

# Health risk reduction behaviors model for scavengers exposed to solid waste in municipal dump sites in Nakhon Ratchasima Province, Thailand

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**Abstract:** The aim of this study was to evaluate the effect of comprehensive health risk protection behaviors, knowledge, attitudes, and practices among scavengers in open dump sites. A control group of 44 scavengers and an intervention group of 44 scavengers participated in this study. Interventions included the use of personal protective equipment, health protection training, and other measures. The analysis showed significant differences before and after the intervention program and also between the control and intervention groups. These observations suggest that further action should be taken to reduce adverse exposure during waste collection. To reduce health hazards to workers, dump site scavenging should be incorporated into the formal sector program. Solid waste and the management of municipal solid waste has become a human and environmental health issue and future research should look at constructing a sustainable model to help protect the health of scavengers and drive authorities to adopt safer management techniques.

**Keywords:** scavenger, health risk reduction behaviors model (HRRBM), personal protective equipment (PPE), knowledge, attitude, and practice (KAP), waste health coordinator (WHC)

## Introduction

Solid waste arising from human activity has become a major environmental problem causing extensive pollution, which threatens human health.<sup>1</sup> There has been a significant increase in municipal solid waste generation in Thailand over the last few decades. Humans increasingly exploit resources as the population increases, using natural resources both for daily life and to improve overall living standards. The result is the depletion of natural resources and further negative effects on human life. In Thailand, this is largely because of the rapid population growth and economic development.<sup>2</sup> The quantity of municipal solid waste generated per day is approximately 39,221 tons, as reported in 2005 by the Pollution Control Department.<sup>3</sup> It is expected that by 2012, this figure will have increased to 47,000 tons per day. Waste material in the air, water, and soil can be dangerous. Consequently, there has been a high incidence of illnesses, such as dysentery, typhoid, fever, enteritis, cholera, and diarrhea. Indeed, it is common to find large heaps of garbage lying in a disorganized manner in and around cities due to the inability of municipal corporations to handle the large quantities of waste.<sup>4</sup>

Landfill sites often lack provisions for leachate collection and treatment, and landfill gas collection and use.<sup>5</sup> As a consequence, landfill gases escape into the atmosphere,

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adding to greenhouse gas emissions. Thus, landfilling practices are considered unsafe for human health and the environment.<sup>6</sup> Waste picking is the informal extraction of recyclable and reusable materials obtained from mixed waste. Scavengers collect materials that have been discarded as waste and add value to them by sorting, cleaning, and altering the physical shape to facilitate transport or by combining materials to make commercially viable products. The health and safety risks associated with informal recycling include occupational health risks posed to scavengers and community health risks posed to the general public. In many cities, municipal garbage dump scavengers work illegally; however, thousands of people in developing countries depend on recycling material from waste for their livelihoods.<sup>7</sup> These people live in unhygienic conditions and the nature of their occupation exposes them to potentially pathogenic bio-aerosols that may lead to the spread of various diseases. The abundance of fleas and offensive odors in waste disposal sites, along with the lack of proper protective devices, make working conditions even more unhygienic. Rag-pickers collect plastics, paper, glass bottles, rubber materials, and ferrous and non-ferrous metals from dump sites, which can be risky as they are exposed to various infectious agents (Ray et al<sup>13</sup>) and toxic substances that may cause illness. In addition, they face social abuse from certain elements of society, which may lead to social problems. They also commonly smoke and drink alcohol.<sup>8</sup>

Nakhon Ratchasima Province is located in northeast Thailand and has an approximate area of 20,494 square kilometers. The province is subdivided into 32 districts. Solid waste is a very important environmental problem in Nakhon Ratchasima because the amount of solid waste in municipalities is increasing every year by an average of 204.44 tons a day (1,308 tons a day in 2011).<sup>9</sup> The government therefore encourages the recovery of solid waste by recycling and the number of waste scavengers is expected to increase. Further characterization of scavengers, work situations, environmental exposures, environmental health risks, and quality of life is therefore critical. To date, there has been no study about participation, coordination of groups, and health protection training programs. The purpose of this study is to evaluate the effects of a Health Risk Reduction Behaviors Model (HRRBM) on scavengers exposed to solid waste in dump sites in Nakhon Ratchasima Province.

