

Research Article

Integrated Screening for Non-Communicable Diseases in Sanitation Workers

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Abstract

Background: Municipality sanitation workers employed by Municipal Corporation of Bengaluru City, India are known as Pourakarmikas (PKs). The nature of their work exposes them to Non-Communicable Diseases (NCDs). This study was conducted to determine the prevalence of NCDs and the common cancers among these sanitation workers.

Method: The study was conducted in partnership between a government body, a not-for-profit organization and a dental institute. PKs were screened at designated Primary Health Centers for anthropometric measurements, oral and breast cancers by clinical examination and cervical cancer by Visual Inspection with Acetic acid (VIA) and Pap smear. A dedicated mobile application was used for data collection and evaluation. Electronic records were maintained to enable follow-up. Over a period of five months, 2076 PKs were screened. 574 (27.6%) had elevated Blood Pressure (BP) and 116 (5.5 %) had elevated random blood sugar (RBS) levels. Body mass index and waist-hip ratio were significantly and positively correlated with elevated BP and RBS. Oral examination revealed 194 cases of oral potentially malignant disorders. 5 women had breast lumps, 1 case of carcinoma cervix was detected and 10 women had positive results on VIA/Pap.

Conclusion: It was concluded that PKs had a higher prevalence of NCDs, tobacco use and high screen positive rates for OPMDs, breast and cervical cancers. This study established that partnerships can be used to screen larger populations and vulnerable sections of the society.

Keywords: Cancer; Mobile Health; Non-Communicable Diseases; Sanitation Worker

Introduction

Municipality sanitation workers are employed in collection of solid waste and manual sweeping of roads. The sanitation workers employed by the Municipal Corporation of Bengaluru City (Bruhat Bengaluru Mahanagara Palike- BBMP), which is one of the largest municipal corporations in India are known as Pourakarmikas (PKs). The services of Sanitation workers are essential in maintaining public health, however, the workers themselves face health risks due to exposure to adverse biological and chemical agents [1]. PKs face risk of injury from heavy labor, poor and prolonged postures and psychosocial stress [2]. Other challenges they face include poverty, low literacy, child labor, migration, alcohol abuse, discrimination, social stigma and societal neglect [2,3]. The nature of work may lead to lifestyle disorders such as diabetes, hypertension and common cancers like oral, breast and cervical cancers among sanitation workers. However, no official estimates are available for mortality or morbidity in sanitation workers in India [4]. This screening program was planned to assess the health status of PKs of West Zone of Bengaluru city, to determine the prevalence of non-communicable diseases and signs of common cancers among them.

Methodology

Screening of PKs was initiated by BBMP in association with partners including a non-government organization (Biocon Foundation), a dental school (KLE Society's Institute of Dental Sciences) and a citizen's group (B.PAC). Screening and data entry were carried out by a team of experienced public health and oral medicine specialists.

An integrated screening for Non-Communicable Diseases (NCDs) including hypertension, diabetes mellitus and screening for the common cancers -Oral, breast and cervical was planned for all PKs in 44 wards of BBMP West Zone. A pilot screening was conducted for 89 PKs from a single ward. After obtaining requisite permissions, a schedule of screening dates with locations was prepared and communicated to 29 Urban primary health centers. Screening was carried out on every Tuesday, Thursday and Saturday with half-day paid leave granted to PKs.

Prior information of schedule and action plan was shared with the concerned Medical Officers of the health centers and the Corporators of the wards. Pre-screening group counseling sessions were conducted at the worksite of the PKs to educate them about the importance of health screening and repeated at the health center on the day of the screening by the clinicians about the process involved. Participants who provided informed consent were registered with unique IDs. The screening of PKs was implemented using mobile technology previously deployed for the surveillance of oral cancer [5]. A mobile application with decision-based algorithm enabled the creation of an electronic medical record with the following details:

Demographic details, anthropometric measurements to establish Body Mass Index (BMI) and Waist-to-Hip Ratio (WHR), Random Blood Sugar (RBS) and Systolic (SBP) and Diastolic (DBP) blood pressure. Risk factor assessment for cancers was based on the participant's medical history, personal and family history of cancer and tobacco, areca nut and alcohol consumption. Data such as parity, menstrual history, history of undergoing tubectomy or hysterectomy and other relevant factors, were recorded for women.

