

# Prevalence of Adverse Health Effects among Municipal Solid Waste Workers, Southern Thailand

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Received May 16, 2017; Revised July 09, 2017; Accepted December 04, 2017

This paper is available on-line at <http://ijoh.tums.ac.ir>

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## ABSTRACT

This study evaluated the prevalence of adverse health effects among municipal solid waste workers and described their socioeconomic situation and work characteristics.

This cross-sectional descriptive study conducted with 114 municipal solid waste workers. They were recruited from workers who worked on 5 sanitary landfill areas in southern Thailand, between January and May 2017. Information was collected via a questionnaire. Data analysis comprised of descriptive and analytical components. The health problems noted with the study group over the period were musculoskeletal problems (65.8%), skin problems (58.8%), respiratory disease (47.4%), nail problems (45.6%), gastrointestinal problems (42.1%), and eye problems (20.2%). General characteristics, work type characteristics, the use of PPE, and the personal hygiene behavior of municipal solid waste workers were significantly associated with adverse health effects among these workers at  $P < 0.05$ . There appears to be a strong correlation between waste disposal work and some health problems. The prevention and reduction of adverse health effects among municipal solid waste workers should include improving their education on how to reduce health risks while working.

**KEYWORDS:** *Monitoring of risk assessment, PHA, Accident indicator*

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## INTRODUCTION

The disposal of municipal solid waste is a common problem globally. Sanitary landfill is often the preferred solution, particularly in developing countries, due to attaining an acceptable result at the lowest cost. In Thailand, as a developing country, the level of hygiene education and number of effectively implemented environmental safeguards is limited. Consequently, the people who work at landfills are often exposed to many work-related health hazards and safety risks. These include injuries caused by work-related accidents, musculoskeletal problems from working characteristics, as well as respiratory, gastrointestinal and infectious diseases from contaminated waste [1- 2].

Many studies have shown adverse health effects among garbage workers in Thailand [3, 4]. In Bangkok, waste pickers are known to be at risk of injury from the materials being disposed of, with reported injuries from glass (88%), needles (73%), bamboo (30%), and metals (25%) [5].

While the documented health problems of scavengers have been shown as low back pain and sprains (95%), common colds (89%), and skin rashes (66%). Other problems included headaches (49%), fatigue (34%), shortness of breath (23%), and impetigo (19%) [3]. Waste pickers also have contact with infectious waste such as syringes and cotton bandages contaminated with blood and other body fluids, which can lead to infectious diseases. In Bangkok, 5% of waste pickers were positive for HIV antibodies, and 24% were positive for hepatitis B antibodies [5].

Although some studies have been undertaken, research and prevalence data on the adverse health effects of workers exposed to municipal solid waste is still rare. There has been no study about adverse health effects that include respiratory disease, eye problems, skin, nail infections, gastrointestinal problems, and musculoskeletal problems among workers in Southern Thailand.

The objectives of this cross-sectional descriptive study were to describe the socioeconomic situation of municipal solid waste

workers, their work characteristics and to evaluate the prevalence of health effects among the workers.

## MATERIALS AND METHODS

**Study Population and Samples:** The Ethics Committee of the Institute of Research And Development Thaksin University approved this research.

The cross-sectional descriptive study was conducted among municipal solid waste workers who worked at five sanitary landfill areas in middle southern Thailand, between January and May 2017. The sampling areas were selected by purposive sampling, two areas located in Nakhon Si Thammarat Province, two areas in Songkhla Province and one area in Phatthalung Province. All of these landfill sites supported the disposal of solid waste from municipalities that totaled an area of more than 24000 square kilometers. All the sanitary landfill areas were managed by their respective Local Administrative Organization.

The subject workers were also selected by purposive selection, 25% of all the workers (456 persons) who worked in these 5 sanitary landfill areas. About 100% of the selected subject workers (114 persons) agreed to participate in the study. Inclusion criteria for the subject workers were: formal workers aged between 20-60 yr and in occupational contact with the solid waste for at least one year. Cooperative letters and informed verbal consent were obtained from all study participants.

