Table 1.5 USA AIDS cases and deaths as of year ended 2000

Cases diagnosed during 2000 (Incidence)	Deaths	CFR %
23,988	8,911	37

(Table 21 2001:1)

Table 1.6 breaks down the statistics to include adults and specifically highlights women and children. This table gives more specific data in that it presents tanges of data. As of 2003,

women accounted for 17 000 000 cases of people living with HIV/AIDS. Children under 15 accounted for 2 100 000 cases of people with with HIV/AIDS. Additionally, children under 15 accounted or 630 000 cases of people newly infected. As of 2003, children under 15 accounted for 490 000 deaths. These statistics are overwhelming and alarming. They should serve as a WARNING to the medical community specifically and to the human population in general so that both can take the proper action towards safeguarding the populace.

Table 1.6 World estimates of the HIV/AIDS epidemic at the end of 2003 (in millions)

		Estimate	Range
Number of people living with HIV/AIDS in 2003	Total Adults Women Children <15	37.8 35.7 17 2.1	34.6 - 42.3 32.7 - 39.8 15.8 - 18.8 1.9 - 2.5
People newly infected with HIV in 2003	Total Adults Children <15	4.73 4.1 0.63	4.17 - 6.34 3.6 - 5.6 0.57 - 0.74
AIDS deaths in 2003	Total Adults Children <15	2.9 2.4 0.49	2.6 – 3.3 2.2 - 2.7 0.44 - 0.58

(World HIV 2003:1-3)

Table 1.7 compares 2002 and 2003 HIV/AIDS cases, deaths and case fatality rates. The previous tables also highlighted some of this information. What is new here is both HIV/AIDS prevalence and incidence. Prevalence is defined as the number of events, e.g. instances of a given disease or other condition, in a given population at a designated time. In 2000 HIV/AIDS prevalence was 42 000 000 and HIV/AIDS incidence was 5 000 000. Incidence is defined as the number of instances of illness commencing, or the number of

persons falling ill, during a given period in a specific population.

Table 1.7 Global AIDS and HIV cases for the years ended 2002-2003

Year	HIV/AIDS Cases	Deaths	CFR%	HIV/AIDS Prevalence	HIV/AIDS Incidence
2002	42 mil	3.1 mil	62	42 mil	5 mil
2003	40 mil	3 mil	60	40 mil	5 mil

(UNAIDS 2002:1; World HIV 2003:1; UNAIDS/WHO 2002; Worldwide AIDS Stats 2003)

Table 1.8 shows the HIV/AIDS epidemic, in the year 2002, has killed 3 100 000 people. This pandemic is relentless. It kills regardless of race, creed, gender, or age. It is non-discriminating.

Table 1.8 Global summary of the HIV/AIDS epidemic, December 2002

Number of People Living with HIV/AIDS	Total Adults Women Children under 15 years	42 million 36,6 million 19,2 million 3.2 million
People Newly Infected with HIV in 2002	Total Adults Women Children under 15 years	5 million 4,2 million 2 million 800 000
AIDS Deaths in 2002	Total Adults Women Children under 15 years	3,1 million 2.5 million 1,2 million 610 000

(UNAIDS/WHO 2002)

Table 1.9 shows the 2002 total population HIV INCIDENCE RATES for the South African Provinces. The incidence rate is defined as the rate at which new events occur in a population. The numerator is the number of new events that occur in a defined period and denominator is the population at risk of experiencing the event during this period (Last, 2001;92).

Table 1.9 Indicator Data – View by [Geographic (SA Provinces)]

	EC	FS	GP	KZN	LP	MP	NC	NW	WC	ZA
HIV incidence rate										
2002 Mother's milk (of infants)	3.5	4.1	3.5	5.4	3.2	4.4	2.1	3.7	1.0	[1] 3.8
2002 Perinatal (births)	5.5	6.5	5.6	8.3	5.2	6.9	3.4	5.9	1.5	[2] 6.0
2002 Total population	2.1	2.3	2.1	2.3	1.9	2.3	1.3	2.1	2.1	[3] 2.1
2002 adult female(18-64)	3.2	2.9	2.4	2.5	2.6	2.9	2.0	2.6	2.6	[4] 2.4
2002 adult male(18-64)	1.5	1.7	1.5	1.6	1.5	1.7	2.6	1.6	1.6	[5] 1.5
2002 adults (18-64)	3.4	3.4	2.9	3.3	3.1	3.5	1.4	3.2	3.2	[6] 3.1
2004 Total population	-	-	-	-	-	-	-	-	-	[7] 1.3

EC: Eastern Cape; **FS**: Free State; **GP** Gauteng Province; **KZN**: KwaZulu-Natal; **LP**: Limpopo Province; **MP**: Mpumalanga Province; **NC**: Northern Cape; **NW** North West; **WC**: Western Cape; **ZA**: South Africa.
(Health Systems Trust 2004: 1-2)

Table 1.10 highlights the devastation caused by HIV/AIDS in the United States of America. From the beginning of the epidemic through 2000, the total average case fatality rate was 57%. For a country that expends the largest amount of dollars for health care, this statistic in unacceptable.

Table 1.10 AIDS cases and deaths through December 2000 – United States

Emerging Infectious Disease	Cases	Incidence	Prevalence	Deaths	CFR%
Before 1981	100	100	100	30	30
1981	337	337	437	130	39
1982	1 199	1	199	465	39
1983	3 152	3 152	4 788	1 510	48
1984	6 344	6 344	11 132	3 522	55
1985	12 033	12 033	23 165	6 991	58
1986	19 379	19 379	42 544	12 155	63
1987	29 096	29 096	71 640	16 461	57
1988	36 099	36 099	107 739	21 255	59
1989	43 474	43 474	151 213	28 011	64
1990	49 511	49 511	200 724	31 782	64
1991	60 519	60 519	261 243	37 033	61
1992	79 595	79 595	340 838	41 623	52
1993	79 871	79 871	420 709	45 456	57
1994	72 988	72 988	493 697	50 134	69
1995	69 774	69 774	563 471	50 798	73
1996	60 716	60 716	624 187	37 475	62
1997	48 763	48 763	672 950	21 399	44
1998	40 784	40 784	713 734	18 304	42
1999	36 725	36 725	750 459	15 254	42

2000	23 988	23 988	774 447	8 911	37
Total	**774 447**	**774 447**	**774 447**	**447 648**	**57,8**

(CDC – NCHSTP – DHAP: HIV/AIDS Surveillance Report 2000)

In contrast to the United States of America, **The United Kingdom** had a case fatality rate of 19,2% through September 2003, as shown in Table 1.11. the United States of America should learn a lesson from the United Kingdom in what they are doing to keep the case fatality rate down. Perhaps it is better surveillance or more surveillance systems in place.

Table 1.11 HIV and AIDS statistics by year – United Kingdom

Emerging Infectious Disease	Cases HIV/AIDS	Incidence	Prevalence	Deaths	CFR%
1987 or earlier	11,673	11,673	11,673	979	8.4
1988	2,859	2,859	14,532	481	16.8
1989	3,224	3,224	17,756	744	23.0
1990	3,786	3,786	21,542	894	23.6
1991	4,110	4,110	25,652	1,106	26.9
1992	4,318	4,318	29,970	1,237	28.7
1993	4,406	4,406	34,376	1,562	35.5
1994	4,426	4,426	38,802	1,700	38.4
1995	4,420	4,420	43,222	1,719	38.9
1996	4,126	4,126	47,348	1,462	35.4
1997	3,809	3,809	51,157	735	19.3
1998	3,601	3,601	54,758	507	14.1
1999	3,815	3,815	58,573	469	12.3
2000	4,633	4,633	63,206	477	10.3
2001	5,677	5,677	68,883	471	8.3
2002	6,488	6,488	75,371	395	6.1
Until end of 9/03	3,941	3,941	79,312	258	6.5
Total UK	79,312	79,312	79,312	15,196	19.2

(United Kingdom 2003:1)

All of the above referenced tables reflect a great many deaths caused by the HIV/AIDS pandemic. The information provided by all these tables should serve as a **WARNING** to the medical community and the general public that HIV/AIDS does not discriminate.

1.1.2 MONKEYPOX VIRUS

Although Monkeypox is not a new zoonosis, its recrudescence in the western hemisphere is. As of July 8, 2003, 72 cases have been investigated (MMWR Weekly 2003:1-8). Forty-nine percent (37) of cases reported were laboratory confirmed by the Centers for Disease Control and Prevention and 51% (35) cases were classified as probable and suspect.

Table 1.12 reports as of 30 July 2003 there were 37 laboratory confirmed cases of Monkeypox in the central part of the United States of America. This data is important because from an epidemiological point of view the rest of the country remained Monkeypox free. Treatment, prevention and eradication of the disease could be focused in the states reported, while still maintaining vigilance in the rest of the country.

Table 1.12 Report of Monkeypox cases in the United States as reported to CDC as of 30 July 2003

State	Cases Under Investigation	Laboratory Confirmed Cases
Illinois	13	9
Indiana	16	7
Kansas	1	1
Missouri	2	2
Ohio	1	0
Wisconsin	39	18
Total	**72**	**37**

(CDC/OC 2003:1)

The Monkeypox virus occurs naturally only in western and central Africa in the vicinity of tropical jungles. The eradication campaign, based on mass vaccination and epidemiological surveillance, was launched by the World Health Organization in 1958 and stepped up in 1967. No cases of human smallpox (except two laboratory cases in England

in 1978) have occurred since October 1978. Scientists used smallpox vaccine because Monkeypox, human smallpox (variola), vaccinia, and cowpox bear a close antigenic relationship to the variola and vaccinia viruses (Acha and Szyfres : 2003: 235-242).

In 1986, intensified surveillance was discontinued because Monkeypox immunity, >85% efficacy from smallpox vaccination, was effective with estimated coverage of >60% for the 1970's and early 80's. It should also be noted that *orthopoxvirus* antibodies (OPV) have been identified in several monkey and squirrel species and other wild caught animals in endemic areas.

This information is important because it indicates that tighter animal control is necessary to contain the virus within the animal population to prevent animal to human transmission (WHO/CDC/CSR/99.5 1999:1-12). If animals have seroconverted, meaning a change in their serology from negative to positive indicative of the development of antibodies from a previous *orthopoxvirus* exposure, they could be either asymptomatic or symptomatic. Exportation of animals caught in the wild needs to be tightly controlled. Animals that have seroconverted should not be allowed to be exported. Containment of enzoonoses is critical for the public health.

Table 1.13 compares Monkeypox cases between The Western Hemisphere and The Democratic Republic of the Congo. Monkeypox does kill. The outbreak in The United States of America was correctly handled, in that it was taken very seriously.

Table 1.13 Monkeypox cases, incidence, prevalence, deaths and case fatality rates

Monkeypox	Cases	Incidence	Prevalence	Deaths	CFR%
Western Hemisphere as of July 30, 2003	37	37	37	0	0
Equatelur Province – DRC 2001	31	-	-	5	16
DRC – 2/96 – 10/97 Katako Kombe Health Zone	344	-	-	5	1.5

(Meyer et al 2002:2919; CDC/OC 2003:1; Human Monkeypox 1997:1)

Table 1.14 focuses on two Health Zones in The Democratic Republic of the Congo. Lodja Health Zone had no deaths attributed to Monkeypox, while Katako-Kombe had 5 deaths.