## Methods

### Study area and subjects

This quasi-experimental study involved scavengers divided into two groups. Forty-four scavengers were randomly

selected from 63 scavengers at one dump site in muang Nakhon Ratchasima municipality to act as the intervention group; 44 scavengers were selected from 58 scavengers at eight dump sites for the control group. The HRRBM was developed for use with the intervention group.

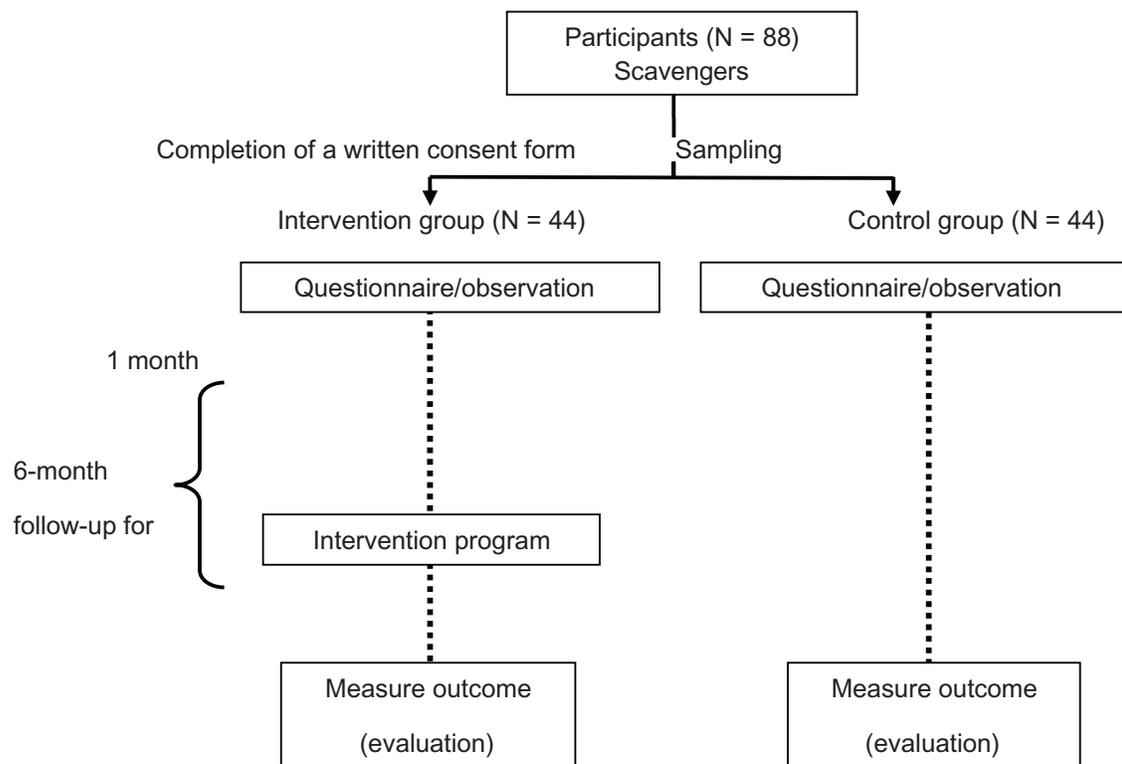
The Ethics Committee of Public Health, Mahidol University approved the study protocol (MUPH 2011-183) and The Ethics Committee of College of Public Health Sciences Chulalongkorn University Project No 009.1/54 COA No.041/2555.<sup>10</sup> The aim is to increase people's awareness of particular risks and move them to action to improve public understanding as to how to change risk behavior and take preventive action. A health interview survey targeting all the scavengers at the sample dump sites was completed via face-to-face interviews to obtain baseline data about the knowledge, attitudes, and practice of risk behavior, and the prevalence of personal protective equipment (PPE) use in both groups. The selection criteria for the participants in the current study were as follows. The participants' intervention program consisted of training, peer-to-peer training, production and distribution media, supporting the use of three items of protective equipment (gloves, rubber boots and masks), the selection of three waste health volunteers from all the scavengers, and dump site visits (workplace visits).