All participants were screened for oral lesions and oral cavity images were captured using the mobile application. Patients with Oral Potentially Malignant Disorders (OPMDs) were counseled about cessation of tobacco/areca nut habit and were referred for biopsy.

Clinical Breast Examination (CBE) was done by inspection and palpation to look for abnormalities or changes. CBE included palpation for cervical, axillary and supraclavicular nodes. Patients detected with a lump were referred for mammogram or ultrasound and biopsy. The women were taught the technique of self-breast examination and advised to perform the self-examination once a month. The mobile application permitted annotation of the size and position of the lump on the standard breast image.

Cervical cancer screening was conducted using Visual Inspection with Acetic acid (VIA) and Pap test. Visual Inspection with Lugol's Iodine (VILI) was performed for VIA positive cases as confirmation. Pap smear test of the vaginal vault was conducted for women who had undergone hysterectomy. The Pap smears were studied and reported by a pathologist. For instances where abnormal growth in cervix was detected, VIA and Pap tests were not performed and such cases were immediately referred. In the process of screening, reproductive tract infections were also diagnosed and treated. Unmarried women and women who were menstruating were excluded from cervical examination.

Medical reports were shared with the participants. Counseling for change in diet and habit cessation along with advice for treatment and follow-up of diabetes, hypertension and common cancers was provided by the doctors. Pap smear reports which were received a week after the screening, were distributed to the PKs through the Medical Officer, Solid Waste Management Unit for counseling and referral. Cases who were detected as VIA positive and/or with abnormal cytology were advised Colposcopy and evaluation by gynecologists.

Referral pathway for PKs is predetermined. They are equipped with unique ID cards, that enable them to seek medical care at designated medical hospitals. The medical reports arising from this screening program were shared with medical authorities for further confirmation and management of cases.

Prevalence of NCDs was measured as percentage values and cross-tabulation was done using chi-square test. 'P' values <0.05 were considered statistically significant. Odds ratio for correlation of BP and RBS with predisposing factors was determined.

Results

The number of eligible participants was 2690, while the number examined was 2076, a coverage of 77.17%. There were 1734 female participants and 342 male participants. The mean age (SD) of females was 38.82 (7.54) years (range 19 to 73 years) and the mean age (SD) of males was 39.7 (9.12) years (range 18- 61 years).

Mean (SD) of BMI in females (n=1726) was 20.1 (5.62) (range 12.49 to 56.40) and in males (n=340), mean BMI (SD) was 20.68 (5.06) (range 15.06 to 43.50). Classification of BMI was based on that given by Misra, et al., [6]. WHR was measured to determine central obesity for 2038 participants. Mean (SD) WHR in females was 0.84 (0.06) (range 0.52 to 1.33), while in males it was 0.93 (0.06) (range 0.67 to 1.17), classified based on description by Snehalatha, et al., [7].

Among the participants (n=2076), 328 reported a family history of hypertension/diabetes/ cardiovascular diseases, while 42 reported a family history of cancer. Two participants were cancer survivors.

There were 124 participants with known hypertension. Mean (SD) SBP among women was 128.2 (21.17) mm/Hg (range 84 to 225) and mean (SD) DBP was 80.5 (12.14) mm/Hg (range 41 to 166). Among males, mean (SD) SBP was 136.5 (22.63) mm/Hg (range 82 to 218) and mean (SD) DBP was 84.2 (13.52) mm/Hg (range 50 to 170). Furthermore, 75 patients were found to be in hypertensive crisis (BP $\geq$ 180/120 mm/Hg) of which 53 had no known history of hypertension. Age (p=0.00), BMI (p=0.00) and waist hip ratio (p=0.00) are significantly and positively correlated with systolic and diastolic blood pressure (Table 1).