Table 1.14 Human Monkeypox – Kasai Oriental, Democratic Republic of Congo, February 1996 – October 1997

	Cases	Probable Cases	Possible Cases	Deaths	CFR %
Katako-Kombe Health Zone	344	304	115	5	1.5
Lodja Health Zone	75	-	-	0	0
Total	419	304	115	5	1.5

(Human Monkeypox 1997:1)

Monkeypox is included in this research because it is a new disease in the Western Hemisphere. Because of 'heightened awareness', no deaths occurred in the United States of America.

1.1.3 SEVERE ACUTE RESPIRATORY SYNDROME (SARS)

Doctor Meng, Assistant Professor, College of Veterinary Medicine, Virginia Tech, Blacksburg, Virginia, said, **"**Regardless of whether the virus is zoonotic, it has evolved the

ability to spread from humans to humans, so even if you cull all the animals it can only alleviate the problem but cannot stop it as the virus has now entered the human population" (Meng 2003). SARS has been able to spread along the routes of international air travel (CSR/WHO 2003:1-10).

Cohort studies that were done on the major outbreak in Hong Kong confirmed SARS as being a serious respiratory illness leading to significant morbidity and mortality (Lee *et al* 2003:1986-1994). A Cohort study can be defined as the analytic method of epidemiological study, in which subsets of a defined population can be identified who are, have been, or in the future may be exposed or not exposed, or exposed in different degrees, to a factor or factors hypothesised to influence the probability of occurrence of a given disease or other outcome (Last 2001:33-34). Sixty-six male patients and seventy-two female patients were in this cohort study, of which sixty-nine were health care workers. Symptomatology included fever, chills, rigors, myalgia, cough, headache, lymphopaenia, thrombocyto-paenia, elevated lactase dehydrogenase and creatine kinase levels. Thirty-two patients were admitted to the intensive care unit; five patients died, all of whom had coexisting conditions. Advanced age was a predictor of an adverse outcome (Lee *et al* 2003: 1986-1994).

An important implication for this research is that one can expect a high case fatality rate. It appears that a surveillance system was lacking in the Guangdong Province of China, which did not prevent an outbreak. The Chinese government had under-reported the number of SARS cases and covered up the epidemic in the news. Both the Health Minister *Zhang Wenkang* and Beijing mayor *Meng Xuenong* shall be remembered as the men with the

wrong numbers and have been removed from their communist party posts (China Support network 2003:1). The effect of the under-reporting was complacency on the part of the health care system in China. Being aboveboard is of utmost importance. The outcome of the SARS epidemic may have been less severe had the Health Minister and Beijing mayor been honest in reporting the number of SARS cases.

In April 2000, the World Health Organization launched the Global Outbreak Alert and Response Network (GOARN), which enabled WHO to keep close watch over evolving infectious diseases electronically. On 12 March 2003, WHO issued a global alert about SARS. On 14 March 2003, the CDC activated its emergency operations centre to support WHO's response to this global threat. By 15 March 2003, WHO received information about more than 150 cases of SARS. The global alert achieved its purpose. After WHO issued its global alert, all countries with imported cases, with the exception of provinces in China, were able, through prompt detection of cases, immediate isolation, strict infection control, and vigorous contact tracing, to either prevent further transmission or keep the number of additional cases very low (CSR/WHO 2003: 1-10). Additionally, the Global Public Health Intelligence Network (GPHIN) scanned the Internet for rumours and reports of suspicious disease events. Although these sophisticated systems have helped to prevent a SARS pandemic, they did nothing to prevent a SARS outbreak (Severe 2003:1-13).

The swiftness with which WHO's global alert took affect is impressive. WHO has proven the strength of an active surveillance system as opposed to monitoring, sentinel surveillance or

a passive surveillance system. This is an important issue because reducing case fatality rates, incidence rates and prevalence rates is the main objective of this research.

A full year of surveillance has been recommended by the World Health Organization to determine if SARS has established endemicity (WHO/CSR 2003k:1). Endemicity can be defined as a disease that is present or usually prevalent in a population or geographical area at all times (Dorland's Medical Dictionary 2003: 612). Under the right conditions, like a crowded airport, a single, highly infectious patient can infect almost 100 additional people. The term given to such a patient is '***super spreader"***(WHO WER 2003:1-3).

Another significant problem with SARS is that other diseases mask it. This can further lead to the spread of the disease, especially if infected patients unknowingly are not kept under isolation (WHO | Update 83 2003:1-5). According to Dr. Heymann, from the World Health Organization, "there is no evidence at present that SARS has become an endemic disease in humans at this point in time. There were, however, three outbreaks related to laboratory accidents" (Heymann 2004).

Table 1.15 is a summary of SARS cases by country from 1 November 2002 to 7 August 2003. The total number of SARS cases was 8422 and the total number of deaths was 916. The average case fatality rate was 11%. Since 22 April 2004 a total of 9 SARS cases, including 2 researchers, have been reported with one death (WHO/CSR 2004:1). The SARS epidemic was contained because of the fast response by the global community to this devastating disease.

Table 1.15 Summary Table of SARS Cases by Country, 1 Nov. 2002 – 7 Aug. 2003

	Cumulative number of cases				Status							
Areas	Female	Male	Total	Median Age (range)	No of cases currently hopita-lised	No. of cases re-covered	No. of deaths	CFR %*	No. of Impor-ted cases %	No. of HCW affected %	Date onset 1st probable case	Date onset Last Prob case
Australia	4	2	6	15(1-45)	0	6	0	0	6(100)	0(0)	3/24/03	4/1/03
Brazil	1		1	4	0	1	0	0	1(100)	0(0)	4/3/03	4/3/03
Canada	151	100	251	49(1-98)	10	200	41	17	5(2)	108(43)	2/23/03	6/12/03
China	Pending	Pending	5327	Pending	29	4949	349	7	NA	1002(19	11/16/02	6/25/03
China, Hong Kong, Spec. Admin. Region	977	778	1755	40(0-00)	7	1448	300	17	NA	386(22)	2/14/03	5/31/03
China, Macao Spec. Admin. Region	0	1	1	28	0	1	0	0	1(100)	0(0)	5/5/03	5/5/03
China, Taiwan	349***	319***	665	46(2-79)	10	475	180	27	50(8)	86(13)	2/25/03	6/15/03
Colombia	1	0	1	28	0	1	0	0	1(100)	0(0)	4/2/03	5/2/03
Finland	0	1	1	24	0	1	0	0	1(100)	0(0)	4/30/03	4/30/03
France	1	6	7	49(26-1)	0	6	1	14	7(100)	2**(29)	3/21/03	5/3/03
Germany	4	5	9	44(4-73)	0	9	0	0	9(100)	1(11)	3/9/03	5/6/03
India	0	3	3	25(253)	0	3	0	0	3(100)	0(0)	4/25/03	5/6/03
Indonesia	0	2	2	56(4765)	0	2	0	0	2(100)	0(0)	4/6/03	4/17/03
Italy	1	3	4	30.5(25-54)	0	4	0	0	4(100)	0(0)	3/12/03	4/20/03
Kuwait	1	0	1	50	0	1	0	0	1(100)	0(0)	4/9/03	4/9/03
Malaysia	1	4	5	30(26-84)	0	3	2	40	5(100)	0(0)	3/14/03	4/22/03
Mongolia	8	1	9	32(17-63)	0	9	0	0	8(89)	1(11)	3/31/03	5/6/03
N Zealand	1	0	1	67	0	1	0	0	1(100)		4/20/03	4/20/03
Philippines	8	6	14	41(29-73)	0	12	2	14	7(50)	4(29)	2/25/03	5/5/03
Republic of Ireland	0	1	1	56	0	1	0	0	1(100)	0(0)	2/27/03	2/27/03
Republic of Korea	0	3	3	40(20-80)	0	3	0	0	3(100)	0(0)	4/25/03	5/10/03
Romania	0	1	1	52	0	1	0	0	1(100)	0(0)	3/19/03	3/19/03
Russian Federation	0	1	1	25	1	0	0		NA	0(0)	5/5/03	5/5/03
Singapore	161	77	238	35(1-90)	0	205	33	14	8(3)	97(41)	2/25/03	5/5/03
South Africa	0	1	1	62	0	0	1	100	1(100)	0(0)	4/3/03	4/3/03
Spain	0	1	1	33	0	1	0	0	1(100)	0(0)	3/26/03	3/26/03
Sweden	1	2	3	33	0	3	0	0	3(100)	0(0)		
Switzer-land	0	1	1	35	0	1	0	0	1(100)	0(0)	3/9/03	3/9/03
Thailand	5	4	9	42(2-79)	0	7	2	22	9(100)	1**(11)	3/11/03	5/27/03
UK	2	2	4	59(28-74)	0	4	0	0	4(100)	0(0)	3/1/03	4/1/03
U.S.	16	17	33	36(0-83)	7	26	0	0	31(94)	1(3)	1/9/03	7/13/03
Viet Nam	39	24	63	43(20-6)	0	58	5	8	1(2)	36(57)	2/23/03	4/14/03
Total			**8422**		**64**	**7442**	**916**	**11**		**1725(20)**		

*Cases fatality based on cases with known outcome and irrespective of immediate cause of death.
**Includes imported cases in HCWs (Health Care Workers) occupationally exposed.
***Following discarding of 3 cases, new breakdown by sex pending
(Summary Table 2003:1)

The Philippines Department of Health has maintained an active surveillance system since 17 March 2003 in sixteen Philippine regions. The Philippines aligned with the Global Outbreak Alert and Response Network. SARS is a potential pandemic outbreak that GOARN has responded to. The Department of Health (Philippines) has reported to WHO that active surveillance has been ongoing to detect and investigate any new SARS cases in sixteen Philippine regions (WHO/CSR 2003g:1).

The global surveillance of SARS began at the end of February 2003. The Global outbreak Alert and Response Network (GOARN) was doing its job (WHO/CSR 2003k:1). As of April 2003 Chinese authorities started a nation wide surveillance system to detect and report SARS cases. China aligned with the Global Outbreak Alert and Response Network (WO/CSR 2003:1).

SARS is included in this research because it is a newly emerging infectious disease, more devastating than Monkeypox and yet not pandemic as HIV/AIDS.

1.1.4 EBOLA VIRUS

The Ministry of Health, the Republic of the Congo, has reported 143 cases of Ebola Haemorrhagic Fever (EHF), including 128 deaths, in the districts of Mbomo and Kelle (WHO/CSR 2003c:1). Ebola virus is endemic to Africa (Acha and Szyfres 2003:117-120). Outbreaks have occurred in Uganda, Sudan, Zaire (now known as the Democratic Republic

of the Congo), Gabon, South Africa and Liberia. Documented cases have also occurred in the United States of America, England and Italy (Special Pathogen Branch 2003:1).

