

Occupational health and safety challenges reported by women in selected South African gold and platinum mines

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ABSTRACT

Historically, the South African mining industry has been a male-dominated sector and the employment of women in this sector is relatively new. Compared to their male counterparts, women in mining have unique health and safety needs due to their anatomical and physiological makeup. Currently there is a paucity of published data on health and safety concerns and issues pertaining to women in mining. A cross-sectional descriptive survey was conducted among 118 women working in two purposively selected South African gold and platinum mines, to explore occupational health and safety challenges reported by the women. Results showed that they faced challenges related to personal protective equipment and underground environmental conditions, such as unhygienic sanitary amenities. Some of the health conditions they reported may be related to such challenges. Improvement of PPE and underground sanitary amenities is vital to promote their health.

Key words: women, mining, occupational health and safety, challenges, vulnerable workers, personal protective equipment, reproductive health



INTRODUCTION

Historically, the mining industry has been a male-dominated sector and it has been a challenge to introduce and ensure full incorporation of women into this sector. The employment of women in the South African mines, since 2004, is a relatively new phenomenon.¹ As such; the South African government adopted a number of strategies aimed at opening up the mining sector for previously disadvantaged individuals, including women as part of its economic empowerment policy, and in line with the mining charter and the Employment Equity Act.^{1,2}

Compared to their male counterparts, women in mining (WIM) have unique health and safety needs resulting from their anatomical and physiological makeup. Of equal importance is the fact that the International Labour Organization has classified women workers as “vulnerable workers” with special occupational health and safety needs,³ and WIM are no exception. This is compounded by the fact that there is a paucity of published data on occupational health and safety (OH&S) issues concerning WIM.

In general, women workers face equal but also different OH&S challenges at work compared to men. However, because women workers are vulnerable, they tend to suffer the most from work-related diseases, including musculoskeletal and reproductive problems, compared to their male counterparts.⁴ This clearly indicates the need to protect and promote women’s OH&S at work, by addressing issues that

are unique to them. In addition, the Safety and Health in Mines Convention C176 of (1995) was ratified by South Africa on the 9th of June 2009, which recognises the desirability to prevent any fatalities, injuries or ill health affecting workers or members of the public, or damage to the environment arising from mining operations.⁵

In South Africa, Mine Health and Safety Act (MHSA), No 29 of 1996 as amended provides for the monitoring of conditions that will promote a culture of OH&S in the mining industry and protect mine workers and other persons at mines.⁶ However, it has not made specific provision for gender specifications regarding OH&S conditions in the mines. This paper describes socio-demographic characteristics and explores OH&S challenges reported by WIM in two mines. Recommendations are made that should contribute to the improvement of the OH&S of WIM.

METHODS

A cross-sectional descriptive survey was conducted among WIM from selected gold and platinum mines in Rustenburg, Limpopo province. A self-administered structured questionnaire was used to obtain data from WIM. To avoid disrupting productivity, participants (WIM) were recruited to participate in this study from the change rooms (i.e. at the end of their morning shifts). Over 500 WIM were employed in the selected gold mine, whilst the platinum mine had about 300 WIM. For this study, 200 WIM were recruited and 118 gave a written informed consent to participate in the study, giving a response rate of 59%.

Permission to conduct the study was also granted by mine management of each study site. Approval to conduct the study was granted by the Ethics Committee of the University of South Africa prior to data collection (Ethical clearance no: 9016-705-8).

Data analysis was done using SPSS 18.0.1 Windows version. Participants' demographics and other categorical data were summarised using descriptive summary measures: expressed as means (standard deviation) for continuous variables, and percentages for categorical variables. Responses for questions that had 'other and specify' were also coded accordingly. The Chi-square test was used to test for associations between variables.

RESULTS

One hundred and eighteen WIM participated in this study, of whom 65 (55.0%) were from the gold mine, while 53 (44.9%) were from the platinum mine.

Participants' baseline characteristics

Participants' demographic data is summarised in Table 1. Some data was not provided by participants, hence small variations in sample size. Almost all participants (96.6%) were permanently employed.