On screening for diabetes, 82 participants had a known history of diabetes. Among females, mean (SD) RBS was 117.3 (54.21) mg/dl (range 51 to 852) and among males, mean (SD) RBS was 124.3 mg/dl (59.58) (range 55 to 564). Age (p=0.00), BMI (p=0.00) and waist hip ratio (p=0.00) are significantly and positively correlated with RBS (Table 1).

Distribution of types of tobacco habit and alcohol habit was assessed (Table 2). The number of women with tobacco chewing habit was 174, while 331 of them chewed areca nut. 5 women were smokers and 11 of them gave history of alcohol use. Among men, 42 had a tobacco chewing habit, while 12 of them chewed areca nut. 98 men were smokers and 63 of them gave history of alcohol use. The most common frequency of these habits was 5 times a day and most participants had habit duration of 5 years. Screen positive rates of oral, breast and cervical cancer screening are as described in Table 3. Among the participants whose oral examination was done (n=2003), 211 had oral lesions. This included 50 males (n=342, 15%) and 161 females (n=1661, 10%), showing a significant difference among the genders (p=0.003). The most common lesion encountered was leukoplakia (n=111, 52.6%), followed by 63 cases of tobacco pouch keratosis, 16 cases of oral submucous fibrosis and 9 cases of lichen planus/lichenoid reactions. There were 17 cases with non-tobacco associated benign lesions. Participants with any form of tobacco habit were significantly more likely to have oral lesions (Table 4, p= 0.0000).

Among the women who underwent clinical breast examination (n=1561), 10 participants were positive for lumps while 5 of them also reported tenderness. There was no significant association of breast lumps with obesity, parity or menopausal status (Table 5).

Data obtained from women PKs (n=1734), 883 (51%) reported parity three or more, 423 (24%) had attained menopause and 1183 (68%) were premenopausal. The average age at marriage of the women was 15.6 years. Tubectomy procedure had been performed on 1235 (71%) of the women and 85 women (5%) had undergone hysterectomy. Leukorrhea was reported by 67, malodorous discharge was detected in 18 cases, 4 cases each of endocervical polyp and nabothian cysts were diagnosed, 32 women were detected with cervicitis and 7 cases of prolapse were observed.

Pap smear was obtained for 967 women; one patient was detected with a low grade squamous intraepithelial neoplasm and three patients had Atypical Squamous Cells of Undetermined Significance (ASC-US). Of the 845 women who underwent examination with VIA, 6 were VIA positive. These VIA positive patients underwent additional examination with VILI and 5 were found positive. Three patients had clinically visible growths from the cervix. One of them had bleeding on insertion of the speculum

and hence no further investigations were carried out and the case was referred immediately to a government hospital. Biopsy confirmed a diagnosis of squamous cell carcinoma of cervix. The second patient had a polypoid growth arising from the vault. For the third patient, a Pap smear was obtained, which reported no abnormalities. All patients were suitably referred and treated.

Follow-up

At the end of screening, a review meeting was held. The invitees included primary care physicians from the wards where screening had been carried out. They were all given a list of PKs from their wards who had abnormal results on screening. All of them were trained to perform visual oral examination. They were asked to follow up all these patients for a period of one year. An attempt at telephonic conversation to ensure follow-up was made. However, the response to follow-up by PKs has not been encouraging so far.

	Hypertension: Odds ratio (CI)	p-value	Diabetes: Odds ratio (CI)	p-value
Age				
18-29	1 (reference)		1 (reference)	
30-39	1.851 (1.22 to 2.80)	0.004	4.465 (1.05 to 18.8)	0.042
40-49	3.930 (2.59 to 5.95)	0.000	6.831 (1.62 to 28.64)	0.009
50-59	9.411 (5.72 to 15.45)	0.000	10.450 (2.33 to 46.83)	0.002
>60	19.494 (6.48 to 58.62)	0.000	24.584 (3.93 to 153.63)	0.001
Gender				
Female	1 (reference)		1 (reference)	
Male	1.638 (1.23 to 2.18)	0.001	1.436 (0.84 to 2.44)	0.182
Overweight/obesity				
Absent	1 (reference)		1 (reference)	
Present	2.135 (1.70 to 2.67)	0.000	1.619 (1.06 to 2.47)	0.026
Abdominal obesity (Waist hip ratio)				
Absent	1 (ref)		1 (reference)	
Present	1.179 (0.94 to 1.47)	0.153	2.813 (1.54 to 5.12)	0.001
Smoking				
No	1 (reference)		1 (reference)	
Yes	0.964 (0.70 to 1.31)	0.819	0.772 (0.39 to 1.50)	0.448
Alcohol				
No	1 (reference)		1 (reference)	
Yes	2.009 (1.14 to 3.51)	0.015	1.345 (0.50 to 3.55)	0.550
Family history				
No	1 (reference)		1 (reference)	
Yes	1.672 (1.20 to 2.32)	0.002	4.802 (3.11 to 7.41)	0.000