In 1989 and 1990, a filovirus, named Ebola-Reston, was isolated in monkeys imported from the Philippines being held in quarantine in laboratories in the United States of America in Reston, Virginia, Alice, Texas and Pennsylvania. A number of monkeys died and at least four persons were infected and developed antibodies to Ebola-Reston, although none of them suffered clinical illness. In 1976 there was one case in England in which a laboratory worker was infected with Ebola-Sudan by an accidental stick of a contaminated needle. No death occurred. In 1992 Ebola-Reston was introduced into facilities in Sienna, Italy, by monkeys imported from the same export facility in the Philippines that was involved in the episodes in the United States of America. No humans were infected. In 1996 monkeys imported from the Philippines introduced Ebola-Reston into a quarantine facility in Texas. No humans were infected (Special Pathogen Branch 2003:1). One would think that more stringent measures of quarantine and animal control would be implemented after the first occurrence of an outbreak outside of an endemic area.

The natural reservoir of Ebola virus remains unknown. The gorilla is suspect because it is a source of bushmeat, which is meat eaten from animals killed in the jungles of Africa. A chimpanzee originating from the Tai forest in the ***Cote d'Ivoire*** was infected with Ebola virus, which infected a Swiss ecologist who did an autopsy on the chimpanzee (Meslin *et al* 1997:18-20). Ebola virus is caused by a member of the family *Filoviridae* (Acha and Szyfres 2003:117). Until the reservoir of Ebola virus is discovered, eradication remains

elusive. The case fatality rate is in the range of 30 - 90% (WHO/CSR 2003c:1; Disease Archive 2003a:1). The total number of cases in Africa, between 1976 and 2002, were 1,644 with 1,109 fatalities (Casillas et al 2003:1-2). Case fatality rates reflect the number of deaths caused by the disease divided by the number of cases of the disease times 100 to give a percentage. The implications of this information are extremely relevant because the reservoir of the Ebola virus remains undiscovered, hence the extremely high case fatality rates. Although the research hypothesis states that 'active surveillance systems can reduce case fatality rates', the response to outbreaks of Ebola Haemorrhagic Fever are reactive and not proactive with active surveillance occurring after an outbreak. Ebola virus is most horrific and in most cases close to 100% fatal. Finding the reservoir is the first and major step towards the eradication of this most deadly disease.

Table 1.16 is a very comprehensive table showing all known cases and outbreaks of Ebola Haemorrhagic Fever since 1976 through 2002. The table also shows the EBOLA subtypes involved in the outbreaks and number of deaths. The first recognition of the outbreak of this disease was in 1976.

Table 1.16 Known cases and outbreaks of Ebola Haemorrhagic Fever, in chronological order

Year	Ebola Subtype	Country	No. of Human Cases	% of Deaths Among Cases	Situation
1976	Ebola-Zaire	Zaire (Democratic Republic of the	318	88%	Occurred in Yambuku and surrounding areas. Disease was spread by close personal contact and by use of

		Congo) (DRC)			contaminated needles and syringes in hospitals/clinics. This outbreak was the first recognition of the disease.
1976	Ebola-Sudan	Sudan	284	53%	Occurred in Nzara, Maridi and the surrounding area. Disease was spread mainly through close personal contact within hospitals. Many medical care personnel were infected.
1976	Ebola-Sudan	England	1	0%	Laboratory infection by accidental stick of contaminated needle.
1977	Ebola-Zaire	Zaire	1	100%	Noted retrospectively in the village of Tandala.
1979	Ebola-Sudan	Sudan	34	65%	Occurred in Nzara. Recurrent outbreak at the same site as the 1976 Sudan epidemic.
1989	Ebola-Reston	USA	0	0%	Ebola-Reston virus was introduced into quarantine facilities in Virginia, Texas, and Pennsylvania by monkeys imported from the Philippines. Four humans developed antibodies to Ebola-Reston virus but did not become ill.
1990	Ebola-Reston	USA	0	0%	Ebola-Reston virus was introduced once again into quarantine facilities in Virginia and Texas by monkeys imported from the Philippines. Four humans developed antibodies but did not get sick.
1992	Ebola-Reston	Italy	0	0%	Ebola-Reston virus introduced into quarantine facilities in Sienna by monkeys imported from the same export facility in the Philippines that was involved in the United States. No humans were infected.
1994	Ebola-Zaire	Gabon	49	59%	Occurred in Mekouka and gold-mining camps deep inrain forest. Initially thought to be yellow fever; identified as Ebola Haemorrhagic Fever in 1995.
1994	Ebola-Ivory Coast	Ivory Coast	1	0%	Scientist became ill after conducting autopsy onwild chimpanzee in the Tai Forest. Patient treated in Switzerland.
1995	Ebola-Zaire	Democratic Rep of the Congo (formerly Zaire)	315	81%	Occurred in Kikwit and surrounding area. Traced to index case-patient who worked in forest adjoining the city. Epidemic spread through families and hospitals.
1996	Ebola-Zaire	Gabon	31	68%	Occurred in Mayibout area. A chimpanzee found dead in the forest was eaten by people hunting for food. Nineteen people who were involved in the butchery of the animal became ill; other cases occurred in family members.
1996	Ebola-Zaire	Gabon	60	75%	Occurred in Booue area with transport of patients to Libreville. Index case-patient was a hunter who lived in a forest camp. Disease was spread by close contact with infected persons. A dead chimpanzee found in the forest at the time was determined to be infected.
1996	Ebola-Zaire	South Africa	2	50%	A medical professional travelled from Gabon to Johannesburg, South Africa, after having treated Ebola virus-infected patients and thus having been exposed to the virus. He was hospitalised, and a nurse who took care of him became infected and died.
1996	Ebola-Reston	USA	0	0%	Ebola-Reston virus was introduced into a quarantine facility in Texas by monkeys imported from the Philippines. No human infections were identified.
1996	Ebola-Reston	Philippines	0	0%	Ebola-Reston virus was identified in a monkey export facility in the Philippines. No human infections were identified.
2000-2001	Ebola-Sudan	Uganda	425	53%	Occurred in Gulu, Masindi, and Mbarara districts of Uganda. The three most important risks associated with Ebola virus infection were attending funerals of Ebola Haemorrhagic Fever case-patients, having contact with case-patients in one's family, and providing medical care to Ebola case-patients without using adequate personal protective measures.
2001-2002	Ebola-Zaire	Gabon and the Republic of the Congo	122	79%	Outbreak occurred over the border of Gabon and the Republic of the Congo. Additional information is currently available on the WHO website.

(Special Pathogens Branch 2003:1)

Table 1.17 shows more specifically cases and deaths caused by Ebola virus from 1976 through May 2004. There were 1 815 cases with 1 261 deaths. The average case fatality

rate is 69,5%. The reservoir for Ebola virus may never be found. Of all the emerging infectious diseases discussed, Ebola virus is by far the most elusive and deadly. The case fatality rate remains consistently high, indicating that not enough is being done to combat the disease.

Table 1.17 Ebola outbreak chronology

Year	Country	Virus subtype	Cases	Deaths	Case Fatality
1976	Sudan	Ebola-Sudan	284	151	53%
1976	Zaire (DRC)	Ebola-Zaire	318	280	88%
1979	Sudan	Ebola-Sudan	34	22	65%
1994	Gabon	Ebola-Zaire	19	9	48%
1995	Democratic Republic of the Congo (formerly Zaire)	Ebola-Zaire	315	250	81%
1996 Feb-April	Gabon	Ebola-Zaire	37	21	56%
1996-97 July-Jan.	Gabon	Ebola-Zaire	61*	45	74%
2000-2001	Uganda	Ebola-Sudan	425	224	53%
2001-2002 (10/01-03/02)	Gabon/Republic of the Congo	Ebola-Zaire	124	97	78%
2002-2003 (12/02-4/03)	Republic of the Congo	Ebola-Zaire	143	128	89%
2003 (Nov.-Dec.)	Republic of the Congo	Ebola-Zaire	35	29	83%
2004 (May)	Sudan	Ebola-Sudan	20	5	(Outbreak ongoing)
Total**			1815	1261	

*Includes one fatal case in South Africa acquired following contact with an exported case.
**When cases from smaller outbreaks, including those associated with imported cases, are included, the total number of cases approaches 1850.
(Ebola Hemorrhagic Fever 2004:1).

Four case notification categories have been initiated for the identification of Ebola Haemorrhagic Fever (EHF). They are:

- Alert
- Suspect
- Probable
- Laboratory-confirmed.

The following definitions apply to the case notification categories:

- ✓ An alert case is any person with sudden onset of high fever or sudden death or bleeding or bloody diarrhoea or blood in urine.
- ✓ A suspect case is any person, dead or alive, with contact with a probable or confirmed EHF case or contact with a dead or sick animal and fever or fever and at least three specific symptoms (headache, anorexia, fatigue, myalgia or arthralgia, dyspnea, vomiting or nausea, diarrhoea, abdominal pain, dysphagia, hiccups) or any unexplained bleeding.
- ✓ A probable case is a person with symptoms compatible with EHF, as evaluated by a clinician or a dead person with an epidemiological link with a confirmed case.
- ✓ Laboratory samples are confirmed positive if either Ebola virus antigen or Ebola IgG (Immunoglobulin G) antibody is detected. If there are no specific detectable antibodies or antigens the term "Not a case" is used. (CCDR 2003:1-6)

Since the reservoir for the Ebola virus has not yet been discovered, outbreaks are almost impossible to predict. The 'heightened awareness' previously mentioned in relationship to Monkeypox as a response to an outbreak, is similar to a reinforced active surveillance system when the outbreak has ended and the disease contained. The European Space Administration is providing space satellites to help with identifying environmental features that can be marked where outbreaks either have occurred or are occurring. The researchers hope to study and identify temporal and spatial changes in:

- ➢ The vegetation
- ➢ Water level
- ➢ Weather,

and to link an Ebola outbreak with climatic changes. The research will focus on the Northwest Gabon/Congo region, which has had 8 outbreaks since 1994. (Wolfe *et al* 2004: 932-937). A follow-up on this study would be an invaluable insight into the Ebola mystique meaning, **the discovery of Ebola's reservoir.**

1.1.5 NIPAH VIRUS

Nipah virus has been classed within a new genus called "*Henipavirus"*. The Nipah virus has a high case fatality rate of 48%. In 1999 more than 100 pig handlers died of the virus in Malaysia. The virus caused 229 cases of febrile encephalitis with 111 deaths. Fruit bats may be a reservoir. After 1.1 million pigs were culled, meaning selectively slaughtered, in Malaysia, the epidemic and spread of the disease stopped (Meng 2003; Disease Archive 2003b:1; Lashley and Durham 2002:374-375,414). The chain of transmission for Nipah virus encephalitis was from bat to pigs to man. Neutralising antibodies to Nipah virus were detected in the following wild-caught animals from five species:

- *Pteropus hypomelanus* (island flying fox)
- *P.* vampyrus (Malayan flying fox)
- *Econycteris* spelaea (cave bat)
- *Cynopterus brachyotic* (lesser dog-faced fruit bat)
- *Scotophilus kuhlii* (house bat).