**Sample Collection:** The instrument to measure adverse health effects and personal protection equipment (PPE) used was a questionnaire based on the literature reviewed by the researcher. Five experts for validity approved it. The content had a validity of 0.83 and a Kuder-Richardson 20 (KR-20) reliability of above 0.95. The questionnaire was conducted via face-to-face interview and information on the following variables was collected. General information (gender, age, and income), worker characteristics (positions, duration of work, days worked per week), personal hygiene behavior (PPE's used, ate snacks or drank water in the work area, washed hands before lunch, and changed clothes after work). Respondents were asked about the practices, which they performed and asked to describe the

frequency they carried out the different activities as "sometimes" or "always", and "yes" or "no".

The occurrence of adverse health effects among the workers was also observed. These effects included respiratory disease (sore throat, sinusitis, etc.), eye problems (burning sensations, watering, redness, and itching of the eyes, etc.), skin problems (dermatitis, eczema, and infection cause, etc.), nail infections (either fingers or toes), gastrointestinal problems (abdominal colic, diarrhea, dyspepsia, vomiting, or dysentery), and musculoskeletal problems (order of predilection as low back, neck, shoulder, elbow, wrist, knee, and ankle, etc.). These health effects were noted either during the initial study time or during a 3-months recall period. Information was also collected by self-reported complaints and doctor's diagnoses. Respondents were asked about the occurrence of each adverse health effect and required to reply with "yes" or "no".

**Statistics Analysis:** Data were collected by questionnaire and analyzed using a software program. For descriptive statistics, percentages, and frequency values, the variables were computed. The analytical component assessed the relationships between health problem prevalence and the independent variables; with chi-square tests and 95% CI computed at a P-value of <0.05.

## RESULTS

**General:** The make-up of the study group was municipal solid waste workers (73.7%) and office workers (26.3%). Eighty-five of the study groups (74.6) were male and 57.9% were aged less than 35 yr ( $35.18 \pm 13.21$  yr). Most subject workers had secondary level education and 66.7% had income less than 225 USD per month ( $226.8 \pm 9.62$  USD per month). 28.1% of all participants were working more than 6 d per week and average hours of  $8.50 \pm 1.8$  h per day. 85.0% of all the subject workers had worked in sanitary landfill areas for more than 10 yr ( $18 \pm 5.42$  yr).

The health problems noted with the subject workers during the 3 months recall periods were, musculoskeletal problems (65.8%), skin problem (58.8%), respiratory disease (47.4%), nail problem (45.6%), gastrointestinal problems (42.1%), and eyes problem (20.2%) (Table 1).

**Table 1.** Classification, frequency and prevalence of health problem among subject workers (n=114)

Morbidity	Number of subject workers (n=114)	Percentage	95% CI
Respiratory disease	54	47.4	40.3-53.6
Eyes problems	23	20.2	15.8-25.3
Skin problems	67	58.8	54.2-66.2
Nail infections	52	45.6	42.0-52.3
Gastro-intestinal problems	48	42.1	42.3-53.0
Musculoskeletal problems	75	65.8	58-1-66.2

**Socioeconomic:** The occurrence of health problems, including musculoskeletal problems (80.0%), and nail infections (52.9%) was statistically significantly higher among male subject workers than female subject workers, at  $P < 0.001$  and  $P < 0.001$ , respectively. Gastro-intestinal problems (62.1%), and eye problems (37.9%) were statistically significantly higher among female subject workers than male subject workers, at  $P < 0.001$  and  $P < 0.001$ , respectively.

With reference to age, the occurrence of health problems in the subject workers, including musculoskeletal problems (89.6%), skin problems (89.6%), respiratory disease (85.4%), nail infections (79.2%), gastrointestinal problems (56.3%), and eye problems (37.5%), was

statistically significantly higher among subject workers who were  $\geq 35$  yr of age compared to subject workers aged  $< 35$  yr, at  $p < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$  and  $P < 0.001$ , respectively.