Slightly more than half of the participants (52.6%) were

Table 1. Participants' mining and socio-demographic characteristics

Type of mine where employed (n=118)			Employment status (n=118)		
	No.	Percent		No.	Percent
Gold	65	55.0	Permanent	114	96.6
Platinum	53	44.9	Contract	4	3.4
Total	118	99.9	Total	118	100
Age (in years) (n=116)			Highest level of education (n=117)		
20 – 30	61	52.6	Primary	15	12.8
31 – 40	53	45.7	Secondary	80	68.3
41 – 50	2	1.7	Tertiary	22	18.8
Total	116	100.0	Total	117	99.9
Marital status (n=118)			Years of experience (n=110)		
Single	74	62.7	< 2	4	3.6
Married	30	25.4	2 – 4	88	80.0
Cohabiting	10	8.5	5 – 7	15	13.6
Widowed	4	3.4	≥ 8	3	2.7
Total	118	100.0	Total	110	99.9

aged between 21-30 years; 45.7%, were 31-40 years old. Two WIM did not provide their ages. All participants were Black. Almost two-thirds (62.7%) were single, while 25.4% were married. Most participants (68.3%) had achieved secondary education compared to those with primary (12.8%) and tertiary education (18.8%). The mean number of years of working experience was 3.6, whilst the majority (80.0%) had 2-4 years experience.

Table 2. Distribution of participants' current occupational categories (n=118)

Current occupation	No	Percent	Current occupation	No	Percent
Artisan assistant	10	8.5	Mine overseer operator	2	1.7
Assistant	2	1.7	Panel miner	1	0.8
Assistant grade 1 construction	1	0.8	Pump attendant	25	21.2
Banksman	1	0.8	Pump operator	7	5.9
Battery assistant	2	1.7	Safety representative	2	1.7
Blasting assistant	1	0.8	Sampling assistant	2	1.7
Cleaner underground	2	1.7	Sampling unsupervised	1	0.8
Construction assistant	1	0.8	Shaft team assistant	10	8.5
Control room operator	2	1.7	Shaft timber assistant	9	7.6
Conveyer belt assistant	1	0.8	Stope team	5	4.2
Development labourer	1	0.8	Stoping labourer	1	0.8
Fitter assistant	2	1.7	Supervisor health and safety underground	1	0.8
General miner	4	3.4	Team member secondary support	1	0.8
Loco crew supervisor	2	1.7	Underground banks man	2	1.7
Loco driver	7	5.9	Underground assistant	4	3.4
Loco operator	3	2.5	Winch operator	4	3.4
Mine assistant	1	0.8	Missing	7	5.9

“Other . . . included unhygienic conditions and lack of access to adequate sanitary facilities while working underground.”

Table 3. OH&S challenges relating to PPE reported by participants (n=118)

Challenges related to personal protective clothing	Frequency	Percent
Overall (one way piece)		
Too tight and difficult to take off for toilet use	96	81.5
Not comfortable and not friendly to use	22	18.5
2-Piece overall pants		
Too tight at the hips, buttocks and thighs as well as material shrinks after washing, making the size smaller	109	92.1
Exposes the lower back (pants are too wide around the waist)	9	7.9
2-Piece overall top		
Too small at chest and breast	92	78.0
Not comfortable to wear	26	22.0
Hard hat		
Too heavy to carry with head lamp	102	86.5
Causes headache at the end of the shift	16	13.5
Gumboots		
Too big and heavy when walking long distance	112	94.8
Causes corns and painful feet	6	5.2
Safety shoes		
The sizes are too big for women's feet and does not fit well	106	89.7
Suitable for men	12	10.3
Hand gloves		
Too hard, too big and uncomfortable to work with	111	93.9
End part too wide allows dirt and water to enter inside	7	6.1
Safety glasses		
Too big for women faces (constantly slipping and have to adjust them)	111	94.3
Allow dust particles to get inside the eyes and cause sore eyes	7	5.7
Dust mask		
Experience suffocation when wearing it	113	95.5
Hearing protection		
Experienced itching and ear infections from earplugs	116	98.2
Still hears noise with them in place	2	1.8
Rescue pack, lamp battery and securing belt		
Too heavy to carry and causes discomfort and chaffing on lower abdomen	112	95
Causes back pain	6	5

Reasons for working in mining

Reasons for working in the mining industry are shown in Figure 2. The most common (92.4%) was because of a lack of other job opportunities, followed by working in the mines being better than being unemployed (81.2%).