### Instruments

A standard questionnaire previously used by Sunthonchai and Phoolpokin<sup>11</sup> was modified for use in this study. The information was obtained via face-to-face interviews and the scavengers were asked about their demographic characteristics, occupational information, socioeconomic conditions, work shifts, health status, general health impairments (accidents, injuries, complaints, and diseases), and knowledge, attitudes, and practices regarding self-protective behaviors. An observation form was used to record the conditions of scavengers' work in relation to environmental health risk and self-protective behaviors.

### Data analysis

A descriptive statistical method was used to describe the demographic characteristics of the sample. The findings were statistically interpreted using SPSS 18.0 for Windows. Continuous variables were expressed as mean  $\pm$  standard deviation (SD), and categorical variables were expressed as counts and percentages. All statistical analyses were two-tailed, and a *P* value of  $< 0.05$  was considered to be statistically significant.



**Figure 1** Flow of the quasiexperimental study.

## Results

### General data

The study revealed that for the control group, the age of the scavengers ranged from 14–60 years old, the mean age was 43.59, and the SD was 11.43. For the intervention group, the age ranged from 19–76 years old, the mean age was 33.52, and the SD was 11.88. There were no significant differences between male and female scavengers between the groups. The control group was equally male and female while the intervention group consisted of 48% males and 52% females. As regards marital status in the control group, 82% were married, 9% were single, and 9% were divorced or widowed. In the intervention group, 80% were married, 16% were single, and 4% were divorced or widowed. The education level was mostly primary school in both groups: 79.5% in the control group and 61.4% in the intervention group. The average income was 5,390 baht per month (180 USD) in the control group and 6,375 baht per month (210 USD) in the intervention group. Of the control group, 61% lived in their own homes, 23% rented a room/home, 14% lived with relatives or friends, and 2% lived in temporary shelters on dump sites. Of the intervention group, 36% lived in their own homes, 52% rented a room/home, and 11% lived with relatives or friends.

### Health information

As regards the health information and health risk behavior of scavengers working on the dump site, most had worked as scavengers for more than ten years (mean 11.52 years, SD = 9.10 in the control group; mean 10.98 years, SD = 10.23 in the intervention group). For the control group, the motivation behind doing this job included scavenging being the family business (68%), recommendation from a neighbor and to increase income (61%), no requirement for initial investment (36%), and other reasons (16%). For the intervention group, the motivation included no requirement for initial investment (82%), increasing income (68%), scavenging being the family business (36%), and recommendation from a neighbor (18%). Concerning job satisfaction, 75% of the control group were satisfied and 86% of the intervention group were satisfied. Working hours ranged from 6–18 hours/day for 4–7 days/week. As regards self-protective attire, 46% of the control group used PPE every time, 48% used PPE sometimes, and 7% never used PPE. For the intervention group, 46% used PPE every time and 55% used PPE sometimes. Of the control group, 43% had been injured during work compared to 40% in the intervention group (accidents, injury caused by a sharp objective such as broken glass or needles, cuts, falls).



**Figure 2** (A) Temporary shelter at a dump site. (B) Routine work activities. (C) Routine work: carrying a load. (D) Personal protective equipment demonstration on training day.

Only 23% of scavengers had received health information from the municipality.