Additionally, the occurrence of health problems, [respiratory disease (86.8%), skin problems (86.8%), nail infections (84.2%), gastrointestinal problems (78.9%), and eyes problems (39.8%)], was statistically significantly higher among subject workers who had an income of  $\geq 225$  USD per month, compared to subject workers who had an income of  $< 225$  USD per month, at  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$  and  $P < 0.001$  respectively (Table 2).

**Table 2.** Frequency and prevalence of health problem were classified by general characteristics of subject workers (n=114)

Morbidity	Gender (n, %)		P-value	Age (years)(n, %)		P-value	Income (USD)		P-value
	95% CI			95% CI			(n, %) 95% CI		
	Male (n= 85)	Female (n=29)		$\leq 35$ (n=66)	$>35$ (n=48)		$<225$ (n=76)	$\geq 225$ (n=38)	
Respiratory disease	40 (47.1)	14 (48.3)	0.052	13 (19.7)	41 (85.4)	$<0.001^*$	21 (27.6)	33 (86.8)	0.001*
Eye problems	12 (14.1)	11 (37.9)	$<0.001^*$	5 (7.6)	18 (37.5)	$<0.001^*$	8 (10.5)	15 (39.8)	$<0.001^*$
Skin problems	51 (60.0)	16 (55.2)	0.055	24 (36.4)	43 (89.6)	$<0.001^*$	34 (44.7)	33 (86.8)	$<0.001^*$
Nail infections	45 (52.9)	7 (24.1)	$<0.001^*$	14 (21.2)	38 (79.2)	$<0.001^*$	20 (26.3)	32 (84.2)	$<0.001^*$
Gastro-intestinal problems	30 (35.2)	18 (62.1)	$<0.001^*$	21 (31.9)	27 (56.3)	$<0.001^*$	18 (23.7)	30 (78.9)	$<0.001^*$
Musculoskeletal problems	68 (80.0)	7 (24.1)	$<0.001^*$	32 (48.5)	43 (89.6)	$<0.001^*$	52 (68.4)	23 (60.5)	0.053

\*Significantly associated at  $P$  value of  $<0.05$ .

**Work Characteristics:** Regarding the type of work done, the incidence of health problems including skin problems (71.4%), musculoskeletal problems (65.5%), respiratory disease (59.5%), nail infections (56.0%), gastrointestinal problems (51.2%), and eye problems (25.0%) was statistically significantly higher among subject workers who physically worked with municipal solid waste workers compared to subject workers who worked in an officer position, at  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$  and  $P < 0.001$  respectively.

Regarding the period working in sanitary landfill areas, the incidence of health problems, including musculoskeletal problems (72.1%), skin problems (63.9%), respiratory disease (53.6%),

gastrointestinal problems (43.3%), and eye problems (21.6%) was statistically significantly higher among subject workers worked  $\geq 10$  yr, compared to subject workers worked  $< 10$  yr, at  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ , and  $P < 0.001$ , respectively.

In addition, the incidence of health problems in subject workers including musculoskeletal problems (93.8%), skin problems (93.8%), nail problems (87.5%), and eyes problems (37.5%) was statistically significantly higher among subject workers who worked  $> 6$  d per week compared to subject workers who worked  $\leq 6$  d per week, at  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ , and  $P < 0.001$ , respectively (Table 3).

**Table 3.** Frequency and prevalence of health problem were classified by work characteristics of subject workers (n=114)

Morbidity	Positions		p-value	Duration of work		P-value	Day worked per week		P-value
	(n, %) 95% CI			(years) (n, %) 95% CI			(n, %) 95% CI		
	Office worker (n=30)	Municipal solid waste workers (n=84)		$<10$ (n=1)	$\geq 10$ (n=9)		$\leq 6$ (n=82)	$>6$ (n=32)	
Respiratory disease	4(13.3)	50(59.5)	$<0.001^*$	2(11.8)	52(53.6)	$<0.001^*$	37(45.1)	17(53.1)	0.067
Eyes problems	2(6.7)	21(25.0)	$<0.001^*$	2(11.8)	21(21.6)	$<0.001^*$	11(13.4)	12(37.5)	$<0.001^*$
Skin problems	7(23.3)	60(71.4)	$<0.001^*$	5(29.4)	62 (63.9)	$<0.001^*$	37(45.1)	30(93.8)	$<0.001^*$
Nail infections	5(16.7)	47(56.0)	$<0.001^*$	7(41.2)	45(46.4)	0.420	24(29.3)	28(87.5)	$<0.001^*$
Gastro-intestinal problems	5(16.7)	43(51.2)	$<0.001^*$	5(29.4)	43(43.3)	$<0.001^*$	33(40.2)	15(46.9)	0.075
Musculoskeletal problems	7(23.3)	68(65.5)	$<0.001^*$	5(29.4)	70(72.1)	$<0.001^*$	45(54.9)	30(93.8)	$<0.001^*$

