

Impact of Urban Solid Waste on the Health of Municipal Sanitation Workers in Twin Cities of Hubballi-Dharwad

Usha Ramesh Phirangi¹, Prof. (Smt.) V. B. Saviramath²

¹Research Scholar, Dept. of Geography, Karnatak University, Dharwad

²Professor, Dept. of Geography, Karnatak Science College, Dharwad

Abstract

Urban solid waste is an accumulation of refused waste generated from households, commercial, industrial, healthcare etc. The improper disposal and management of waste can lead to harmful impact on the human health and environment of the cities. In the process of the solid waste management, the sanitation workers play a crucial role. Due to the poor SWM process and working conditions, the workers suffer from the serious health issues. It is essential to understand the work condition and health challenges faced by sanitation workers to protect their safety and well-being. In this context, the present study aims to investigate the health status of the sanitation workers in twin cities of Hubballi-Dharwad, Karnataka, India and impact of their working environment on their health.

The present study is based on both primary and secondary data. Questionnaire based survey is conducted to know the socio-demographic attributes, health status and working conditions and occupational safety of the sanitation workers. The secondary data is collected from Solid Waste Management (SWM) Reports and relevant articles. Data analysis is done by using MS-Excel and other statistical methods.

Major findings of the paper indicate a lack of basic facilities in the working area. Female workers face specific difficulties in the workplace due to the absence of toilets and the use of poor quality Personal Protective Equipments (PPE). Majority of the sanitation workers i.e. 28.30 Percent of them are facing musculoskeletal pain. Further, Sanitation workers of the Dumping Yard are facing injuries and respiratory problems due to waste segregation.

Keywords: Sanitation workers, Waste generation, Waste Segregation, Waste disposal, SWM, Health impact.

Introduction:

The expeditious urbanisation and population growth has resulted in an increase in urban solid waste generation, creating major environmental and public health problems in the urban area. According to the Solid waste Management Rules, 2016 (Government of India), solid waste is defined as “domestic, commercial, and institutional waste, including street sweepings, market waste, and silt from drains, but excluding hazardous waste, biomedical waste, e-waste, and industrial waste”. “The Solid Waste Management systems require significant amounts of physical labour at every step of the sanitation chain for waste collection, waste transportation, equipment maintenance, cleaning, and other tasks” (WHO, 2017). “The people who are maintaining the waste and keep our surroundings clean and healthy are often

ignored. Improper handling and management of municipal solid waste exposes sanitation workers to infections, toxic substances, injuries, and long-term health risks” (WHO, 2017). “The absence of effective source segregation and mixing of hazardous waste with municipal solid waste further aggravate health risks, especially in cities where waste handling remains manual” (UNEP, 2016). Inadequate use of personal protective equipments and limited health awareness resulting in increased occupational health risks.

Therefore, understanding the impact of urban solid waste on the health of municipal sanitation workers in Hubballi-Dharwad is important for improving the occupational safety and health services of the workers and sustainable urban waste management.

Objectives:

1. To understand the working conditions and occupational safety of municipal sanitation workers in twin cities of Hubballi-Dharwad.
2. To study the impact of urban solid waste on the health of municipal sanitation workers.

Hypothesis:

H₀: There is no association between the gender of the sanitation workers and health Problems.

H₁: There is an association between the gender of the sanitation workers and health Problems.

Database and Methodology: The present study has used both primary and secondary methods for data collection. Primary data is collected by questionnaires and interview method to know the socio-demographic attributes, health status, working conditions and occupational safety of the sanitation workers. Out of 2023 sanitation workers, 212 workers are contacted for collecting the information. Secondary data is collected from SWM Reports and relevant articles. A data analysis is done by using MS-Excel and other statistical methods. Further, the hypotheses are tested by applying Chi-square method.

Study area: The twin cities of Hubballi-Dharwad are located on 15° 36' N latitude, 75° 12' E longitude. The total area of cities is 202.3 Km². In 1962, Hubballi-Dharwad cities were combined to form Hubballi-Dharwad Municipal Corporation (HDMC). At present, it is the second largest Municipal Corporation in Karnataka state after Bengaluru. The area is divided into 82 wards for administrative purposes. Dharwad is the administrative headquarters. While Hubballi, which is located about 20 Km away in the south-east of Dharwad, is the commercial center and business hub of North Karnataka. Population of the cities as per the 2011 census was around 9.43 lakh and it is projected to 11.46 lakh in 2021. Hubballi-Dharwad have been selected by the central government as one of the hundred Indian cities to develop as a Smart City under the Smart Cities Mission.