## Health history and health care information

This data relates to health status and health service accessibility. As regards illness lasting three or more months, most members of the two groups had never suffered such illness and had never had an annual medical checkup. If sick, most self-medicate by buying drugs (39% in the control group and 41% in the intervention group) or go to government public health facilities (55% in the control group and 46% in the intervention group). Some use traditional medical practitioners and private clinics. Regulated drugs and medicine were used by 64% and 43% in the control and intervention groups, respectively. One hundred percent of both groups had access to health service facilities. For the intervention group, the mean cost of self-care before intervention was 604 baht/month and after intervention it was 486 baht/month. For the control group, the mean cost of self-care before intervention was 474 baht/month and after intervention it was 484 baht/month. Regarding factors reinforcing health risk behaviors, 38.6% of the control group smoked compared to 25% of the intervention group; 47.7%

of the control group consumed alcohol compared to 32% of the intervention group. More than 80% in both groups got food from the workplace and found food on the dumpsite for cooking. The main drinking water supply (70%) was rain water from home.

## Knowledge, attitudes, and practices

The results of the intervention program reveal all the mean scores for knowledge, attitudes, and practices among scavengers. Most had low levels of knowledge in terms of alertness, negative and neutral attitudes about health risk behaviors affecting their health, and inappropriate practices regarding the prevention of infection, injury, and disability. After follow-up, knowledge, attitudes, and practices improved significantly in the intervention group ( $P < 0.001$ ), but there was no significant difference in the control group. (In terms of knowledge level, 15 closed questions were used. For attitudes and practices, rating scale questionnaires were used).

## Physical health problems of scavengers

Regarding the physical health problems of scavengers undertaking routine work on dump sites, most suffered with low back pain and sprains (95%), common colds (89%), and skin rashes (66%). Other problems included

**Table 1** Socioeconomic characteristics of the scavenger intervention and control groups

Characteristics	Total (n = 88)		Intervention (n = 44)		Control (n = 44)		P-value
	n	%	n	%	n	%	
Sex							
Male	43	48.9	21	47.7	22	50	0.833
Female	45	51.1	23	52.3	22	50	
Age (year)							
≤30	27	30.7	20	45.5	7	15.9	0.000**
31–40	22	25	12	27.3	10	22.7	
41–50	26	29.5	8	18.2	18	40.9	
51–60	10	11.4	4	9	6	13.7	
61+	3	3.4	0	0	3	6.8	
Mean ± SD	38.56 ± 12.646		33.52 ± 11.878		43.59 ± 11.429		
Marital status							
Single	11	12.5	7	15.9	4	9.1	0.309
Married	71	80.7	35	79.5	36	81.8	
Widowed	1	1.1	0	0	1	2.3	
Divorced	5	5.7	2	4.6	3	6.8	
Education							
Uneducated	13	14.8	6	13.6	7	15.9	0.046**
Primary school	62	70.4	27	61.4	35	79.5	
Secondary school	6	6.8	5	11.4	1	2.3	
Undergraduate degree	7	8	6	13.6	1	2.3	
Income (Baht)							
<3,500	20	22.7	8	18.2	12	27.3	0.165
3,500–5,000	27	30.8	12	27.3	15	34.1	
>5,000–10,000	37	42	22	50	15	34.1	
>10,000	4	4.5	2	4.5	2	4.5	
Mean ± SD	5,882 ± 3312.089 (196 US)*		6,375 ± 2665.728 (210 US)*		5,390 ± 3820.131 (180 US)*		
Residence							
Rented	33	37.5	23	52.3	10	22.7	0.003**
Live with relatives/friends	11	12.5	5	11.4	6	13.6	
Own home/family	43	48.9	16	36.4	27	61.4	
Temporary shelter at dump site	1	1.1	0	0	1	2.3	

Note: \*USD was approximately = 30 THB; \*\*P < 0.05.

headaches (49%), fatigue (34%), shortness of breath (23%), and impetigo (19%) (scavengers could have experienced more than one symptom). After a six-month follow-up, the prevalence of physical health symptoms was as follows: low back pain and sprains (89%), common colds and headaches (75%), skin rashes (39%), and fatigue (32%). The control group experienced low back pain and sprains (84%), common colds (62%), skin rashes (59%), headaches (44%), fatigue (31%), shortness of breath (19%), and impetigo (20%). The intervention group had problems with low back pain and sprains (68%), common colds (49%), skin rashes (32%), headaches (37%), fatigue (28%), shortness of breath (8%), and impetigo (12%).