The presence of neutralising antibodies to Nipah virus in the fruit bat species is interpreted as evidence of infection with Nipah virus (Johara *et al* 2001: 439-441).

Unpublished data from the Australian Animal Health Laboratory (AAHL), Geelong, Australia, showed that Nipah virus was found in the respiratory secretions and urine of infected pigs (Journal of Infection 2001: 40-43). Additionally, Nipah virus was isolated from the upper respiratory secretions and urine in 8 out of 20 patients who were virologically confirmed to be infected with Nipah virus encephalitis (Chua *et al* 2001: 40-43).

Proactive responses to emerging infectious diseases can save lives. Once the chain of transmission was identified, steps were taken to break it and stop the spread of the disease. This information is important to know because it is evidence of what a proactive response to an emerging infectious disease can accomplish.

Table 1.18 gives an excellent representation of the initial Nipah Virus outbreak in the mid-1999 and its recrudescence in Bangladesh in March 2004.

Table 1.18 Nipah Virus outbreak in Malaysia and Bangladesh

Emerging Infectious Diseases	Cases	Incidence	Prevalence	Death	CFR%
Nipah (Malaysia) as of mid-1999	229	229	229	111	48
Nipah (Bangladesh March 2004**	34	34	34	26	77

(Disease Archive 2003b:1;Meng 2003; Lashley and Durham 2002:374-375; **WHO/CSR 2004:1)

Table 1.19 reinforces the fact that the chain of transmission was broken when one million pigs were culled.

Table 1.19 Active response to Nipah Virus outbreak

1999	The chain of infection was broken when 1.1 million pigs were culled. The reservoir suspected is *megachiropteran* (fruit bat) Bats→ Pigs → Humans

(Disease Archive 2003b:1; Meng 2003; Lashley and Durham 2002:374-375)

This is a **classic example of active surveillance** in action. The chain of infection was broken when 1,100,000 pigs were culled, meaning the number of pigs was reduced by selective slaughter (Johara *et al* 2001: 439-441).

1.1.6 DENGUE FEVER / DENGUE HAEMORRHAGIC FEVER

The viruses of Dengue Fever are in the family *Flaviviridae,* which is also responsible for Dengue Hemorrhagic Fever. The genera, in the family *Flaviviridae* that includes Dengue viruses, are *Flaviviruses*. The disease vector is *Aedes aegypti*. *Aedes* is a genus of mosquitoes of the tribe *Aedini*, subfamily *Culicinae*, having broad appressed scales on the head and scutellum. The palpi in the female are short and sparsely tufted and have three segments of equal length; in the male, the palpi are long and tufted. *Aedes aegypti*, the tiger mosquito, breeds near houses and transmits urban yellow fever and dengue; it may also transmit filariasis and encephalitis (Dorland's Medical Dictionary 2003:34-35). The *A. aegypti* mosquito is the main vector of all four serotypes of Dengue and the only one that has been identified so far in the Americas and Australia (Acha and Szyfres 2003:94). Serotype is defined as the type of a microorganism as determined by the kinds and

combinations of constituent antigens (Dorland's Medical Dictionary 2003:1686). Four serotypes of Dengue are recognised:

- Den-1
- Den-2
- Den-3
- Den-4.

Aedes albopictus may also be involved in transmission (Acha and Szyfres 2003:94). *Aedes albopictus* transmits yellow fever, equine encephalomyelitis and dengue (Dorland's Medical Dictionary 2003:34-35). *A. albopictus* may be the only vector in some parts of southeast Asia (Acha and Szyfres 2003:94-98). *A. albopictus* and *A. aegypti* are the principal vectors of the Dengue virus in rural and urban Malaysia (Acha and Szyfres 2003: 94-98). *Aedes niveus,* which feeds on monkeys and humans, is believed to be the vector of the wild cycle in Malaysia (Acha and Szyfres 2003: 94-98).

Demography and global warming may be contributing factors (Gill 1998:1-84; Lashley and Durham 2002:374-375, 414). This is an instance where climatology and the environment play a role in the spread of the disease. Since Dengue virus occurs most often during rainy seasons, knowing weather cycles can aid in when to begin spraying to kill mosquitoes. Knowledge of the specific species involved in the transmission of disease is very important because breaking the chain of transmission can be accomplished by destroying the vector. A proactive approach to Dengue surveillance would mean that public health authorities should monitor weather conditions and be prepared with chemical sprays to destroy the

vectors when appropriate. Additionally, the public should be educated about the dangers of Dengue and how to take appropriate safety measures to prevent the spread of disease. Some preventive measures include eliminating or destroying mosquito larval habitats, which could be artificial or natural water holding containers like old tires, flowerpots and water storage containers close to or within human habitations and protecting against day biting mosquitoes by using screening, protective clothing and repellents (Chin 2000:142-147).

Table 1.20 gives data for selected countries and areas in the Western Pacific Region between 1995 and 2000. This table was selected for presentation in this thesis because it was most comprehensive and gives a clearer picture of the devastation caused by this disease in a particular region of the world. The total cases and deaths respectively between 1995 and 2000 are 873 939 and 3 858. Although the total case fatality rate is very low at 0,44%, looking at a broader perspective of emerging infectious diseases, one can look at quality of life issues with having this disease. Onset is sudden, with fever, chills, cephalgia, retro-ocular pain, photophobia, and muscle and joint pain. There can also be nausea, vomiting, and sore throat. Additionally, a general erythema is common. The lymph nodes become enlarged and palbable. The fever is diphasic and can last up to several days. Convalescence, with fatigue and depression may take several weeks (Acha and Szyfres, 1003:94-98).

Table 1.20 Number of reported Dengue Virus cases and deaths from selected countries and areas in the Western Pacific Region, 1995-2000. C = cases; D = deaths.

Year	1995		1996		1997		1998		1999		2000	
Country/Area	C	D	C	D	C	D	C	D	C	D	C	D
American Samoa	246		49				205		1		0	
Australia	34	0	43		205		558	0	181		231	

Brunei Darussalam	3						2		8		0	
Year Cambodia	10428	424	1433	73	4224	177	16216	475	1530	37	3148	73
China	6114	0	8		637	0	76		1306	0	405	
Cook Islands	786		2		1075	0	0	0				
Fiji	31	0	2				24780	13	430			
French Polynesia	206		577				16	0	33	0	3	0
Guam	0		0		1		2	0	1			
Hong Kong	6		5		10		15		5		11	
Japan	19	0	17	0	15	0	58	0	10	0	18	0
LaoPDR	7781	31	8197	24	3411	16	7671	30	2507	4	1377	4
Macao			1				0		0		0	
Malaysia	6543	28	14255	30	19544	50	27379	58	10008		7118	37
N Mariana Isl	0						3	0	0		0	
Marshall Isl	0		0				0		0		0	
FS Micronesia	66		67				315	0	0		14	
New Caledonia	2211		2121		154		2612	0	354	0	12	0
New Zealand			11				25		9		7	
Niue	0	0	1	0			0		0		0	
Palau	202						13	0	1	0	739	1
Philippines	5166	88	13614	197	12811	314	35648	514	9221		7731	
Samoa	388		1006		163		49	0				
Singapore	2008	1	3128	3	4300	1	5258	1	1355	5	673	0
Solomon Isl	1		3									
Tokelau			6									
Tonga	0		3		0		205	1				
Tuvalu			3		0		2					
Vanuatu	100		19				131	0	110			
Viet Nam	80447	222	86621	204	107188	226	234920	377	36996	66	24116	52
Wallis & Futana	3		0				395	1				
Total	122789	794	131189	531	153738	784	356554	1470	64066	112	45603	167

(Summary 2001:8)

Dengue disease is caused by invertebrate vectors:

- ***Aedes aegypti***
- ***Aedes albopictus***
- ***Aedes niveus.***

This disease is also dependent on climatology. Dengue occurs most often during rainy seasons. ***Aedes aegypti* is highly anthropophillic**, meaning it loves to feed on man and in so doing infects man (Acha and Szyfres, 2003:94-98).

1.1.7 WEST NILE VIRUS

The case fatality rate for West Nile Virus for 2002 in the United States of America was 7%, with 4,156 cases and 284 deaths as shown in Table 1.21(CDC/DVBID 2003:1). An increase in the incidence of West Nile Virus is projected in Florida, United States of America, because of the occurrence of four (4) hurricanes that hit the state in the year 2004. A massive amount of rain fell on Florida. An increase in the incidence of West Nile Virus is projected if there are favourable environmental factors such as warmer, more humid weather (Hubolek and Halouzka 1999:643-648).

Table 1.21 West Nile Virus – 2002 Case Count

State	Laboratory-Positive Human Cases	Deaths
Alabama	49	3
Arkansas	43	3
California	1	
Colorado	14	
Connecticut	17	
Delaware	1	
District of Columbia	34	1
Florida	28	2
Georgia	44	7
Illinois	884	64
Indiana	293	11
Iowa	54	2
Kansas	22	
Kentucky	75	5
Louisiana	329	25
Maryland	36	7
Massachusetts	23	3
Michigan	614	51
Minnesota	48	
Mississippi	192	12
Missouri	168	7
Montana	2	

Nebraska	152	7
New Jersey	24	
New York	82	5
North Carolina	2	
North Dakota	17	2
Ohio	441	31
Oklahoma	21	2
Pennsylvania	62	7
Rhode Island	1	
South Carolina	1	
South Dakota	37	
Tennessee	56	7
Texas	202	13
Vermont	1	
Virginia	29	2
West Virginia	3	2
Wisconsin	52	3
Wyoming	2	
Totals	**4156**	**284**

(CDC/DVBID 2003:1)

These are the total West Nile virus (WNV) disease cases from 2002 reported to ArboNet, a national, electronic surveillance system established by CDC to assist states in tracking WNV and other mosquito-borne viruses.

A West Nile Virus surveillance program has been initiated in 49 states and human surveillance for West Nile Virus infection in Ontario, Canada (Ford-Jones 2002:29-35; CDC/DVBID 2003:1-3).

The start of West Nile Virus (WNV) infections in the United States of America prompted Ontario, Canada to establish a surveillance system to monitor the spread of WNV into the province. The surveillance system incorporated monitoring dead birds, sentinel chickens, mosquito pools and human disease.

Between 1 July 2000 and 31 October 2000 active human surveillance for WNV infection was undertaken at 60 selected sentinel hospitals in Ontario, Canada. Enhanced passive surveillance was conducted through education and review of laboratory reports of specimens submitted from other hospitals and physicians' offices (CMAJ 2002: 29-35). Based on the following data, it appears that the human surveillance system for West Nile Virus in Ontario, Canada is effective:

- For the year 2004 the total clinical cases were 13 with 0 deaths. The Case fatality rate was 0%

- For the year 2003 the total clinical cases were 89 with 2 deaths. The Case fatality rate was 2.25%.