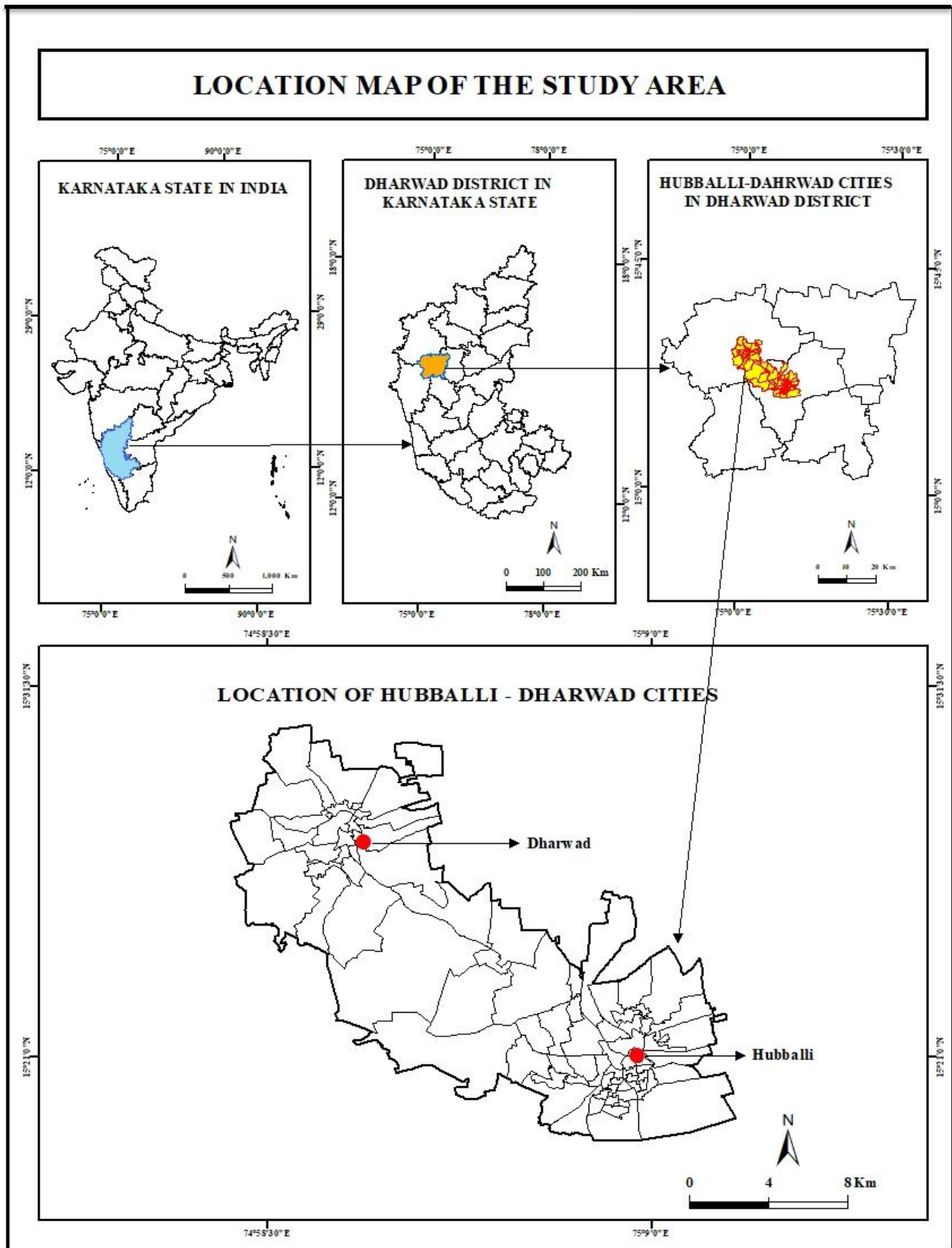


Fig.1

Results and discussion:

Sex and Age Composition of the Sanitation workers:

Out of the total 212 respondents, 66.03Percent are male workers and 33.96 Percent are females. It shows that majority of the workers are males and female workers are less in number. As far as the age of the respondents is concerned, 37.73 Percent of workers belong to 35-44 years age group, 25.47 Percent of workers are in age between 25-34 years, while 23.58 Percent of workers are between 45-54 years age, Workers are belonging to age groups of below 25 years and above 55 years. Account for about 6.60 percent of the workers each.

Among the males, majority of the workers i.e. 35.71 percent belong to the age group of 35-44 years. Even number of female workers is more in this age group i.e. 41.66 percent. Further, Percentage of males in the age group of 25-34 years is 32.85 Percent. However, number of females in this category (11.11 Percent) is lesser. Women’s share is more (38.88 percent) in the age group of 45-54 years. Opposite to this, there are very few men workers (5.71 Percent) who are above 55 years. While, there are no female workers who are younger than 25 years. (Table 1 and Fig. 2)

Table 1 Sex and Age Composition of the Respondents

Age Group	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
Below 25	14	10.00	0	0.00	14	6.60
25-34	46	32.85	8	11.11	54	25.47
35-44	50	35.71	30	41.66	80	37.73
45-54	22	15.71	28	38.88	50	23.58
Above 55	8	5.71	6	8.33	14	6.60
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

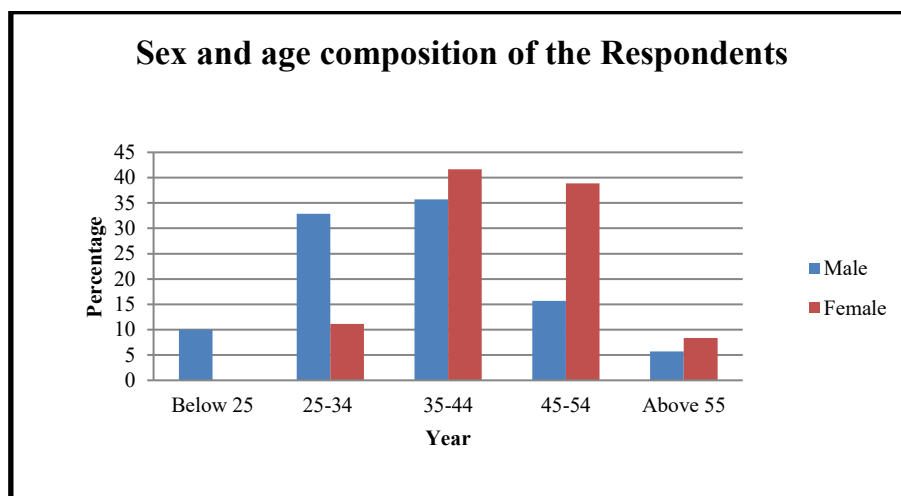


Fig.2

Education level of the Respondents:

“Education enhances human capability and expands occupational choices”. (Amartya Sen) Data pertaining to the education level of the respondents reveals that most of the workers i.e. 36.79 Percent, have

completed Primary education. While, 28.30 percent workers studied up to high school and 26.41 Percent workers are illiterate. Further, 7.54 percent of them have completed PUC/diploma and only 0.94 Percent workers are UG graduates. Majority of the workers have low levels of education due to socio-economic barriers. Among the males, most of the workers i.e. 40.00 percent, completed high school, and many female workers i.e. 47.22 percent, have primary school level education, and 44.44 percent are illiterate. Compared to women percentage of illiterate men (17.14 percent) is lower. Only 1.42 percent of male workers are degree holders, while, there are no female workers who are graduates. Thus, compared to the male workers literacy level of female workers is lower. (Table 2 and Fig.3)