\*Significantly associated at  $P$  value of  $<0.05$ .

The occurrence of health problems, including respiratory disease (93.1%), skin problems (93.1%), nail problems (89.7%), and eye problems (41.4%) were statistically significantly higher among subject workers who did not use a cotton mask compared to subject workers who used a cotton mask, at  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ , and  $P < 0.001$ , respectively.

Furthermore, the health problems, including skin problems (93.1%), nail problems (64.4%), and gastrointestinal problems (58.8%), were statistically significantly higher among subject workers who did not use gloves compared to subject workers who used gloves, at  $P < 0.001$ ,  $P < 0.001$ , and  $P < 0.001$  respectively (Table 4).

With regards to eating and drinking at work, gastrointestinal problems (70.3%) were statistically significantly higher among subject

workers who always ate snacks or drank water in the work area compared to subject workers who sometimes did, at  $P < 0.001$ .

Nail infections (83.0%), skin problems (80.9%), and gastrointestinal problems (78.7%) were statistically significantly higher among subject workers who sometimes washed hands before lunch compared to subject workers who always did, at  $P < 0.001$ ,  $P < 0.001$ , and  $P < 0.001$ , respectively.

Skin problems (72.2%), gastrointestinal problems (54.2%), and respiratory disease (54.2%) were statistically significantly higher among subject workers who sometimes changed clothes after work compared to subject workers who always did, at  $P < 0.001$ ,  $P < 0.001$ , and  $P < 0.012$ , respectively (Table 5).

**Table 4.** Frequency and prevalence of health problem were classified by PPE used of garbage workers (n=114)

Morbidity	Cotton mask (n, %) 95% CI		P -value	Gloves (n, %) 95% CI		P -value
	No (n=29)	Yes (n=85)		No (n=73)	Yes(n=41)	
Respiratory disease	27 (93.1)	27 (31.7)	<0.001*	34 (46.6)	20(48.8)	0.085
Eye problems	12 (41.4)	11 (12.9)	<0.001*	13 (17.8)	10(24.9)	0.056
Skin problems	27 (93.1)	40 (47.1)	<0.001*	51(69.9)	16(39.0)	<0.001*
Nail infections	26 (89.7)	26 (30.6)	<0.001*	47 (64.4)	5(12.2)	<0.001*
Gastro-intestinal problems	12 (41.4)	36 (42.4)	0.073	43 (58.9)	5(12.2)	<0.001*
Musculoskeletal problems	17 (58.6)	58 (68.2)	0.051	45 (61.4)	28(68.3)	0.064

\*Significantly associated at  $P$  value of  $<0.05$ .

**Table 5.** Frequency and prevalence of health problem were classified by personal hygiene behaviors of garbage workers (n=114)

Morbidity	Ate snacks or drank water at work area (n, %) 95% CI		P -value	Washed hands before lunch (n, %) 95% CI		P -value	Changed clothes after work (n, %) 95% CI		P -value
	Sometimes (n=60)	Always (n=54)		Some times (n=47)	Always (n=67)		Some times (n=72)	Always (n=42)	
	Respiratory disease	28 (46.7)		26(48.1)	0.073		25(53.2)	29(43.3)	
Eye problems	10(16.7)	13(24.1)	0.059	12(25.5)	11(16.4)	0.051	13(18.1)	10(23.8)	0.075
Skin problems	35(58.3)	32(59.2)	0.067	38(80.9)	29(43.3)	<0.001*	52(72.2)	15(35.7)	<0.001*
Nail infections	30(50.0)	22(40.7)	0.067	39(83.0)	28(41.8)	<0.001*	31(43.1)	21(50.0)	0.058
Gastro-intestinal problems	10(16.7)	38(70.3)	<0.001*	37(78.8)	11(16.4)	<0.001*	39(54.2)	9(21.4)	<0.001*
Musculoskeletal problems	38(50.0)	37(68.5)	0.057	32(68.1)	43(64.2)	0.850	45(62.5)	30(71.4)	0.059