Table 1: Odds of having elevated BP and RBS.

	Tobacco chewing (%)	Areca nut chewing (%)	Smoking (%)	Alcohol use (%)	Total
Female	174 (10.03)	331 (19.09)	5 (0.29)	11 (0.63)	1734
Male	42 (12.28)	12 (3.51)	98 (28.65)	63 (18.4)	342
Total	216 (10.4)	343 (16.52)	103 (4.96)	74 (3.56)	2076

Table 2: Prevalence of tobacco and alcohol habits among PKs.

Screen-positive cases	No. of PKs examined	Positive	Percentage
Oral	2003	194	9.68
Breast	1561	5	0.32
Cervical VIA	845	6	0.71
Cervical pap	967	5 (1 squamous cell carcinoma)	0.51

Table 3: Screen positive cases of cancer screening.

	Positive	Negative	X ²	p
Tobacco chewer	129	86	620.1917	0.000
Non- tobacco chewer	82	1708		
Areca nut chewer	99	237	151.6481	0.000
Non-areca nut chewer	112	1559		
Smoker	27	74	28.4236	0.000
Non-smoker	182	1720		

Table 4: Correlation of positivity of OPMD with habit history.

	Positive	Negative	X ²	p
Obese	4	910	0.8116	0.367
Not obese	6	630		
Tobacco user	3	343	0.0393	0.842
Non-tobacco user	7	1192		
Para=>1	10	1455	0.0000	1.000
Nulliparous	0	46		
Menopause	1	385	0.6204	0.430
Premenopause	9	1097		

Table 5: Correlation of breast lump with predisposing factors.

Discussion

PKs, municipality sanitation workers employed by BBMP, are exposed to multiple risk factors and suffer from high rates of occupational health problems.[8] Bearing these health hazards of PKs in mind, we conducted an integrated screening program to evaluate their general health status by screening for hypertension, diabetes and common cancers.

NCDs account for over 60% of deaths in India [9]. The risk factors for NCDs include behavioral and metabolic risk factors. Behavioral risk factors include tobacco, alcohol, physical inactivity and unhealthy diet. Metabolic risk factors comprise raised blood glucose, raised blood pressure, overweight/ obesity and hyperlipidemia [10]. Tobacco use, in any form and excessive alcohol use are major risk factors for oral cancer. With dietary deficiencies, these factors cause more than 90% of oral cancers [11]. Risk for breast cancer may be elevated for women with high BMI, occupational exposures to nightshift work, ionizing radiation, some chemicals, job stress and sedentary work [12]. The known risk factors of developing cervical cancer are human papilloma virus, low SES, smoking, marrying before age 18 years, young age at first coitus, multiple sexual partners, multiple sexual partners of spouse and multiple childbirths [13].

As per National family Health Survey-5 (NFHS-5), 22.9% of Indian men and 24% of Indian women are overweight/obese [14]. 47.7% of men and 56.7% of women have a high WHR. Among our study population, the proportion of women having obesity was lower than the national average, while greater proportion of men had central obesity. The participant PKs in our study were residents of an urban area and hence were exposed to urban lifestyle and dietary pattern. All these factors might have led to the high central obesity among them.