Table 2 Education level of the Respondents

Level of Education	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
Illiterate	24	17.14	32	44.44	56	26.41
Primary School	44	31.42	34	47.22	78	36.79
High School	56	40.00	4	5.55	60	28.30
PUC/Diploma	14	10.00	2	2.77	16	7.54
UG	2	1.42	00	0.00	2	0.94
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

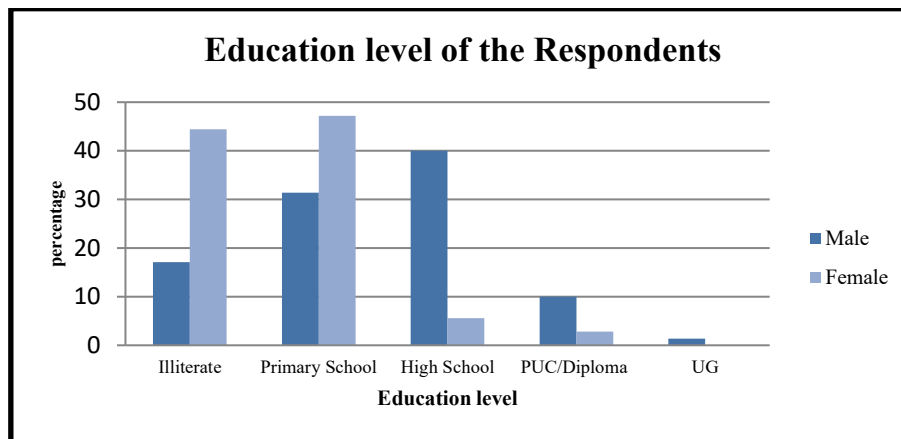


Fig.3

Occupation Status of the Respondents:

“The low education attainment increases the likelihood of employment in hazardous and informal occupations”. (International labour organization-ILO) The occupational status of the sanitation workers shows that both male and female workers commonly work in garbage collection and Drainage cleaning. The highest percent of workers i.e. 48.11 are engaged in garbage collection. While, drainage cleaners account for about 30.19 Percent and 12.26 Percent of them are working in the dumping yard. Only 9.43 Percent of workers are sweepers. Among the males, majority (62.86 percent) of workers are garbage collectors, whereas the number of females in this (19.44 percent) occupation is less. 61.11 percent of female workers are drainage cleaners, 18.57 Percent of males work at dumping yard, however no female workers are employed at dumping yard, male sweepers are fewer (4.29 Percent) compared to the female sweepers (19.44). (Table 3 and Fig. 4)

Table 3: Occupation Status of the Respondents

Occupation Status	No. of Male	Percentage	No. of Female	Percentage	Total	Percentage
Sweeper	6	4.29	14	19.44	20	9.43
Garbage Collector	88	62.86	14	19.44	102	48.11
Drainage Cleaner	20	14.29	44	61.11	64	30.19
Dumping yard	26	18.57	00	0.00	26	12.26
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

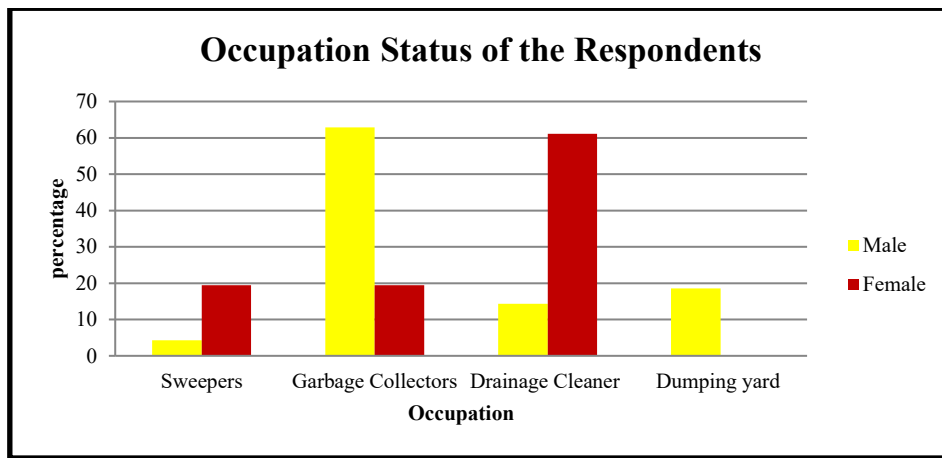


Fig.4

Monthly Income of the Respondents:

As far as the income of the respondents is concerned, most of them have low monthly incomes. Hence, they are not satisfied with their salary as it is insufficient for their daily needs. 71.70 percent of the workers have a monthly income below Rs 20,000 per month and 16.04 Percent are earning between Rs. 20,000 to 40,000. Further, 11.32 Percent have a monthly income ranging between Rs. 40,000 to 60,000 and only 0.94 percent of the workers have an income above Rs. 60,000 per month. Among the males, majority of the workers i.e. 72.86 Percent have income below Rs. 20,000 per month, even most of the female workers (69.44 Percentage) also belong to this group. Opposite to this, only 1.43 Percent of male workers have income above Rs. 60,000 per month. No female workers are there in this category. (Table 4 and Fig. 5)

Table 4 Monthly Income of the Respondents

Income in Rs.	No. of Male	Percentage	No. of Female	Percentage	Total	Percentage
Below 20,000	102	72.86	50	69.44	152	71.70
20,000 to 40,000	28	20.00	6	8.33	34	16.04
40,000 to 60,000	8	5.71	16	22.22	24	11.32
Above 60,000	2	1.43	0	0.00	2	0.94
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