Participants' current and previous occupational categories

Twenty-five (21.2%) of the participants were employed as pump attendants, followed by equal proportions of artisan assistants and shaft team assistants (Table 2).

Regarding previous employment, 27 (43.5%) participants reported being unemployed before joining the mining industry. Slightly more than half (52.5%) indicated their previous occupations prior to employment in the mining industry, which included domestic work, casual and general working in retail and food industries.

OH&S challenges experienced by participants

Participants were asked if they experienced health and safety (H&S) challenges related to PPE provided; and almost all of them (98.3%) agreed, compared to 16.9% who did not experience any H&S challenges. Dissatisfactions about OH&S related primarily to the type and style of personal protective equipment (PPE) with which female participants were provided as illustrated in Table 3.

Sanitary facilities underground

Other OH&S challenges reported by participants included unhygienic conditions and lack of access to adequate sanitary facilities while working underground. Slightly more than half (52.5%) of the participants complained about the latter in their work stations. The results also revealed that almost all participants (99.8%) complained about the unhygienic conditions of underground sanitary facilities: 37 (31.4%) rated them as “poor” while 80 (67.8%) rated them as “unacceptable”.



Figure 1. A sanitary facility underground

All participants complained about the lack of hand washing facilities after use of the sanitary facility (Figure 1). Furthermore, the majority (90.6%) reported that existing underground sanitary facilities were not demarcated by gender, while 110 (95.7%) reported the lack of sanitary bins for disposal of used (soiled) sanitary towels. Consequently, almost all participants (96.4%) reported that they were unable to appropriately dispose of their soiled sanitary towels/pads in underground sanitary facilities, and were forced to dispose of them at the end of their shifts when they returned to the surface.

Coping mechanism reported by participants

Participants reported that coping mechanisms they practiced in dealing with the challenges of the unavailability of and unhygienic sanitary facilities underground included suppression of the urge to use the toilets (59; 50.0%) and avoidance of drinking fluids (66; 55.9%) when working underground so that they would not have to use the unhygienic toilet facilities. The latter has implications in terms of dehydration while working underground.

Diagnoses of health conditions and ailments reported by participants

Participants described the common health conditions and other ailments (work and non-work related) with which they had been diagnosed since their employment in the mining industry. Almost all (97.5%) reported some form of skin condition, while 82 (69.5%) reported various gynaecological conditions ranging from vaginal thrush to other bacterial infections (Figure 3). In addition, equal proportions of participants 114 (96.6%) reported to have been diagnosed with ailments like abdominal, joint and back pains.

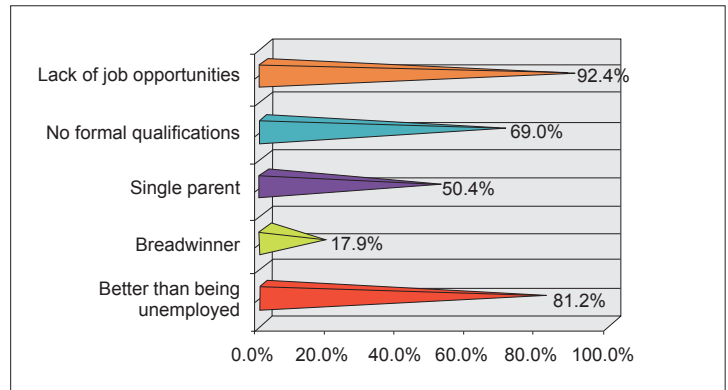


Figure 2. Participants' reasons for working in the mining industry (n=118)

Associations between the type of mine and other variables

Associations between the type of mine and all related variables are shown in Table 5. No socio-demographic variables were associated with the types of mine and PPE and H&S challenges. However, more women from the gold mine (52.5%) reported experiencing H&S challenges compared to the platinum mine (41.5%). Gynaecological diseases were significantly associated ($p=0.001$) with the type of mine as more women from platinum mine (37.2%) reported gynaecological diseases compared to those from the gold mine (30.5%). Significantly more women from

Table 4. Access to sanitary facilities and perceptions of hygiene conditions reported by participants