\*Significantly associated at  $P$  value of  $<0.05$ .

## DISCUSSION

In this study, as with studies in other countries, most of the subject workers were male [6-9]. The majority of subject workers had low educational levels, a low socioeconomic standard and inadequate housing [4]. All the subject workers had a relatively high workload. This result was supported that the scavengers working hours had ranged from 6-18 h/day for 4-7 d/week [3].

Regarding the percentage of health problems by type, the most suffered were musculoskeletal problems (65.8%), skin problems

(58.8%), and respiratory disease (47.4%). The physical health problems of scavengers who worked on dumpsites in Thailand were low back pain and sprains (95%), common colds (89%), and skin rashes (66%) [3].

Health problems related to gender showed a statistically significant difference between male and female subject workers. Musculoskeletal problems were statistically significantly higher among male, compared to female subject workers. The nature of waste collection work, which involves heavy lifting, determined that most

collectors were male. Thus, the musculoskeletal problems mostly occurred in male subject workers. The health of solid waste workers was strongly related to their social, economic, and environmental situations and involved gender issues [10].

Musculoskeletal problems also occurred more often in workers aged  $\geq 35$  yr. 60.8% of musculoskeletal complaints were particularly among MSWW's and 22% had reported low back pain [7].

In addition, health problems compared to income showed a statistically significant difference. Subject workers who had a high income had significantly more direct contact with solid waste than the low-income workers [11].

Work characteristics, including position, duration of work and days worked per week showed statistically significant differences for the health problems of subject workers. The independent risk factors for musculoskeletal symptoms among MSW collectors were: the duration of employment; lifting, pulling, pushing, carrying heavy loads; different types of MSW collectors; and walking for long periods of time [12]. Working at open waste dumps was increased the risk of respiratory disease [13]. Organic dust, concentrations of airborne bacteria, gases, and bio-aerosols could cause respiratory disease among workers [14]. Philippines [15], India [16], and Geneva [17] were reported on, regarding the prevalence of health problems among workers who pick the waste.

A statistically significant relationship was observed between the use (or lack of use) of PPE's and the occurrence of health problems in subject workers. From observation, personal protective equipment was not used for waste collection. The waste collectors repeated use (of mask or gloves) lead to an accumulation of old personal protective equipment. In addition, they preferred working without wearing gloves, as these limited their free movement during work. This caused nail infections, skin irritation, and dryness [18].

Eating snacks or drinking water in the work area, and washing hands before lunch were related to gastrointestinal symptoms such as diarrhea, dysentery, vomiting, and nausea. This is a well-known problem among workers who have contact with sewage [19, 20] wastewater treatment [21- 22] and MSWW's [23-24].

Using personal protective clothing and equipment, (for the protection of skin, eyes, and respiratory tract) will significantly reduce the risk of ill health [25-27]. Good personal hygiene behavior is very important in order to inhibit the growth and spread of microorganisms. Garbage workers who have good hygiene practice can reduce the risk of exposure to microorganisms [13] and harmful chemicals [28].

## CONCLUSION

There is a strong relationship between municipal solid waste work and adverse health effects. The most prevalent health issues were musculoskeletal problems (65.8%), skin problems (58.8%), and respiratory disease (47.4%). Further education on good personal hygiene practices, the use of personal protective equipment and health risks while working should be included in plans to the prevent and reduce adverse health effects among municipal solid waste workers.

## ACKNOWLEDGEMENT

The author(s) declare no conflicts of interest to the content of this article.

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