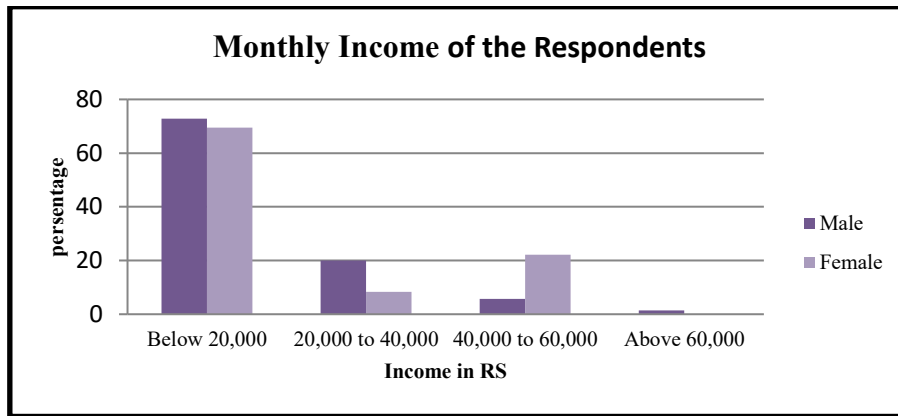


Fig.5

Working experience of the respondents:

34.91 Percent of workers have less than 10 years of experience. Same number of workers has 10-20 years of experience. While, 29.25 percent of workers have 20-30 years of service and only 0.94 Percent of workers have above 30 years of experience. Among the males, the highest number (48.57 Percentage) of workers has less than 10 years of experience. Whereas, majority of the female workers i.e. 47.22 percent have 20 to 30 years of experience. 41.67 percent of females having experience 10-20 years. Very few workers i.e. 2.78 percent of females have more than 30 years of experience. While, there are no male workers in this category. Figures of work experience show that the male workers have less work experience compared to the female workers. (Table 5 and Fig. 6)

Table 5: Working experience of the Respondents

Years	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
Less than 10	68	48.57	6	8.33	74	34.91
10-20	44	31.43	30	41.67	74	34.91
20-30	28	20.00	34	47.22	62	29.25
Above 30	0	0.00	2	2.78	2	0.94
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

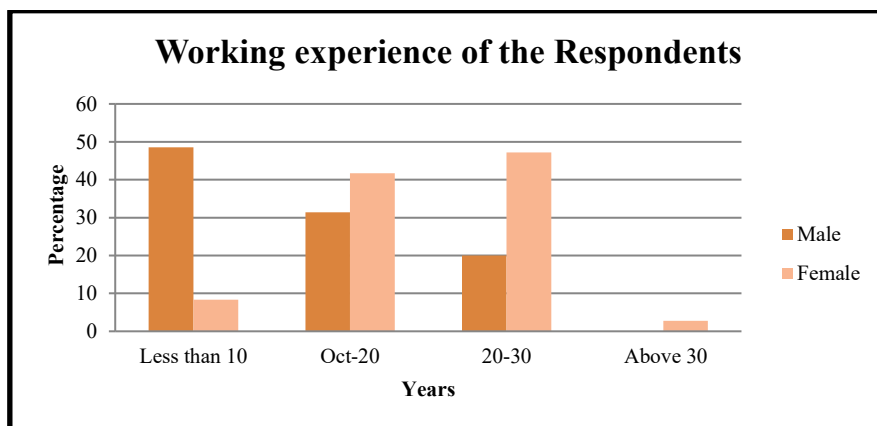


Fig.6

Frequency of new PPE provision:

When the workers were asked about the supply of PPE, 55.66 percent of the workers said that it is provided regularly. While, 38.67 percent of workers said it is often provided. However, 4.71 Percent told that it is rarely provided and only 0.94 Percent said that it is never provided. This means that, PPEs are regularly supplied by the HDMC. Majority of male (54.28percent) and female (58.33 percent) workers agreed that PPE is provided regularly. Further, 13.88 percent of females said that PPEs are rarely provided. However, there are no male workers in this category. During the field observation, most of the workers were not wearing PPEs as they were using only gloves and uniforms. Further, many dumping yard workers informed that gloves, masks and shoes which are provided to them are very low quality. Consequently, they suffer from cuts, injuries and are exposed to dust, bio-aerosols, which can lead to respiratory problems while handling mixed waste and hazardous waste, during the waste segregation and composting. (Table 6 and Fig.7)

Table 6 Frequency of new PPEs provision

Provide PPE	No. of Male	Percentage	No. of Male	Percentage	Total	Percentage
Always	76	54.28	42	58.33	118	55.66
Often	64	45.71	18	25	82	38.67
Rarely	00	0.00	10	13.88	10	4.71
Never	00	0.00	2	2.77	2	0.94
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

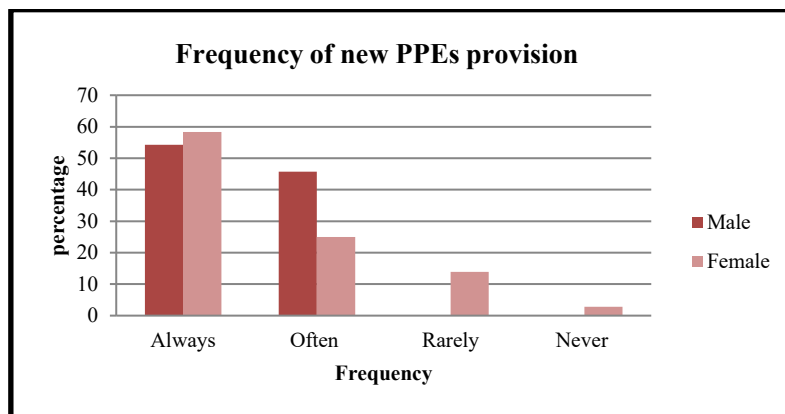


Fig.7

Health check-up for the respondents:

61.32 Percent of workers reported that HDMC conduct regular health check-ups, 31.13 Percent said sometimes, and only 7.55 Percent of workers that no health check ups are conducted, it indicates that though HDMC conduct health check-ups regularly for sanitation workers. workers are not using that facility properly. Among the males, majority of the workers i.e. 58.57 Percent, reported regular check-ups, number of female workers is more in this category i.e. 66.67 Percent. Opposite to this, there are very few males (11.43 percent) who said that there are health check ups, there are no females in this category. (Table 7 and Fig.8)