Access to sanitary facilities and their hygiene conditions	No.	Percent
<i>Have access to sanitary facility underground? (n=118)</i>		
Yes	56	47.5
No	62	52.5
<i>Hygiene conditions of sanitary facilities underground (n=118)</i>		
Good	1	0.8
Poor	37	31.4
Unacceptable	80	67.8
<i>Availability of hand washing facilities after using the toilet (n=118)</i>		
Yes	0	0.0
No	118	100.0
<i>Sanitary facilities underground demarcated by gender (n=117)</i>		
Yes	11	9.4
No	106	90.6
<i>Sanitary bins provided for disposal of used sanitary towel (n=115)</i>		
Yes	5	4.3
No	110	95.7
<i>How do you dispose sanitary towel? (n=110)</i>		
Put sanitary towel in bag and dispose of when get to surface	106	96.4
Dispose in buckets in toilet or open area where people are not working	2	1.8
Sometimes do not change sanitary towel for the entire shift	2	1.8

the gold mine (58.4%) were diagnosed with various skin conditions ($p < 0.001$). Hygiene conditions for sanitary facilities were also significantly associated with the type of mine ($p = 0.004$) and more women (38.1%) from the platinum mine complained about the unacceptable hygiene conditions for the sanitary facilities.

Further analysis showed that reported gynaecological diseases were significantly associated ($p < 0.005$) with accessibility and hygiene condition of the toilet facilities as well as the availability of hand washing facilities and sanitary (S-H-E) bins (data not shown).

DISCUSSION

Findings from this study showed that almost all participants were below the age of 40 years and about a fifth had a tertiary education. A study conducted by the South African Department of Minerals Resources in 2009 on WIM showed that the majority of WIM were below the age of 40 years.⁷ Given the high unemployment level in South Africa which currently stands at 25.2%,⁸ it is not surprising that relatively young women of child bearing age group are involved in

mining, which remains a very male-dominated industry.

In this study participants cited the lack of other job opportunities and being previously unemployed as important reasons for their interests in mining. Furthermore, evidence from the literature reveals that, within the Australian mining industry, women enter the industry because of both the limited opportunities for practical experience and as an indication of their suitability to the mining environment.⁹ However in South Africa, the concept of women working in the mining industry is relatively new and is supported by the Mining Charter of 2004, which requires that 10% of the workforce in this sector be women by the year 2009.¹ Compared with other industries, the integration and participation of women in the South African mining industry has been slow. With the changes in the demographics of the 'traditional' mining workforce, there is a need to establish the role of gender in occupational health risks inherent in mining. This information could in turn be used to assess the relevance of current occupational exposure limits, selection criteria based on workers abilities and limitations, the design of workstations and equipment, as well as occupational health management systems.

The results of this survey clearly indicate that WIM mostly from the gold mine face OH&S challenges related to the size and fitting of PPE that they use. Mining is male-dominated and PPE is designed for a male body structure. Women reported having been diagnosed with various types of illnesses such as ear infections, headaches, etc. They also reported ailments such as back, joint, shoulder and abdominal pains which are musculoskeletal disorders associated with labour-intensive tasks, coupled with prolonged standing involved in mining, as well as sore eyes which they related to poorly fitting safety eye goggles, that could allow exposure to dust particles from silica and other hazardous chemicals. The ill-fitting PPE could pose an OH&S hazard for WIM as dust and dirt in mining environments can be highly abrasive.¹⁰ When inhaled, dust can cause systemic and lung diseases and other respiratory ailments. Exposure to dust can also cause skin irritations and eye damages.¹¹

Some participants raised the issue of discomfort from PPE used, for example small overall pants, large boot sizes, loose safety goggles, heavy hard hats, and rescue packs that they had to carry for the entire shift. Studies consistently report that women differ from men in terms of anthropometry but the majority of available PPE as well as tools are designed for male workers resulting in female workers with different height and weight dimensions than males, being unprotected and unable to perform their tasks efficiently.¹²⁻¹⁵

It is acknowledged that the findings of this study are based on participants' self-reported experiences. However, ill-fitting PPE fails in purpose to protect the user.^{16,17} It undermines efforts to protect women who are vulnerable employees against OH&S hazards in the workplace. Similarly, research conducted by the National Institute of Occupational Safety