- For the year 2002 the total confirmed cases were 319 with 18 deaths. The case fatality rate was 5.64%.

- For the year 2001 there were no confirmed cases.
- For the year 2000 there were no confirmed cases.

(Ontario 2004:1).

Based on the following data, it would appear that the human surveillance system for West Nile Virus in Canada is effective:

- For the year 2004 surveillance programme there were a total of 25 clinical cases with 0 deaths reported. That is a 0% case fatality rate.

- For the year 2003 surveillance programme there were 851 probable positive human cases with 466 confirmed positive human cases and 10 deaths. That is a 2.15% case fatality rate.

- For the year 2002 surveillance programme there were 86 probable positive human cases with 340 confirmed positive human cases and 20 deaths. That is a 5.88% case fatality rate.

This goes to prove that an active, responsive surveillance system working in tandem with an enhanced passive surveillance system can have an effect on zoonosis. As reflected in the decreasing case fatality rates, the human surveillance programme for West Nile Virus in Canada and in Ontario in particular is extremely effective (Ontario 2004:1;West Nile Virus Monitor 2004:1).

By looking at the tables 1. 21, 1.22 and 1.23, one sees that not all of the 49 states have reported data in the West Nile Virus surveillance program in the United States of America. Looking at Table 1.22, West Nile Virus Activity for 2003, the total human cases reported to CDC was 9862 with 264 deaths. That is a case fatality rate of 2.68%. Table 1.23, West Nile

Virus Activity for 2004, shows 2470 cases reported to CDC with 88 deaths. That is a case fatality rate of 3.56%. For the state of Florida the case fatality rates for the years 2002, 2003 and 2004 respectively are as follows:

- 7.14%
- 6.38%
- 4.88%.

Interpretation of the above data does not appear to support Hubalek's and Halouzka's projections but it does indicate that overall West Nile Virus surveillance needs improvement since there has been an increase in the case fatality rate from 2003 to 2004 by 0.88%.

Table 1.22 2003 West Nile Virus Activity in the United States of America (As of 21 May 2004)*

State	Neuroinvasive disease	Fever	Un-specified	Total Human Cases Reported to CDC	Deaths
Alabama	25	10	2	37	3
Arizona	7	2	4	13	1
Arkansas	23	2	0	25	0
California	2	1	0	3	0
Colorado	621	2326	0	2947	63
Connecticut	12	5	0	17	0
Delaware	12	4	1	17	2
District of Columbia	3	0	0	3	0

Florida	61	33	0	94	6
Georgia	27	21	2	50	4
Idaho	0	1	0	1	0
Illinois	30	24	0	54	1
Indiana	15	31	1	47	4
Iowa	81	65	1	147	6
Kansas	89	0	2	91	4
Kentucky	11	1	2	14	1
Louisiana	101	23	0	124	8
Maryland	49	23	1	73	8
Massachusetts	12	5	0	17	1
Michigan	14	4	1	19	2
Minnesota	48	100	0	148	4
Mississippi	34	38	15	87	1
Missouri	39	25	0	64	8
Montana	75	135	12	222	4
Nebraska	194	1741	7	1942	29
Nevada	2	0	0	2	0
New Hampshire	2	0	1	3	0
New Jersey	21	9	4	34	3
New Mexico	74	135	0	209	4
New York	57	12	2	71	11
North Carolina	16	8	0	24	2
North Dakota	94	523	0	617	5
Ohio	84	24	0	108	8
Oklahoma	56	23	0	79	0
Pennsylvania	145	90	2	237	8
Rhode Island	5	2	0	7	1
South Carolina	3	3	0	6	0
South Dakota	151	869	19	1039	14
Tennessee	21	5	0	26	1
Texas	431	289	0	720	37
Utah	0	1	0	1	0
Vermont	0	3	0	3	0
Virginia	19	1	6	26	1
West Virginia	1	1	0	2	0
Wisconsin	7	2	8	17	0
Wyoming	92	210	73	375	9
Total	**2866**	**6830**	**166**	**9862**	**264**

(CDC/DVBID 2004:1-4)

Total Human Cases Reported to CDC for 2003 - These numbers reflect both mild and severe human disease cases occurring between 1 Jan - 31Dec 2003 that have been

reported to ArboNet by state and local health departments. ArboNet is the national, electronic surveillance system established by CDC to assist states in tracking West Nile virus and other mosquito-borne viruses.

Table 1.23 2004 West Nile Virus Activity in the USA (As of 11 January 2005)*

State	Neuroinvasive disease	Fever	Other Clinical/ Unspecified	Total Human Cases Reported to CDC	Deaths
Alabama	15	0	0	15	0
Arizona	129	76	186	391	14
Arkansas	12	9	1	22	0
California	156	269	346	771	23
Colorado	39	237	0	276	3
Connecticut	0	1	0	1	0
District of Columbia	1	0	0	1	0
Florida	33	8	0	41	2
Georgia	12	7	0	19	0
Idaho	0	1	2	3	0
Illinois	28	28	1	57	3
Indiana	8	1	3	12	1
Iowa	13	8	1	22	2
Kansas	18	25	0	43	2

Kentucky	1	6	0	7	0
Louisiana	81	21	0	102	7
Maryland	8	7	1	16	0
Michigan	13	3	0	16	0
Minnesota	13	21	0	34	2
Mississippi	31	18	2	51	4
Missouri	26	9	2	37	2
Montana	2	3	1	6	0
Nebraska	7	42	0	49	0
Nevada	25	19	0	44	0
New Jersey	1	0	0	1	0
New Mexico	31	53	4	88	4
New York	7	3	0	10	0
North Carolina	3	0	0	3	0
North Dakota	2	18	0	20	1
Ohio	11	1	0	12	2
Oklahoma	15	5	0	20	2
Oregon	0	3	0	3	0
Pennsylvania	9	5	1	15	2
South Carolina	0	1	0	1	0
South Dakota	6	45	0	51	1
Tennessee	13	1	0	14	0
Texas	114	44	0	158	8
Utah	6	5	0	11	0
Virginia	4	0	1	5	1
Wisconsin	5	7	0	12	2
Wyoming	2	7	1	10	0
Total	**900**	**1017**	**553**	**2470**	**88**

(CDC/DVBID 2005:1-4)

Total Human Cases Reported to CDC - These numbers reflect both mild and severe human disease cases occurring between 1 January 2004 through 11January 2005 that have been reported to ArboNet by state and local health departments. ArboNet is the national, electronic surveillance system established by CDC to assist states in tracking West Nile virus and other mosquito-borne viruses.

There are certain things that people can do to protect themselves form the West Nile Virus:

- Spray yourself and your clothing with an effective insect repellent containing DEET® (diethyltoluamide) or permethrin®, a pyrethroid insecticide applied topically in the

treatment of infestations by *Pediculus humanus capitis, Sarcoptes scabei* and various species of ticks (Dorland's Medical Dictionary 2003:1408). Do not use it on children less than two years old.

- Change water in outdoor pet dishes and birdbaths often.

- Keep children's wading pools empty and on their sides when not in use.

- Stay inside during times when there are a lot of mosquitoes (evening or dusk until dawn).

- minimise the number of mosquitoes around the home by eliminating any standing water where mosquitoes can lay their eggs (flower pots, buckets, barrels, and tire swings).

- Don't wear perfume or cologne when you go outside for a long time.
- Wear long-sleeved shirts and long pants and light coloured clothing.

- Put screens on your windows and doors.

- If you use bug spray, wash your clothes before you wear them again.

(FDA/Office of Women's Health 2003: 1-2).

The above referenced measures of prevention can be part of an organised surveillance System, a public awareness campaign to initiate preventive action to decrease the likelihood of human infection.

Table 1.24 shows WNV cases, deaths and case fatality rates from 1999 through 2003 in the United States of America. There was an apparent decrease in case fatality rates of 14% from 1999-2001 to 2% in 2003. This is excellent news, which means that the United States of America's health care system is diligently doing its job and combating this emerging infectious disease.

Table 1.24 WNV cases, deaths and case fatality rates (USA)

Year	Cases	Deaths	CFR
1999 - 2001	131	18	14
2002	4156	284	7
2003 14-20August	322	5	2
2003	715	14	2

(CDC/DVBID 2003b:1-177)

Table 1. 25 describes the functions of the Division of Vector-Borne Infectious Diseases.

Table 1.25 Division of Vector-Borne Infectious Diseases (DVBID)

2003	The DVBID arbovirus disease branch conducts surveillance, field investigations and laboratory studies of vector-borne viral agents and their vectors and additionally it defines disease etiology, ecology and pathogenesis in order to develop methods and strategies for disease diagnosis, surveillance, prevention, and control

(CDC/DVBID 2003a:1)

West Nile Virus was included in the list of emerging infectious diseases because it is also caused by the following invertebrate vectors:

- ***Culix univittatus***
- ***Culix molestus***
- ***Culix vishnui***
- ***Culix modestican***
- ***Culix restuans***
- ***Culix salinarius***
- ***Culix tritaeniorhyncus.***

Although ***Culix*** mosquitoes are ornithophilic, they are not always anthropophilic (Acha and Szyfres 2003:372-377).

During rainy seasons there is a greater chance of having more cases of West Nile Virus because the life cycle of a mosquito is as follows:

- mosquitoes lay their eggs in water
- the eggs become larvae
- larvae turn into pupae
- pupae become adult mosquitoes

(Encyclopaedia of Discovery: Nature 2002:276-277)

1.1.8 GROUP B STREPTOCOCCUS (GBS)

This is a disease of newborns. There are two clinical syndromes of Group B Streptococcus. Early onset or acute syndrome appears between the first and fifth day of life and clinical symptoms are characterized by sepsis and respiratory problems. Early onset has a case fatality rate of 50%. Delayed or late onset occurs after the tenth day of life and is characterized by the following: meningitis, with or without sepsis, lethargy, convulsions and anorexia. Late onset has a case fatality rate of 25%. There is a higher case fatality rate for early onset syndrome. Surveillance data shows a reduction in GBS Disease (Chin 2000:477; Schuchat et al 2001:92-99). The implications of the case fatality rates indicates that more focus should be on the early onset aspect of this disease since it has a higher case fatality rate than late onset. Group B Streptococcus is the only anthroponotic disease studied in this research and it highlights that not all emerging infectious diseases are zoonotic. Although there are some reductions in GBS disease, further improvement is required.

Older children and adults can sometimes also become infected with Group B Streptococcus infection, which then causes the following clinical syndromes: bacteraemia, gangrene, urinary tract infections, postpartum infection, endocarditis, pneumonia, empyema, meningitis, and other conditions of a pathological nature (Acha and Szyfres 2003:257-263). This disease not only infects newborns and young children but can also infect older children and adults. It is a pernicious disease. Knowing of the infectious nature of this disease can help in taking steps towards its prevention.