Table 7: Health check up for the Respondents

Periodicity of Health check up	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
Regularly	82	58.57	48	66.67	130	61.32
Sometimes	42	30.00	24	33.33	66	31.13
Not at all	16	11.43	0	0.00	16	7.55
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

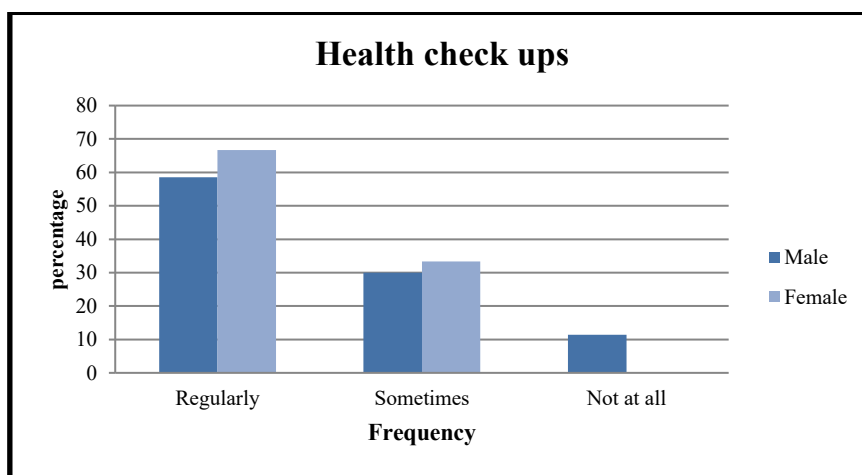


Fig.8

Frequency of visiting the hospital:

The frequency of hospital visits of the sanitation workers, is 66.04 Percent workers only visit during health issue times, 23.58 Percent visit once a month, and only 10.38 Percent workers visit once a year, and no one visits weekly. Among the male workers majority of the workers i.e. 74.29 Percent, visit only health issue time, 50.00 percent of females also visit health issue time only, opposite to this, there are very few 7.14 percent males and 16.67 percent of females who visit once in year only, while no male and female workers visit the hospital weekly. It also indicates that females have more concern about their health compared to males. (Table 8 and Fig. 9)

Table 8 Frequency of visiting the hospital

Frequency	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
Once in month	26	18.57	24	33.33	50	23.58
Once in Year	10	7.14	12	16.67	22	10.38
Health issue time only	104	74.29	36	50.00	140	66.04
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

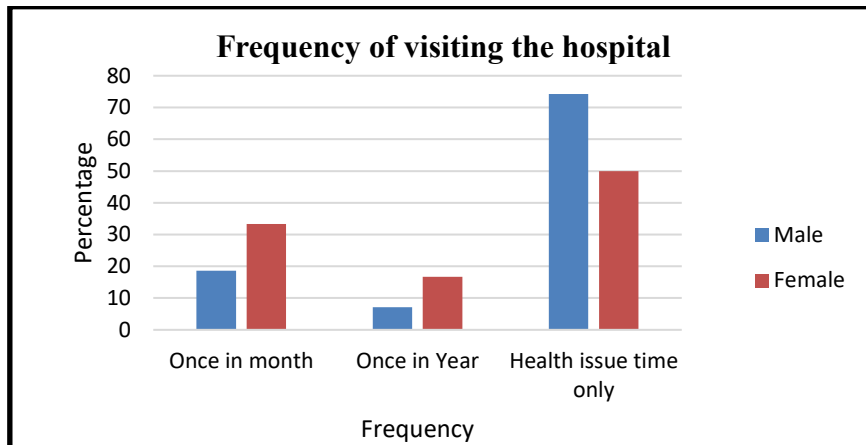


Fig.9

Mode of transportation for hospital visit:

41.50 percent of the workers use public transport, while 36.79 percent are using two-wheelers and 20.75 Percent of the workers go by walk, only 2.77 percent of them use other modes. Among the males, half (50.00 Percent) of them travel by two-wheelers, majority of the females use public transport (61.11 Percent), and very few people i.e. 1.42 percent of males are using other mods and there are no females. Compered to male workers, female workers have lower access to private vehicles and rely more on buses or walking. (Table 9 and Fig.10)

Table 9: Mode of transportation for hospital visit

Mode of transportation	No. of Male	Percent age	No. of Female	Percenta ge	Total	Perce ntag e
By walk	24	17.14	20	27.77	44	20.75
Two wheeler	70	50	8	11.11	78	36.79
Public transport	44	31.42	44	61.11	88	41.50
Others	2	1.42	0	0.00	2	2.77
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

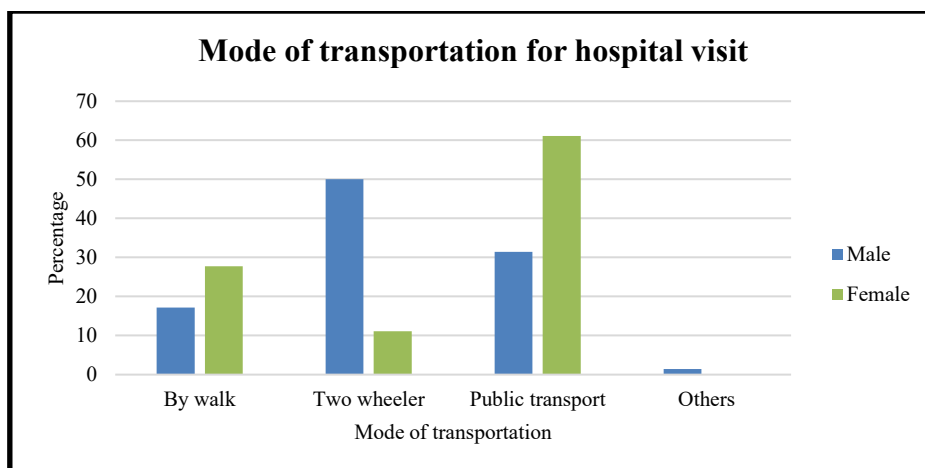


Fig.10

Preference of hospital:

54.71 percent are report they prefer a government hospital and 45.28 percent of workers prefer a private hospital. Among the male workers, 57.14 percent go to government hospitals and 42.85 percent of them private hospitals, among female workers, exactly half 50.00 percent of them prefer government and other prefer half are private hospitals, this shows that males slightly prefer government hospital while females split their Preference between both sectors. It may be due to convenience and perceived quality of service. (Table 10 and Fig.11)

Table. 10: Preference of the hospitals

Type of hospital	No. of Males	Perce ntage	No. of Females	Perce ntage	Total	Perce ntage
Government	80	57.14	36	50.00	116	54.71
Private	60	42.85	36	50.00	96	45.28
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

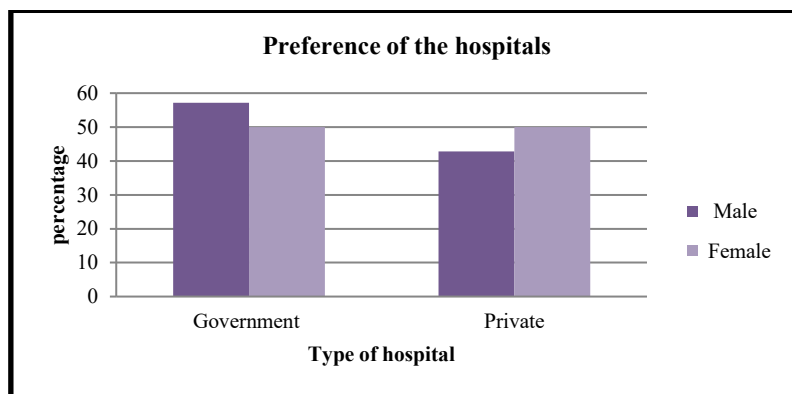


Fig.11

Health problems of the Sanitation workers:

Sanitation workers face significantly many health problems due to exposure to hazardous waste, improper waste management and waste segregation at household levels. Other causes for their health issues are lack of basic facilities like low-quality PPE kits, drinking water, restroom and toilets at the workplace, lack of training on occupational health and safety measures, and their job involves manual handling of waste and inadequate equipment and PPE. These can increase the health risks for sanitation workers. 28.30 Percent workers reported that they are suffering from the musculoskeletal pain, 8.49 Percent are suffering from the infectious diseases, 6.60 Percent have gastro-intestinal issues, 5.66 Percent workers suffer from the respiratory problem, those who work at the dumping yard have respiratory problems because of the dust and low-quality PPEs. And 2.83 Percent workers have Chronic headache and same Percent (2.83 percent) of the workers have injuries. Among the sanitation workers, musculoskeletal pain is a major problem for both genders, but a higher proportion found in females i.e. 41.67 percent than males (21.43 percent). And 52.86 males and 30.56 percent females reported that they have no health problems. Minor health problem faced by male and female workers is chronic headache (1.43 percent and 5.56 percent) and there are no female workers who suffer from injuries and respiratory problems. (Table 11 and Fig.12)

Among male sanitation workers, a smaller proportion reported health issues (66 out of 140 = 47.14 percent) compared to females (50 out of 72 = 69.44 percent). This suggests female sanitation workers were more likely to report health issues.

When the hypothesis that there is an association between the gender of sanitation workers and health problems tested with Chi-square technique at five percent significance level The Chi-square test revealed statistically significant association between the gender of sanitation workers and health problems (Chi-square (χ^2) = 9.544, P = 0.002). Since P value is 0.002 is less than 0.05 the association is statistically significant.

Table 11: Health problems of the Respondents

Health problem	No. of Male	Percent age	No. of Female	Percent age	Total	Percent age
Musculoskeletal pain	30	21.43	30	41.67	60	28.30
Chronic headache	2	1.43	4	5.56	6	2.83
Infectious	10	7.14	8	11.11	18	8.49
Injuries	6	4.29	0	0.00	6	2.83
Respiratory problem	12	8.57	0	0.00	12	5.66
Gastro-intestinal	6	4.29	8	11.11	14	6.60
Nil	74	52.86	22	30.56	96	45.28
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

		Male	Female	Chi-square value (X^2)	Df	P value
Health Problems	Yes	66	50	9.544	1	0.002
	No	74	22			
Total		140	72	-	-	-

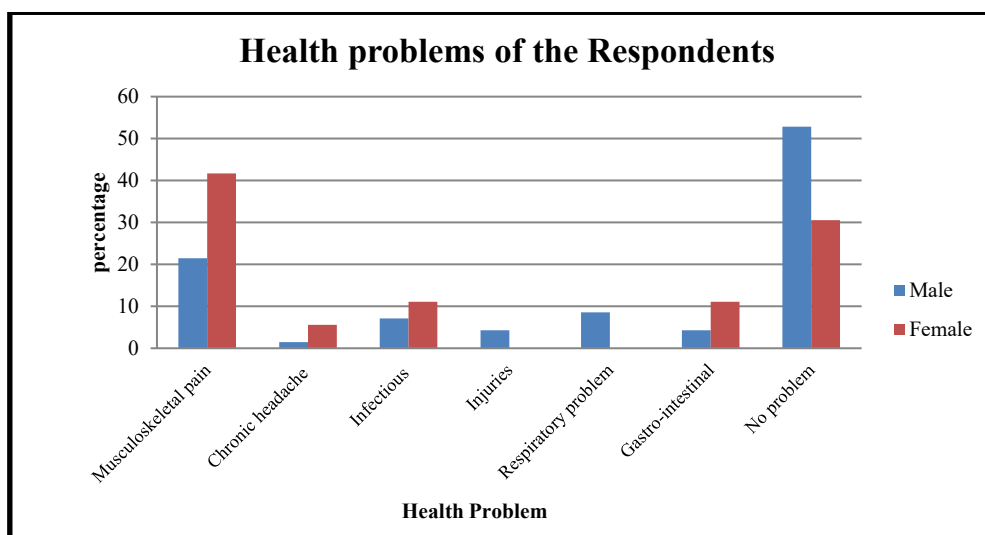


Fig.12

Monthly medical expenditure:

As far as the monthly medical expenditure is concerned 49.06 percent fall in the lowest expenditure group of less than Rs. 500, 26.42 percent of them spend Rs. 600 to 1000, while, 14.15 percent of workers spend Rs. 1100 to 1500, and only 10.38 percent of them spend more than Rs. 1500 per month on health care. Among the males, the majority of the workers, i.e. 48.57 percent spend less than Rs. 500 per month, and 50.00 percent of females belong to the same category, the lowest percent i.e. 8.57 of males and 13.89 percent of females spend Rs. 1500 per month. According to the data, most of the sanitation workers spend a small amount on medical needs monthly, mainly because they utilize government hospitals offering low-cost or free treatment. (Table 14 and Fig.13)

Table 12: Monthly medical expenditure

Amount in Rs	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
0-500	68	48.57	36	50.00	104	49.06
600-1000	42	30.00	14	19.44	56	26.42
1100-1500	18	12.86	12	16.67	30	14.15
Above 1500	12	8.57	10	13.89	22	10.38
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

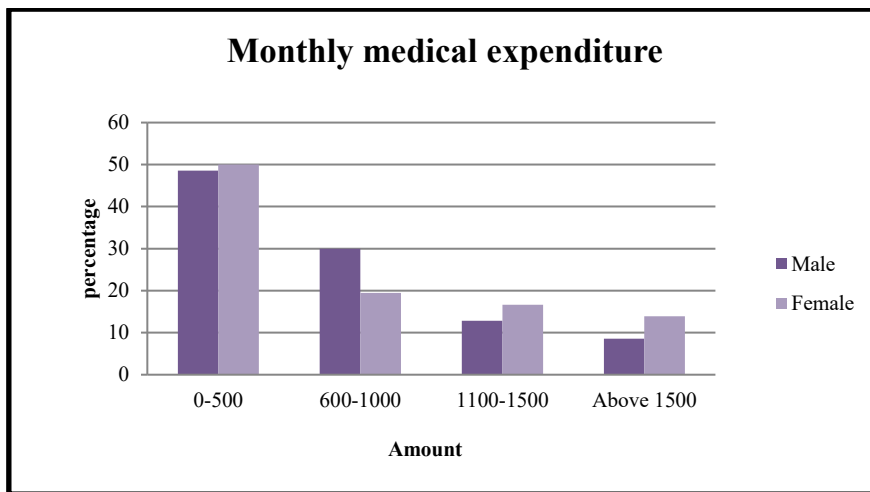


Fig.13

Bad habits of the sanitation workers:

Working condition make sanitation workers to develop bad habits, such as chewing tobacco and alcohol consumption. 50.94 percent of workers chew tobacco, and 38.68 percent of workers reported no such bad habits. and 8.49 percent are consuming alcohol, while only 1.86 percent smoke. Among the male workers, habit of chewing tobacco is highest with 54.29 percent, while the majority of females reported no such habits (55.56 percent), but 44.44 percent of females chew tobacco. In contrast, smoking is a habit of only a few males (2.86 percent) and 12.86 percent of males consume alcohol, while no females are reported to smoke and consume alcohol. Dumping yard workers stated that they cannot work without tobacco. (Table 13 and Fig.14)

Table 13: Bad habits of sanitation workers

Bad habits	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
Chewing tobacco	76	54.29	32	44.44	108	50.94
Smoking	4	2.86	0	0.00	4	1.86
Alcohol	18	12.86	0	0.00	18	8.49
No	42	30.00	40	55.56	82	38.68
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November,2025) and Personal Computation

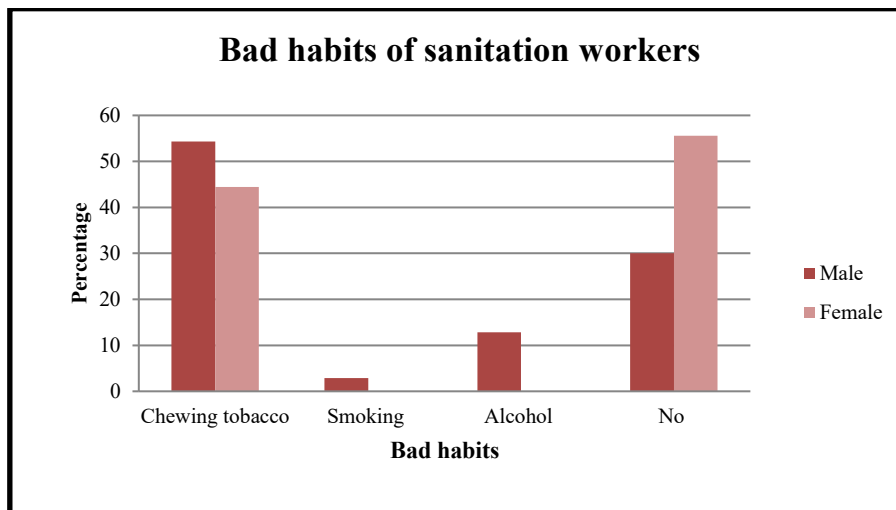


Fig.14

Insurance coverage:

93.40 percent of the workers reported that they have insurance of Employees State Insurance Corporation (ESIC), which is provided by the HDMC while some workers have LIC and others bank’s life insurance. While only 6.60 percent of workers do not have any insurance coverage. Among the male workers, 92.40 percent have insurance, Female worker’s coverage is slightly higher 94.44 percent have insurance and only 7.14 percent of males and 5.56 percent of females are uninsured. Almost all the sanitation workers have insurance, but a few workers remain uninsured. Most of the workers have the ESIC cards, but they are not fully aware of the benefits and use of ESIC. (Table 14 and Fig.15)