### Observation activities at dump sites

Data collected from nine dump sites revealed the average age of a dump site was 15 years, the municipality was responsible

for two dump sites, and the district/sub-district municipality was responsible for seven dump sites. Regarding the working environment, it was revealed that scavengers regularly faced poor sanitation, vibrations from machines, poor ventilation, noise, obnoxious odors, overheating, waste water, and disease-causing animals (rats, reptiles, and insects). Regarding the activities of scavengers and their behavior, it was observed that some lived in the area, finding and cooking food from dump sites. Some did not use any PPE and some used masks, gloves, and rubber boots. Regarding posture, they did a lot of bending, pulling, and carrying things on their backs. They collected papers, aluminum cans, plastic bottles, glass bottles, metal, steel, and other miscellaneous items. After the six-month follow-up, it was found that the rate of injury and the use of PPE among scavengers did not differ for the control group, but that there were fewer injuries and a significant increase in the use of PPE for the intervention group.

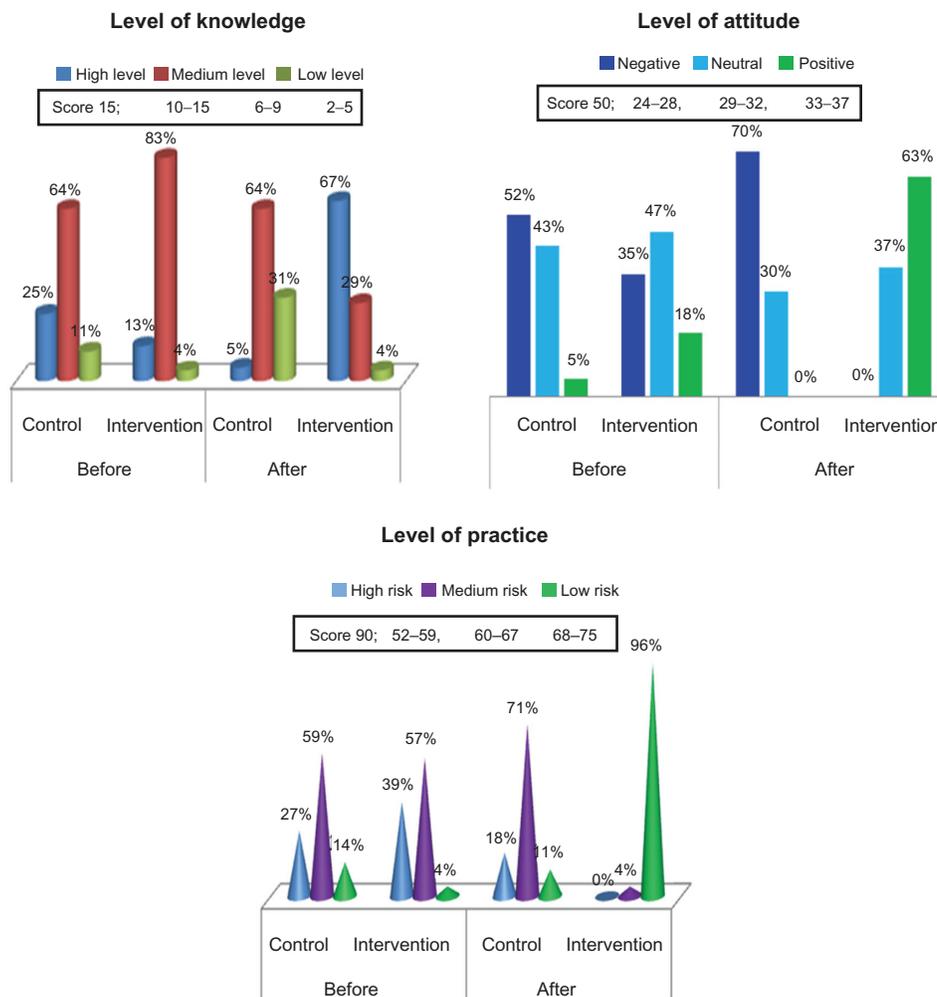


Figure 3 Levels of knowledge, attitudes, and practices before and after intervention.