Group B Streptococcus is an anthroponotic disease passed on from mothers, which are the primary reservoir of this disease, to their newborns. It is sometimes caught by older children and adults. Group B Streptococcus colonises between 7% to >30% of women in different locations of the body such as the cervico-vaginal region, the upper respiratory tract and the intestinal tract (Acha and Szyfres 2003:261). This implies that since we know the reservoir of the disease, it can be contained. As the data shows, this is not the case, otherwise there would be a 0% case fatality rate.

Prevention of early onset has been attempted with promising results by giving active immunisations to pregnant women. This is significant to prevent neonatal death, which has a higher case fatality rate than late onset (Acha and Szyfres 2003:257-263). Capsular polysaccharides of Group B Streptococcus, as well as passive immunisation with immunoglobulin preparations were given intravenously (Acha and Szyfres 2003: 263).

Results have been promising with prophylactic intravenous injections of ampicillin® to women in labour. Success has been achieved, since only 2.8% of newborns of mothers receiving ampicillin® were colonised by Group B Streptococcus and none became ill (Acha and Szyfres 2003: 263). The promising results of these prevention techniques give hope to future mothers.

Possible prevention of infectious disease outbreaks, recrudescence and a decrease in case fatality rates, incidence and prevalence are the expected outcomes if the results of this research are implemented. With the extensive number of emerging infectious diseases in

the human population and the number of related deaths, an increase in the number of surveillance systems can reduce case fatality rates and therefore save lives.

Table 1.26 shows the case fatality rate for two decades and 1997 in the USA.

Table 1.26 Group B Streptococcus Case fatality rates (USA)

Year	CFR%
1970s	50
1980s	10
1997	9

(CDC 2000:24; CDC/ABCs 1997:1)

Table 1.27 shows the number of cases, deaths and case fatality rates from 1997 to 2000 in active bacterial core surveillance areas. Active Bacterial Core Surveillance (ABCs) of the Emerging Infectious Programme Network is a collaboration between the Centres for Disease Control and Prevention and several health departments and universities within the Network. ABCs conducts population-based active surveillance and collects specimens and studies diseases caused by Streptococcus Group A and B, N. Meningitis, S. Pneumoniae and Haemophilus influenza (Schuchat, 2001:92-99). Active Bacterial Core Surveillance is within the Division of Bacterial and Mycotic Diseases within the CDC. This division monitors several diseases icnluding GBS. In January 2001, a population of over 29 953 583 was monitored for GBS.

Table 1.27 Group B Streptococcus cases, deaths, and case fatality rates – Active bacterial core surveillance areas

Year	Cases	Deaths	CFR %
1997	1308	119	9
1998	1454	137	9
1999	1595	171	11
2000	1840	182	10
2001	2031	201	10
2002	2117	207	10

(CDC/ABCs 1997:1; CDC/ABCs 1998:1; CDC/ABCs 1999:1; CDC/ABCs 2000a:1; CDC/ABCs 2001:1;

CDC/ABCs 2002:1)

Group B Streptococcus (GBS) is anthroponotic, meaning it is transmitted from human to human with no vector involved. In this case, the mother is the carrier and the baby is the victim. Group B Streptococcus became the leading cause of sepsis and meningitis during the1970s among newborns throughout the United Sates of America. From the 1970s, when the case fatality rate was 50%, there was a substantial decrease during the 1980s to 10% because of improved recognition and treatment. Group B Streptococcus continues to stay at around the 10% case fatality rate and the Centers for Disease Control and Prevention has recommended that Group B Streptococcus prevention be integrated into all obstetric care programs (CDC 2000:24).

1.2 DEFINITIONS

The following are the operational definitions that will be used throughout this thesis unless otherwise indicated.

Active Surveillance – Is an inclusive dynamic process comprising all or some of the following activities and or actions, either collectively or singularly as required by specific circumstances. It comprises: the seeking of data from participants in the surveillance system on a regular basis; the active solicitation of case reports from health care providers or health care facilities; the selective slaughter or eradication of identified animals and vectors to break the chain of infection; the seeking of reports from all participants in the surveillance system on a regular basis, rather than waiting for reports to arrive; and the regular analysis of information obtained from surveillance systems and case fatality rates

(Word Bank, 2002:1-3; Lilienfeld & Stolley, 1994:105; Johara et al, 2001: 439-441; Wegner, 2004).

Anthroponosis – Is a disease that is spread from humans to humans. There is no vector Involved in the transmission of the disease from humans to humans (Dorland's Medical Dictionary 2003:99).

Case- Is defined as a set of diagnostic criteria that must be fulfilled in order to identify a person as a case of a particular disease (Last 2001:24).

Case Fatality Rate - This refers to the proportion of cases of a specified condition that are fatal within a specified time (Last 2001:24).

Incidence – Refers to the number of new events of a particular disease/conditions, e.g. new cases of disease in a defined population, within a specified period of time (Last 2001:91).

Incidence Rate – It is the rate at which new cases or events occur in a population. The numerator is the number of new events that occur in a defined period; the denominator is the population at risk of experiencing the event during this period (Last 2001:92).

Monitoring - The intermittent performance and analysis of routine measurements, aimed at detecting changes in the environment or health status of populations. Monitoring should

not be confused with surveillance, which is a continuous process (Last 2001:117).

Passive Surveillance - Passive surveillance is the reporting of cases by health care professionals at their discretion (Lilienfeld and Stolley 1994:105). It is surveillance where reports are awaited and no attempt is made to actively seek reports from the participants in the system (World Bank 2005: 1-3).

Prevalence - Indicates the number of events, e.g. instances of a given disease or other condition, in a given population at a designated time (Last 2001:140).

Prevalence Rate - The total number of all individuals who have an attribute or disease at a particular time (or during a particular period) divided by the population at risk of having the attribute or disease at that point in time or midway through the period (Last 2001:141).

Recrudescence - Reactivation or recurrence of a disease after an intermission (Last 2001:153; Merriam-Webster's Medical Dictionary 1995:587; Dorland's Medical Dictionary 2003:1597). As an example, Nipah virus originated in Malaysia in mid 1999 and was eradicated in 1999. There were no new cases of the Nipah virus reported until March 2004 in Bangladesh where there was a recrudescence of Nipah virus.

Reservoir of Infection- Any person, animal, arthropod, plant, soil, or substance, or a combination of these, in which an infectious agent normally lives and multiplies, on which it depends primarily for survival, and where it reproduces itself in such a manner that it can be transmitted to a susceptible host (Last 2001:158).

Sentinel Surveillance – Sentinel surveillance is the collection and analysis of data by designated institutions selected for their geographical location, medical specialty, and ability to accurately diagnose and report high quality data. Generally, sentinel surveillance is useful for answering specific epidemiological questions, but because sentinel sites may not represent the general population or the general incidence of disease, they may have limited usefulness in analysing national disease patterns and trends (USAID Health 2005:1). Sentinel surveillance relies on reports of cases of disease where occurrence suggests that the quality of preventive or therapeutic medical care needs to be improved (Lilienfeld and Stolley 1994:105).

Seroconversion - Seroconversion is defined as the change of a serologic test from negative to positive, indicating the development of antibodies in response to infection or immunisation (Dorland's Medical Dictionary 2003:1685).

Surveillance - Surveillance is the process of systematic ongoing collection, collation, and analysis of data and the timely dissemination of information to those who need to know so that action can be taken (Last 2001:174).

Vector- An insect or any living carrier that transports an infectious agent from an infected individual or its wastes to a susceptible individual or its food or immediate surroundings (Last 2001:185-186).

Zoonosis - An infection or infectious disease transmissible under natural conditions from vertebrate animals to humans (pl-zoonoses) (Last, 2001:189). An unnatural occurrence of a zoonosis would be a case of bioterrorism. For example, a case of Ebola occurring in New York City.

1.3 STATEMENT OF PROBLEM

Seventy-five percent of all human diseases are caused by zoonoses (Field 2003:1-12). It is projected that there will be 278 million more deaths caused by HIV/AIDS by 2050 (Ultricianum Times 2003:1). Since 1981 the cumulative total number of HIV/AIDS deaths is estimated to be 21.8 million (AIDS Hotline 2003:1). WHO, in collaboration with its partners, is developing strategies for strengthening surveillance, prevention and control (WHO/CSR 2003e:1). The central purpose of this research is to provide sufficient research information that can be utilised by responsible parties to possibly save lives. Knowing future projections of the HIV/AIDS pandemic can be a valuable tool because prevention measures can be implemented to possibly break the chain of transmission, although at this point in time that is unlikely since it is now well embedded in the human population. The
best recourse at this time is prevention and public awareness of the disease and its damaging effect on the human population.

More than 804 have died from SARS (Cumulative 2003:1). The cumulative number of probable cases of SARS as of 19 June 2003 was 8462, with 7178 recoveries and 804 deaths (Cumulative 2003:1). WHO determined the case fatality rate for SARS at 9.5%. This implies that this newly emerging infectious disease is a serious threat to the human population and must be dealt with swiftly for fear of a pandemic.

Approximately 2.5 billion people worldwide are at risk of Dengue virus (Gill 1998:1-83). The serotypes of Dengue Fever are non-lethal and the case fatality rate is very low, while the more serious and deadly form is Dengue Haemorrhagic Fever (DHF) carried by DEN-2. The implications here are for further prevention measures and enhanced surveillance particularly for DHF.

Since 2002 there were 116 fatalities caused by Ebola Hemorrhagic Fever:

- Gabon (2002 -18 deaths; 2003 – 50 deaths)
- The Republic of the Congo (2002 – 7 deaths: 2003 – 28 deaths)
- Sudan (2004 – 6 deaths)
- South Sudan (2004 – 7 deaths).

(Special Pathogens Branch 2003:1) .

The implication here is that finding the reservoir for Ebola Virus is of utmost importance as a first step towards breaking the chain of transmission. The total cases of Ebola Haemorrhagic Fever in Africa between 1976 and 2002 were 1644, with 1109 fatalities (Casillas *et al* 2003:268 -275). Ebola Virus has a very high case fatality rate and is endemic to Africa. As reported, for over 26 years the virus has been active in its survival and lethal in 1109 cases.

The case fatality rate for West Nile Virus for 2002 in the United States was 7%, with 4,156 cases and 284 deaths (CDC/DVBID 2004:1). West Nile virus has also been found in farmed alligators in south Georgia and central Florida in the United States, and in one captive crocodile from the District of Columbia and Maryland area (MillerIngram *et al* 2003:794; Steinman *et al* 2003:95). West Nile Virus is tracked by ArboNet, the national electronic surveillance system established by the Centers for Disease Control and Prevention (CDC/DVBID 2004:1). ArboNet, as previously reported, is an effective surveillance tool for capturing West Nile Virus cases but further enhanced surveillance and response is necessary to further reduce case fatality rates.

Nipah virus has a high case fatality rate of 48%, but the disease was stopped through the culling of 1.1 million pigs (Meng 2003; Disease Archive 2003a:1; Lashley & Durham 2002:374-375,414). This is an excellent example of a proactive approach to disease control.