Table 14: Insurance coverage

Response	No. of Males	Percentage	No. of Females	Percentage	Total	Percentage
Yes	130	92.86	68	94.44	198	93.40
No	10	7.14	4	5.56	14	6.60
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

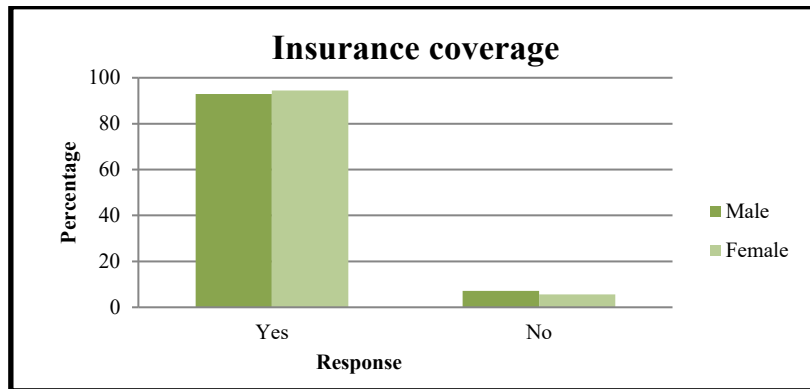


Fig.15

Compensation provided in case of work-related injury or death

69.81 percent of workers said there is no compensation, 19.81 percent have awareness about it, and only 10.38 percent are not sure about the compensation they receive. Among male workers, the majority of workers reported that they do not know about it (72.86 percent), and even 63.89 percent females also expressed it, in contrast very few males are (12.83 percent) are not sure about it Females in this category account for 5.56 percent. Only permanent workers receive compensation in case of death, and this does not cover work- related injury. contract and daily wage workers do not receive any compensation for injury and death, which shows that there is no social, life and job protection for workers and their families. (Table 15 and Fig.16)

Table 15: Compensation provided in case of work-related injury or death

Response	No. of Males	Perce ntage	No. of Females	Perce ntage	Total	Perce ntage
Yes	20	14.29	22	30.56	42	19.81
No	102	72.86	46	63.89	148	69.81
Not sure	18	12.86	4	5.56	22	10.38
Total	140	100.00	72	100.00	212	100.00

Source: Field survey (November, 2025) and Personal Computation

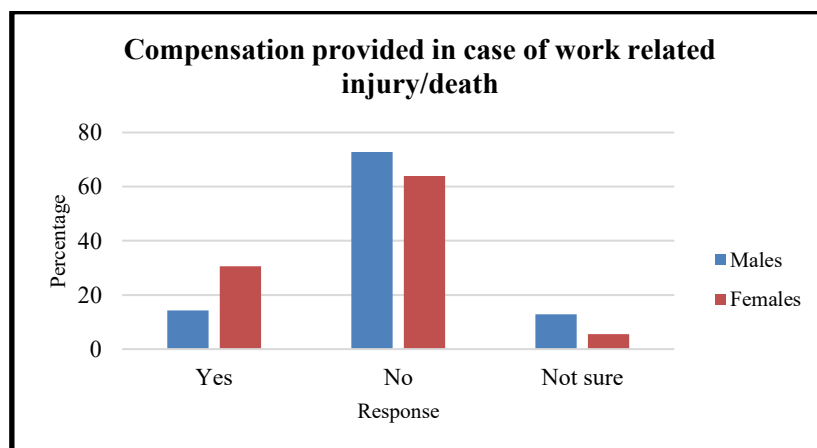


Fig.16

Suggestion:

- Good-quality PPEs should be provided at regular intervals to all sanitation workers, especially dumping-yard workers.
- Arrangements should be made for basic facilities at the workplace, such as drinking water, rest rooms and toilets, especially for female workers who face major difficulties in using toilets.
- Awareness programmes should be conducted for residents on waste segregation at the household level, so that the workload and health risks of sanitation workers can be reduced.
- Good-quality, nutrient-rich food should be provided to the workers.
- HDMC should conduct awareness programmes once a year or half-yearly on ESIC and other government schemes so that the workers can use their ESIC cards, and claim benefits.

Conclusions:

The study has presented an in-depth analysis of the health impact and occupational safety of the municipal sanitation workers in the twin cities of Hubballi-Dharwad. Majority of the sanitation workers are middle-aged and low-educated. Majority of workers are daily-wage or contract-based sanitation workers with low monthly incomes, which makes them socio-economically substandard. The health profile sanitation workers shows that many workers suffer from the musculoskeletal pain, infections, respiratory problems, though, HDMC conduct regular basic health check-ups, compensation for work related injury or death is not provided especially for contract and daily-wage workers, only permanent workers are getting it.

Acknowledgement:

The researcher is extremely thankful to the Sanitation workers of Hubballi-Dharwad Municipal corporation for sharing their working condition and health problems to enhance the excellence of research.

References:

1. **Ajit Kumar Lenka**, (2019): "Health, Identity and Livelihood Status of sanitation workers in Bhubaneswar city, Odisha". IJRAR, Volume 6, Issue 2, PP 438-450.
2. **Dr. Baby K**, (2020): "Health Impact of Solid Waste Management on Sanitary workers: With Special reference to Palakkad Municipality". Journal of Emerging Technologies and Innovative Research, Volume 7, Issue 8, ISSN – 2349-5162, PP 557-567.
3. **International Labour Organization**, (2018): Women and Men in The Informal Economy: A Statistical Picture, 3rd Edition. Geneva: IOL
4. **K. L. Ramitha and Thatipally ankitha et. al**, (2021), "A Cross-Sectional Study on Occupational Health and Safety of Municipal Solid Waste Workers in Telangana". India, Indian Journal of Occupational and Environmental Medicine, Volume 25:169-77.
5. **United Nations Environment Programme**, (UNEP, 2016): Global Waste Management Outlook
6. **World Health Organization**, (WHO, 2017): Health, Safety and Dignity of Sanitation Workers.