## Discussion

Scavengers working in municipality dump sites are exposed to various health risks (infections, injury, disability) while working. There are many waste management problems that lead to a lack of support and interest by local organizations. Scavengers working in the municipalities’ open dump sites still encountered factors affecting health and safety. However, some factors proved to be more significant and more influential than others.<sup>12,13,14</sup> The study was developed as an action health risk reduction behavior-oriented, quasi-experimental demonstration model with simultaneous evaluation and analysis. The purpose of the HRRBM was to improve scavengers’ behavior and prevent and control risk factors and disease. The model was based on the Precede-Proceed model.<sup>10</sup>

The intervention program targeted general scavengers at different dump sites. Questionnaires were completed by 88 scavengers from nine dump sites. The intervention

group consisted of 44 scavengers at one dump site and the control group consisted of 44 scavengers at other dump sites. The study results revealed no differences between sex, age, income, time to work, and other personal data. Most scavengers were married and had a primary school education. Scavenging was the main source of income for taking care of all family members. Most scavengers had insufficient income compared to expenditure and some rented rooms or had temporary shelters at dump sites. This is similar to another study conducted in Thailand by Sunthonchai in 2006<sup>11</sup> in terms of the demographics, characteristics, and working hours. Most scavengers were in debt. A study in Mexico found that scavengers are perceived as the poorest of the poor and live on the margins of mainstream society.<sup>14</sup> Occupational health information indicated that the duration of work for a scavenger was on average ten years more and the main motivations to do the job were to gain income, that scavenging was a family business, and that there was

no investment. Thus, most were satisfied with the job. They worked 4–7 days (mean = 6 days) per week and 6–18 hours per day (mean = 8 hours), had an average income of 6,000 baht per month and collected things to sell, such as paper, plastic, metal, and aluminum (but not organic or hazardous waste). As regards their behavioral health risks, it was found that most did not use PPE, some used their bare hands to collect solid waste, and some experienced small injuries from sharp objects. They were not aware of the need to clean and waited until the job was finished each day. They worked in poor sanitary conditions with overheating, vibration, dust, poor ventilation, obnoxious odors, and disease-causing animals.<sup>11</sup>

Concerning the medical history and health service accessibility, most scavengers had never been ill for long periods of time and had no annual medical checkups. When they get sick they usually self-medicate. There was no difficulty regarding access to health service facilities because of the 30 baht government health care scheme. Almost all had bad health behavior in terms of smoking and drinking alcohol. Physical ailments included common colds, headaches, skin rashes, and low back pain. A study of the population living in the vicinity of a large waste site in Poland revealed that the potential health effects of waste site-related environmental exposure might include psychological problems, digestive tract disorders, respiratory disorders, and allergic symptoms.<sup>8</sup> These findings are in agreement with the research carried out by Sunthonchai in 2006.<sup>11</sup> Most scavengers had low levels of knowledge in terms of alertness. They had positive attitudes regarding health risk behaviors and practices to prevent infection, injury, and disability at a moderate level. This was consistent with the 2004 findings of Khalil and Milhem,<sup>12</sup> who showed that waste collectors with low levels of education have more work-related accidents. In 2004, Pisutthanon<sup>15</sup> studied health risk behaviors and their relationship to infection, injury, and disability among local residents and staff working at the solid waste disposal sites in Nonthaburi Province and found health risk at a high level with people who ignore receiving information through media by government organization. The role of informal sector their practice improve with experience and work condition. The role of informal sector recycling building on their practices and experience while working to improve the effectiveness work condition.<sup>16,17</sup> Some scavengers do not use PPE and thus risk their health. Some eat food found at the dump site and some bring their children to work with them. This study shows the baseline data (demographic characteristics, PPE