Monkeypox has now appeared in the western hemisphere. Monkeypox is not a new zoonoses but its recrudescence in the Western hemisphere is. Thirty-five cases were laboratory confirmed by the CDC. No deaths have occurred in the United States. Since Monkeypox is a most recent emerging infectious disease in the United States of America its implications are great in that it is another threat to the public health. The days of complacency towards infectious disease are over.

An estimated 97 000 – 100 000 invasive infections leading to 10,000 deaths were caused by Active Bacterial Core pathogens, which include Group B Streptococcus (GBS) in the United States of America in 1998 (CDC2000:24;Schuchat *et al* 2001:92). These are problems of great magnitude because lives are at stake. More attention must be paid to surveillance and response to these emerging infectious diseases and to prevention measures for the public safety. During the 1970s, GBS was the leading cause of meningitis and sepsis among newborns throughout the United States of America, leading to a case fatality rate of 50% (CDC 2000:24). Prevention measures have been implemented successfully to reduce case fatality rates via administration of ampicillin®. This research focuses on eight emerging infectious diseases of importance to a wide spectrum of health-related professionals. This study is of importance to the following health professionals: medical practitioners, professional nurses, hygienists, bacteriologists, virologists and many more. The statistics provided here are frightening, if not overwhelming:

- HIV/AIDS – Two hundred and seventy-eight million more deaths are projected by 2050.

- SARS – As of 19 June 2003 there were 804 deaths with a case fatality rate of 9.5%.
- Dengue virus – Approximately 2.5 billion people worldwide are at risk of Dengue virus.
- Ebola virus – Ebola virus has caused 1109 fatalities between 1976 and 2002.
- West Nile Virus – In the United States of America, West Nile Virus has a 7% case fatality rate.
- Nipah virus – Nipah virus had a case fatality rate of 48% and has recrudesced in Bangladesh.
- Monkeypox – Monkeypox has recrudesced in the United States of America.
- Group B Streptococcus (GBS) – GBS had a 50% case fatality rate in the 1970's.

Clearly, a proactive response to these and countless other emerging infectious diseases is necessary in order to save lives by breaking the chain of transmission of each one of these diseases. Needless deaths caused by a lack of proper surveillance are unacceptable. Active surveillance and response could be one solution to prevent and /or decrease case

fatality rates, incidence rates and /or disease prevalence rates caused by emerging infectious diseases.

Furthermore, emerging infectious diseases that are not lethal pose quality of life issues. A key example of a quality of life issue is with HIV patients. Common conditions in patients with HIV include:

- Oral candidasis, better known as thrush caused by *C. albicans*. Commonly characterized by white patches along the gums and tongue and inside the cheeks. When patches are scraped off, an inflamed red undersurface remains. Thrush can be painless or can cause severe pain with chewing or swallowing.

- Another condition known as oral hairy leukoplakia indicates the progressive destruction of the immune system. Painless, wart-like patches appear on the surface of the tongue.

- In women, pelvic inflammatory disease (PID) is another sign of HIV. Serious complications can result from patients with PID, including ectopic pregnancy, chronic pelvic pain, and infertility.

- HIV – infected patients can be expected to experience psychological problems in addition to physical problems (Harper 2000: 31-39). The combination of

psychological and physical problems is an added burden placed on HIV/AIDS patients in addition to dealing with the effects of the disease alone

HIV infected patients can experience stages of grief, denial, anxiety, anger, guilt, bargaining, and depression. HIV infected patients need to go through potent antiretroviral therapy and need psychological support (Harper 2000:31-39).

This implies that emerging infectious diseases should be viewed with a broader perspective, meaning emerging infectious diseases have more ramifications above and beyond the disease itself that must be dealt with. Although death is the final stage, living with an emerging infectious disease is a challenge for the patient in that the patient must deal with the psychological manifestations of having the disease and the physical impact that the disease has on the body.

Many responses to emerging infectious diseases have been reactive. A prime example of a reactive response to an emerging infectious disease is that to Ebola virus. Because the reservoir is still yet unidentified, maintaining active surveillance is difficult. Only when there is an Ebola outbreak, there is a reactive response to it. Of course the consequence of a reactive response is that more lives are lost. This is the most complex situation of all the infectious diseases because the reservoir is still unidentified. Additionally, within the endemic area most villages do not welcome outsiders, which makes surveillance that more difficult. Since active surveillance is expensive, the last resort is a reactive response to an outbreak.

A comprehensive study of the types of surveillance systems in place for each specific disease is part of the focus of this study and will be discussed in Chapter 2. Additionally, a comprehensive comparative table will be provided. Active surveillance could be one solution to prevent or to decrease the number of case fatality rates, incidence rates, and prevalence rates caused by emerging infectious diseases. The number of surveillance systems in place seems to be a relevant issue.

1.4 RESEARCH QUESTIONS

The following research questions are based on the prevailing notion that there is an increase in the number of newly emerging infectious diseases throughout the world. The following four (4) research questions arose from scientific curiosity of the researcher, which led to this research.

1. Are zoonoses and anthroponosis more prevalent in the human population because active surveillance is lacking?

2. Is thwarting a disease at pre-emergence or at outbreak a possibility?

3. Is there a statistical significance between the type of surveillance and the emerging infectious disease?

4. Does the type of surveillance (active, passive, sentinel) and response have any

effect on case fatality rates, disease incidence, and/or disease prevalence?

1.5 SIGNIFICANCE OF STUDY

This study cannot be said to be important only to individuals from one particular discipline. It is essential for all health professionals (inclusive of nurses), environmentalists, hygienists, bacteriologists, epidemiologists and virologists to have an in-depth knowledge of active surveillance, zoonoses and anthroponosis as well as the contribution active surveillance can make in combating the spread of these, and many other diseases, studied in this thesis.

Firstly, every situation involving an emerging infectious disease is different and should be dealt with accordingly, whether it is bioterrorism, zoonotic or anthroponotic. Evaluation of an outbreak and its possible ramifications needs to be considered. One important point of this evaluation should include the type of surveillance system to initiate that is appropriate to the situation. Since active surveillance is more costly than other types of surveillance systems, but is more effective, careful consideration must be taken before initiating such a system.

Active surveillance is not reactive but proactive and depends on regular periodic collection of case reports from health care providers and facilities. As an example, The HIV Seroepidemiology & AIDS Surveillance Unit of the San Francisco Department of Public Health identifies AIDS cases by conducting active surveillance at medical centres, clinics and private medical practices. The data, which is timely, is gathered to monitor trends in

AIDS survival and the impact that the AIDS epidemic is having on the citizens of San Francisco. The goals of the HIV Seroepidemiology Unit are to assess the burden of HIV infection among the population at risk, to monitor trends in transmission, to detect nascent sub-epidemics and to find empirical evidence of the impact of community–wide prevention programs (HIV Seroepidemiology 2005:1). Active surveillance data is more reliable as opposed to passive surveillance data, which relies upon case reporting of health care professional at their discretion.

Reduction of case fatality rates has a positive correlation with the number of surveillance systems. Data has been analysed using one-way analysis of variance. The F ratio is interpreted for critical values of $\alpha=.05$ or $\alpha=.01$. Four diseases, organised by country, were analysed by number of surveillance systems and case fatality rates: AIDS, SARS, Ebola virus and Group B Streptococcus. Case fatality rates were treated as dependent variables and the number of surveillance systems as independent variables. Statistically, there may seem to be sufficient evidence to reject the (H_0) null hypothesis in favour of the (H_1) alternative hypothesis. Active surveillance systems are said to be more effective than passive systems (Lilienfeld and Stolley 1994:104-106). Active surveillance requires more effort by the data collection centre than does passive surveillance. Although active surveillance is more expensive to maintain, the data collected appears to be more complete, accurate and timely. In an evaluation of active and passive surveillance systems for notifiable diseases in Vermont and in Pierce County, Washington, the physicians in the active system reported twice as many notifiable diseases per patient as did physicians in the passive one (Lilienfeld and Stolley 1994:104-105).

With all this in mind, the researcher assumed that even though it may appear that active surveillance is the most effective system, it remains essential to determine through this research to determine to which degree this is so.

Keeping the definition of zoonosis in mind as indicated on page 54 of this thesis, an important aspect is the fact that zoonosis refers to an infectious disease transmissible ***under natural conditions*** from vertebrate animals to humans. Biologically, ***under natural conditions*** refers to not being produced or changed artificially, and also not conditioned. An example of unnatural conditions would be an act of bioterrorism as mentioned in the definition on page 54 above. Zoonoses may be either epizootic or enzootic (Last 2001: 62, 189). Epizootic is defined as an outbreak of disease in an animal population with a possibility of infecting humans. Enzootic is defined as being present only in an animal population (Dorland's Medical Dictionary 2003: 623). Infectious diseases that are not transmitted from vertebrate animals are vector-borne.

Anthroponosis is defined as a disease that is spread from humans to humans (Dorland's Medical dictionary 2003:99). For the purposes of this research, any disease that is transmitted by a vector will be considered zoonotic.

Having knowledge of active surveillance, zoonoses and anthroponosis can indirectly save lives by the direct and immediate implementation of active systems and immediate responses to emerging infectious disease outbreaks. With continued watchfulness for trends of disease incidence, prevalence, incidence rates, prevalence rates and case fatality rates as indicators of disease progression in a population, an active surveillance can save

lives. The implementation of the recommendations of this study will result in reduced case fatality rates, reduced incidence rates and reduced prevalence rates. Emergence of zoonoses and anthroponosis was statistically proven to be limited by the number of surveillance systems in place. A greater number of surveillance systems in place is likely to have an effect on decreasing case fatality rates. Additionally, it was found that there is a negative correlation between the number of surveillance systems and incidence rates. The negative correlation suggests that, given a greater number of surveillance systems, the incidence rates will slow or decrease. It was also found that there is a positive correlation between HIV incidence rates and prevalence rates indicating that if incidence rates decrease, prevalence rates will more than likely decrease and if prevalence rates increase, incidence rates will more than likely show an increase.

The following personnel can all benefit from this research:

- Epidemiologists
- Medical doctors
- Veterinarians
- Health care workers
- Animal caretakers
- Professional nurses
- Farm workers.

1.6 PURPOSE AND OBJECTIVES OF THE STUDY

The general aim of this study is to research if there are any effects of active surveillance and response to zoonoses and anthroponosis. The specific aim of this study though, is to focus on surveillance systems in general and their effects on zoonoses and anthroponosis. Seventy-five percent of human emerging infectious diseases are zoonotic (Field 2003:1-12). This research will focus on several global microbial threats: an AIDS pandemic, two newly emerging infectious diseases—Monkeypox and Severe Acute Respiratory Syndrome (SARS)—Ebola and Nipah viral endemics, Dengue fever and West Nile virus (WNV) epidemics, and Group B Streptococcus which is anthroponotic. Infectious diseases are the third leading cause of death in the USA and the leading cause of death world-wide (Binder *et al* 1999:1311-1313). If this isn't enough information to shock the global healthcare system, which we do not have by the way, into taking appropriate action, nothing will. World health care is splintered and fragmented and in the United States of America specifically the healthcare system is pluralistic, meaning it provides alternatives. For example, medical care can be obtained from solo practitioners or group practices or prepaid health plans (Slee's 2001:490).