As per NFHS-5, 15.7% of men and 12.4% of women in India have elevated BP; while the prevalence was higher in our population (25.6% of women and 37.7% of men). While 0.04% of our participants had been diagnosed with hypertension, 76% of them had

elevated BP on examination. We found low awareness and poor control of hypertension among participants. In some cases, anxiety may have led to higher readings (white coat hypertension) and a re-evaluation on the next three consecutive days was advised for all patients. Overall, it was found that age, BMI and waist hip ratio were significantly and positively correlated with hypertension.

We also found 75 PKs in our study to be in hypertensive crisis ($BP \geq 180/120$ mm/Hg). Some of them reported irregular adherence to medication. The participants might have experienced some anxiety during screening, leading to higher values. They were all reassured and BP was re-estimated. Those who showed consistently high levels after three readings were administered Nifedipine 10 mg sublingually and were immediately referred to a higher center for admission and observation.

NFHS-5 showed that 14% of women and 15.6 % of men in India were known diabetics. The proportion was lower (2.7%) in our participants, as also was the proportion of participants having elevated RBS. It was found that age, BMI and waist hip ratio were significantly and positively correlated with RBS.

As per NFHS-5, 8.9% of women and 38% of men use tobacco in any form in India. The proportion was higher in our participants, being 29.4% among women and 44.4% among men. Of the total of 538 tobacco users in our study, 186 (35%) had oral lesions. Kamala, et al., reported a prevalence of 70.4%, while Hallikeri, et al., reported 54.18% [15,16]. However, these were hospital-based studies which performed opportunistic screening. Feng, et al., reported a prevalence of 10.8% in a population-based cross-sectional study in China [17]. We did not find any case of a lesion suggestive of oral cancer on visual examination. There was a significant association of oral mucosal lesions with tobacco habit, smoking or smokeless and areca nut chewing ($p=0.0000$).

Among our patients, 10 women had breast lumps or tenderness. 4 women with breast lumps had a high BMI. Five patients had breast tenderness, suggestive of an inflammatory cause of the enlargement. The other 5 (0.32%) women had lumps without tenderness or inflammatory features. All the patients were referred to a higher center for mammography.

1734 women were eligible and consented for cervical screening. One woman had a clinically visible growth, which was subsequently diagnosed as squamous cell carcinoma. We conducted examination with VIA for 845 women PKs, of which 6 patients were found to be positive, with a screen-positive rate of 0.7%. Pap smears were also obtained for 967 women, which showed that one patient had a low grade squamous intraepithelial neoplasm (LSIL). Three patients had ASC-US (atypical squamous cells of undetermined significance) (screen-positivity of 0.51%). None of the patients with positive VIA staining had abnormal cytology on Pap.

Screening for cervical cancer using Pap smear testing has reduced the incidence and mortality due to cervical cancer by up to 80% in developed countries. However, in middle-income countries, screening has been suboptimal due to poor organization, coverage, lack of resources and lack of quality assurance. This led to the evaluation of alternative screening approaches such as VIA, VILI, HPV testing-based screening. VIA offers a single-visit triaging and is readily applicable in population-based screening in low resource settings [18].

Based on a single contact, our patients thus had a higher prevalence of NCDs, such as high blood pressure and random blood sugar levels. Prevalence of tobacco use was also higher than the general population. Screen positive rates for OPMDs, breast and cervical cancers were also higher than the rest of the population. Thus, it can be inferred that PKs are vulnerable to developing NCDs and need rigid screening and surveillance. The major limitation of our study is the lack of confirmatory diagnosis of the cancers and hypertension and diabetes. This was in part because this was an outreach program and screening was conducted in different localities across the city. Due to the invasive nature of cervical cancer screening, participants were unwilling to come forward to be screened and required additional counselling and reassurance.

Conclusion

In conclusion, the integrated screening was well-coordinated and on schedule. All the participants were educated about overcoming risk factors and the importance of being screened periodically. The participants were referred to a higher center for confirmatory diagnosis. The results establish that partnerships can be used to scale up screening to larger populations to screen vulnerable sections of the society.

Conflict of Interests

The authors do not have any conflicts to declare.

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