Table 5. Association between type of mine and other variables

Variables	Responses	Type of mine		Chi-squared value	p-value
		Gold No. (%)	Platinum No. (%)		
PPE provides H&S challenges	Yes	62 (52.5)	49 (41.5)	6.125	0.013
	No	3 (2.5)	4 (3.3)		
Gynaecological diseases	Yes	36 (30.5)	44 (37.2)	10.212	0.001
	No	29 (24.5)	9 (7.6)		
Skin conditions	Yes	69 (58.4)	46 (38.9)	13.691	<0.001
	No	1 (0.8)	2 (1.6)		
Hygiene status of sanitary facilities	Poor			11.256	0.004
	Unacceptable	30 (25.4)	9 (7.6)		
		34 (28.8)	45 (38.1)		

and Health (NIOSH) in the United States of America (USA) found that 46% of women could not easily find protective shoes, 41% could not find working gloves, while only 14% of manufacturers surveyed offered ear, head and face protection in women's sizes, and 59% offered foot protection in women sizes.¹³ Although the average fatality rate of 1.80 per 100 000 female construction workers in the USA may appear small, it was more than twice the all-industry average for women workers, indicating that women were more prone to injuries and accidents in that industry than elsewhere.¹⁷ The lack of PPE protection may in part explain the rate of injury and fatality for female workers in heavy duty industries like mining and construction. Therefore, as the PPE for WIM in this study was reported as ill-fitting and cumbersome thus compromising safe and efficient performance of work, it is implied that WIM have inadequate protection against risks from work-related hazards, whilst their personal comfort and work performance are also compromised.

The results showed a significant association between the type of mine and skin conditions that WIM reported. Hot and humid mining conditions coupled with excessive sweating can cause skin irritation, breakdown and erosion of the skin (chaffing). Such skin conditions might predispose WIM to bacterial and fungal infections. Also, the accumulation of sweat in socks and friction from safety gumboots cause blisters which increase WIM vulnerability to feet infections like athletes feet. A study on surveillance of work-related skin diseases among various occupations showed a high rate of women workers with skin conditions due to work-related factors like the type of PPE used, wet work, rubber and chemicals use, etc.¹⁸ Significantly, wet work is a common feature in South African underground mines and exposure to grease and other cleaning solvents is also common among mechanical maintenance as well as cleaning workers who are mostly women.¹⁹

Almost 70% of participants reported to have been diagnosed with gynaecological conditions, most of them were from the platinum mines and a positive association was revealed between the type of mine and gynaecological conditions. Gynaecological conditions could be attributed to the fact that working underground exposes workers to extreme heat conditions, which is a health hazard. However, additional factors could account for the difference between the types of mine. The response to a given level of heat stress also depends on a variety of individual traits (e.g. gender, body mass index (BMI), hormonal changes, age, presence of a chronic illness, etc), which interact with other factors and may vary on a daily basis. Literature has indicated that women workers are more vulnerable and at risk because of their physiological makeup associated with their reproductive system and related organs.⁴

Participants experienced various types of musculoskeletal disorders, such as back and joint pains. Studies have shown that, to reduce work-related musculoskeletal disorders, tools,

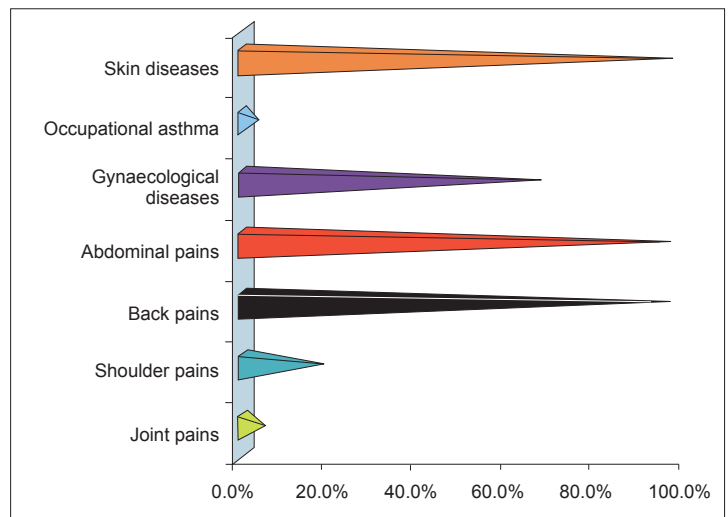


Figure 3. Health conditions and ailments reported by participants (n=118)

materials, and equipment should be designed based, in part, on ergonomic considerations.²⁰ In the mining industry, tools and equipment have been designed to be used by average-sized men.²¹ Similarly the epidemiological studies which provided the strongest basis for the NIOSH guidelines on lifting, were predominantly based on male workers.^{22,23}