The purpose and objectives of this study are to lessen human suffering from infectious diseases by determining whether active surveillance or possibly even the number of surveillance systems can thwart an infectious disease early enough to prevent outbreak and possibly prevent an epidemic and or a pandemic.

With all this in mind, the researcher assumed that even though it may appear that active surveillance is the most effective system, it remains essential to determine, through this research, to which degree this is so.

1.7 HYPOTHESIS

Hypothesis is defined as a supposition, arrived at from observation or reflection, that leads to refutable predictions (Last 2001:89). Additionally, it is defined as any conjecture cast in a form that will allow it to be tested and refuted (Last 2001: 89).

There are two forms of hypothesis: (H_0) null hypothesis and (H_1) alternative hypothesis. Null hypothesis is defined as the statistical hypothesis that one variable has no association with another variable or set of variables or that two or more population distributions do not differ from one another. In simplest terms, the null hypothesis states that the results observed in a study, experiment, or test are no different from what might have occurred as a result of the operation of chance alone (Last 2001:125). The alternative hypothesis is the statement that must be true if the null hypothesis is false (Triola 2001: 370-371). Hypothesis testing is used to either reject the null hypothesis in favour of the alternative hypothesis or fail to reject the null hypothesis. The hypothesis was derived empirically, specifically from the observation of the emergence, outbreak and evolution of the SARS epidemic. Where was the surveillance? Why did it spread so quickly? Why did so many people have to die? Either surveillance plays a very significant role in saving lives or it is futile.

The hypothesis for this research is:

***Active surveillance will have an effect on zoonoses and/or anthroponosis in that it will prevent or at least limit, emergence of infectious diseases*.**

1.8 ANALYSIS OF DATA

This research was undertaken to determine if there are any statistically significant differences between the number of surveillance systems used and case fatality rates. The only data collected for this thesis were the data that had **theoretical significance to the hypothesis**. It is impossible to extract information from data that does not have any information to extract. The data used in this research has the following qualities:

- **Consistency,** meaning that any subset of observations from the original data should produce the same information.
- **Inclusiveness,** meaning the data contains the information needed for this research.

- **Replicability,** meaning any researcher should be able to reproduce the collection of the data with the same information.

- **Extractability,** meaning the information needed for this research could be extracted from the data.

(Shugan2002:46-54).

1.8.1 Trustworthiness, Bias, Consistency, and Applicability of Data

Trustworthiness can be defined as the quality of data analysis (Lingard 2004:1). The project's worth is determined by its validity and reliability (Kuhn 2003:29). Trustworthiness can be ensured because randomisation was used in data selection to reduce bias (Valiela 2001:84-85). Bias is defined as a property of a statistical sample that makes it unrepresentative of the whole population (Dictionary of Mathematics 1981:15). In a random sample members of the population were selected in such a way that each had an equal chance of being selected (Triola 2001:19). Biased interpretation of the data through selectivity was avoided because random sampling was applied to data collection. Data was selected from reputable and reliable sources such as the Centers for Disease Control and Prevention, the World Health Organization, medical journals, governmental agencies, and scientists. Government or university-run sites are often good sources for scientifically sound health and medical information (doegenomes.org 2005:1-5). One criterion to evaluate a responsible web site in which to collect data is if it identified and described sponsoring organisations as well as provided contact information so that visitors could use this to ask questions, request additional information and send comments about site content (doegenomes.org2005:1-5). All web sites used met this criterion. Consistency can be defined in terms of dependability of findings and refers to whether the findings would be consistent if the inquiry were replicated with the same respondents or in a similar context

(Kuhn 2003:30). Consistency was used throughout this research. The same methodology was used to search for data. A neutral position was taken in data selection and no data was discarded because it did not fit with other data. The data used in this research has the following qualities:

- **Consistency,** meaning that any subset of observations from the original data should produce the same information.

- **Inclusiveness,** meaning the data contains the information needed for this research.

- **Replicability,** meaning any researcher should be able to reproduce the collection of the data with the same information.

- **Extractability,** meaning the information needed for this research could be extracted from the data. (Shugan2002:46-54).

The researcher used key words on the Internet to secure data. Some examples of the key words used were:

- 2001 Ebola virus case fatality rates
- 2002 HIV/AIDS Prevalence rates
- 2002 HIV/AIDS Incidence rates.

This was done consistently throughout the research process. Additionally, hard copies of scientific data were copied from scientific journals from medical, university and college libraries.

1.8.2 Statistical Analysis of Data

The statistical methods used will be the univariate one way Analysis of Variance (ANOVA), the F ratio and correlations.

The English statistical pioneer Sir Ronald A. Fisher developed ANOVA. It is a general method by which researchers can compare differences among means and assess whether the differences are larger than may be due to chance alone (Valiela 2001: 51-55).

The decision of whether or not to reject the null hypothesis is determined by the relative size of the F ratio. The critical F values for the level of significance used were 1 in 20 (α=.05), or 1 in 100 (α=.01). These levels are spoken of as 'significant' and 'highly significant'. Larger values of the F ratio tend to discredit the null hypothesis(Brase and Brase 1995:787-795). The Greek symbol **alpha** (α) is used to represent the probability of a type 1 error, which is an error that occurs if one rejects the null hypothesis when it is true (Blueman 1995:639; 643).

A correlation exists between two variables when one of them is related to the other in some way. It is a measure of the degree to which two variables vary together (Valiela 2001:63—67). Correlation is not causation–just because two things vary together does not mean one

causes the other (Valiela 2001:279). Correlations cannot be taken to mean that changes in **X** cause changes in **Y** (Valiela 2001:63-67).

In general 'correlations can only suggest' that variables vary together in some fashion, not that there is a causal link between an independent variable whose effect we are curious about, and the dependent variable presumably affected (Valiela 2001:14-17).

There are five types of possible correlations:

- **Negative correlation**
- **Positive correlation**
- **Uncorrelated**
- **Nonlinear correlation**
- **Spurious correlation**

(Triola 2001:506-507; Valiela 2001:16).

The following definitions apply to correlations:

- **Negative correlation** exists when there is an inverse linear relationship between the two variables. When one variable increases, the other variable decreases.

- **Positive correlation** exists when one variable increases, the other variable also increases. There is linearity.

- **Uncorrelated** means that the two variables are not related.

- **Nonlinear correlation** means that a relationship may exist between two variables but there is no linearity.

- **Spurious correlation** means that although a direct relationship seems implausible, at least to the neutral observer, nonetheless there is a relationship between two variables. One example of a spurious correlation is the increase in telephone poles in the United States of America during the early twentieth century, and the parallel decline in typhoid fever reports (Valiela 2001:16) .

Correlations will be looked for between incidence rates and prevalence rates, and incidence rates and the number of surveillance systems. All mathematical calculations were done by hand and verified as correct using Excel Microsoft Office 2003 with its data analysis tools**.** Calculation of the Pearson correlation coefficient (r) was done using the raw score method. In order to test the significance of the correlation coefficient, a criterion of significance of .05 or .01 was selected. (Welowitz *et al* 1991:175-207).

1.9 ASSUMPTIONS OF THIS STUDY

This research is based on the assumption that the emerging infectious diseases researched for the purposes of this study are either zoonotic or anthroponotic. Vector-borne diseases will, for the purposes of this research, be considered as zoonoses based on an animal invertebrate vector (Hubalek 2003).

Invertebrate vectors, such as mosquitoes, have no backbones. Doctor Hubalek stated that invertebrate vectors are to be classified as zoonoses. Originally this researcher wanted to use the term anthroponosis for vector-borne diseases. Dr. Hubalek had said that using this term might be right in some cases–if the source of the infection is human (e.g. in yellow fever the vector mosquito can infect itself with the blood of a viremic patient). However, according to Dr. Hubalek, in most cases vector-borne diseases are zoonoses (tick-borne encephalitis and borreliosis). Dr. Hubalek would personally prefer to call all vector-borne diseases zoonoses based on the animal invertebrate vector (Hubalek 2003). This researcher follows Dr. Hubalek's recommendation.

1.10 SCOPE AND LIMITATIONS OF THE STUDY

The scope of the study will encompass zoonoses and anthroponosis. The study is limited in that it is observational, meaning no fieldwork was involved. It is done through literature reviews. The literature was reviewed using Internet searches of medical and scientific databases, medical library searches of medical journals with appropriate articles, college

and university library searches for scientific articles, and e-mail correspondence with scientists in the field. Scientific articles, both primary and secondary, are referenced. Scientific books and journals have also been cited. E-mail correspondence from scientists is also referenced.

Only references of key importance and critical to this research were cited. College and university libraries accessed for this research included:

- ✓ Saint John's University
- ✓ Princeton University
- ✓ Daytona Beach Community College
- ✓ Florida Hospital-Orlando's Medical library was also used during the literature search
- ✓ Internet-based research was done extensively
- ✓ Scientific videos (VHS format), DVD's, and audio cassettes have also been researched and referenced as appropriate
- ✓ E-mail correspondence with scientists in the field was very informative.

Since this research relies heavily on secondary data, most of the information comes from appropriate Internet sites, since the publication of data is usually a year behind schedule. Current web based scientific journal articles with data have also been referenced.

This research will encompass zoonoses and anthroponosis pertaining to World Health

Organization (WHO) member states only because, in most cases, more data was available, both on the Internet and in the literature. There were no other reasons used to exclude non-member states. (Basic 2001:470-477). This research is limited to the following specific emerging infectious diseases and does not include information on avian influenza or Marburg Haemorrhagic fever since they emerged after this research had begun:

- HIV/AIDS
- Monkeypox
- SARS
- Ebola
- Nipah Virus
- Dengue Virus
- West Nile Virus
- Group B Streptococcus.

This research did not include any fieldwork, but is primarily based on a study of the literature covering the various zoonoses and anthroponosis.

1.11 SUMMARY

Case fatality rates, incidence rates, and prevalence rates were shown to be key indicators in tracking the progression of emerging infectious diseases. It is hypothesised that active surveillance will have an effect on zoonoses and/or one type of anthroponosis and will prevent or, at least, limit emergence of infectious diseases.

A goal of this research is to objectively look at several types of zoonoses and an anthroponosis and the types of surveillance and response systems in place at specific periods in time in order to determine if there are any relationships, specifically with case fatality rates, incidence rates, and prevalence rates.

In conclusion, surveillance systems need to be targeted in areas where emerging infectious diseases are causing the highest case fatality rates. Of course everything is dependent on the wealth and resources of the areas involved.

Background information has been given as a prelude to this research. Eight emerging infectious diseases (EIDs) have been introduced with specific data pertaining to each. The lethality of these EIDs cannot be underestimated.

It is hoped that the **Tables** conveyed the sense of *urgency* in dealing with the *devastation* and *death* caused by these emerging infectious diseases. Each of the numbers presented in the **Tables** represents a human being, *a life force*, **and a statistic. These statistics should not be in vain.**

More detailed information will be provided in Chapter 2 together with a review of the literature.