Clearly, access to sanitary facilities is frequently a problem for women working underground and a significant association was noted between the type of mine and sanitary



facilities. More than half of the participants reported that they did not have access to adequate sanitary facilities while working underground. Almost all participants reported sanitary hygiene conditions to be unacceptable. Given that mining has traditionally been a male-dominated work environment, there was probably no need to separate sanitary facilities for men and women. However, the employment and influx of women in the mining sector as mandatory by the Mining Charter,¹ challenges the notion that both men and women mine workers can use the same underground sanitary facilities.

Findings from this study shows that the mines surveyed do not have appropriate sanitary facilities for women. Conversely, reports from an Anglo American mining company, which is one of the main South African mining organisations, indicate that they have created women-only toilet facilities underground.²⁴ Other mining groups should follow the same practice to cater for basic health needs of WIM and retain them in the sector.

Due to the lack of easy access to sanitary facilities underground, most participants reported that they avoided drinking water whilst working underground. Working underground involves working in hot humid environments which lead to excessive sweating. Thus, avoiding drinking water (which serves as fluid replacement) increases the risk of dehydration and compromises the OH&S of workers. Dehydration is also associated with a generalised lack of concentration, as well as increased vulnerability to heat exhaustion and/or heat stroke.

Some participants reported that sanitary facilities were not available in their respective work sections and they had to walk long distances (about 10-15 minutes) to the next section where the toilet was located. Consequently, they suppressed the urge to urinate and, by so doing, increased the risk of developing urinary tract infections. Holding urine in

the bladder for an hour after experiencing an urge to urinate leads to a higher incidence of urinary tract infections.²⁵

Participants reported that sanitary facilities underground did not make provision for sanitary bins for the disposal of used sanitary towels. Consequently, they could not frequently change their sanitary towels, which would further increase the risk of developing vaginal infections. The lack of hand washing facilities could add to the risk of transmission of infections and is not in line with the requirements stipulated in section 6 of the MHS Act regarding adequate supply of all necessary OH&S facilities and maintenance as far as "reasonably practicable," of those facilities in a serviceable and hygienic condition.⁶ The significant association between reported gynaecological diseases and accessibility and hygiene condition of the toilet facilities as well as the availability of hand washing facilities and sanitary bins indicates the risks posed by these challenges.

CONCLUSIONS

Women in mining face OH&S challenges related to PPE and underground environmental conditions. Ill-fitting PPE compromises both performance and OH&S. A lack of adequate toilet facilities for women in the mines surveyed, coupled by unacceptable hygiene conditions, pose specific risks for women's reproductive health. The situation is further exacerbated by unorthodox practices reported by participants to avoid using unhygienic underground sanitary facilities possibly resulting in the diagnosis of various types of illnesses.

RECOMMENDATIONS

There is an urgent need to increase the awareness of workplace issues and their impact on WIM in order to promote women's OH&S in the mines. In particular, musculoskeletal strain, reproductive health, skin conditions, and the implementation of health education, and wellness promotion programmes must be addressed. WIM should be educated on correct biomechanics when moving heavy equipment in order to prevent the development of musculoskeletal disorders, and should be provided with ergonomically designed equipment and custom designed PPE. Improving sanitary facilities through the provision of basic amenities such as SHE-bins and hand washing facilities will promote women's reproductive and general health. Demarcating female sanitary facilities for reasons of privacy, protection and dignity is also essential.

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COMPETING INTERESTS

The author declares that there are no financial or personal relationships which may have inappropriately influenced the writing of this paper.

LESSONS LEARNED

- There are distinctive attributes that differentiate the capabilities and needs of women and men workers, which call for specific protection and accommodation of women workers.
- Poorly fitting PPE exposes women to OH&S hazards associated with mining and makes them less able to perform their duties safely and efficiently.
- There is a crucial need for greater awareness, education and focus on the OH&S needs of women in mining
- Designing and implementation of reproductive health promotion interventions for women in mining is essential.
- Improvement of PPE and underground sanitary amenities is vital to promote women's reproductive health.

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