use, types of injury, and knowledge, attitudes, and practices) of the intervention group and the control group before and after intervention. No significant differences were found. The intervention activities and evaluation were integrated components in the HRRBM. Monitoring and evaluations were conducted to assess the extent to which the program attained its objectives and the process of program development and performance was assessed. Self-protective behavior, injury, cost of primary health care, and knowledge, attitudes, and practices are likely to improve in the intervention group whereas they are likely to remain the same in the control group. Waste site coordinators are usually the heads of families that have worked at the dump site for numerous years. Further investigations are needed on the effectiveness of these coordinators to monitor the safety and health of the scavengers and to provide them with the knowledge they need to work safely at these sites.

## Conclusion

The HRRBM significantly decreased the health care costs of individuals and significantly improved knowledge, attitudes, and practices. The percentage of physical symptoms was reduced and the use of PPE increased after intervention in the intervention group compared with the control group. Some scavengers working in open dump sites may face the risk of exposure to solid waste. Therefore, PPE and personal hygiene are important in reducing health risks among the scavengers. Results indicate that the health risk behaviors of smoking, alcohol consumption, getting food from the dump site and cooking it at the dump site, and inadequate cooking may endanger the health of the scavengers. In conclusion, it is important that scavengers exposed to solid waste at dump sites follow safety recommendations concerning routine work at these sites to help reduce health risks. It is also important that site coordinators distribute health and safety material and monitor work safety practices. More research on this topic must be conducted, especially regarding health care.

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## Disclosure

The authors report no conflicts of interest in this work.

## References

- Jha MK, Sondhi, OAK, Pansare M. Solid waste management – a case study. *Indian Journal of Environmental Protection*. 2003;23:1153–11260. Pollution Control Department [database on the Internet]. [cited 2003 Jan 1]. Available from: [http://www.pcd.go.th/count/mgtdl.cfm?FileName=Report\\_Eng2549.pdf](http://www.pcd.go.th/count/mgtdl.cfm?FileName=Report_Eng2549.pdf). Accessed Mar 10, 2010
- Singhal S, Pande S. Solid waste management: status and future direction. *TERI Information Monitor on Environmental Science*. 2001;6:1–4.
- Pollution Control Department [database on the Internet]. [cited 2006 Jan 1]. Available from: [http://www.pcd.go.th/info\\_serv/waste\\_wastethai.htm](http://www.pcd.go.th/info_serv/waste_wastethai.htm). Accessed Jan 3, 2010.
- Kansal A. Solid waste management strategies for India. *Indian Journal of Environmental Protection*. 2002;22:444–448.
- Al-Yaquot AF, Hamoda MF. Report: Management problem of solid waste landfill in Kuwait. *Waste Manag. Res*. 2002;20:328–331.
- Ray MR, Mukherjee G, Roychowdhury S, Lahiri T. Respiratory and general health impairments of workers employed in municipal solid waste disposal at an open landfill site in Delhi. *Int J Hyg Environ Health*. 2005;208:255–262.
- Sebahat Dilek T, Sertac G, Imer I, Ahmet Ragip I, Kazim G. Health and safety risks associated with waste picking. *Turkish J Public Health*. 2006;4(1):41–44. [database on the Internet]. 2006 [cited 2006 Jan 1]. Available from: [http://halksagligiokulu.org/anasayfa/components/com\\_booklibrary/ebooks/THSD\\_2006\\_4\\_1.pdf](http://halksagligiokulu.org/anasayfa/components/com_booklibrary/ebooks/THSD_2006_4_1.pdf). Accessed Jun 12, 2010
- Chandramohan A, Ravichandran C, Sivasankar V. Solid waste, its health impairments and role of rag pickers in Tiruchirappalli City, Tamil Nadu, Southern India. *Waste Manag Res*. 2009;28:951–958.
- Wibulpolprasert S, Sirilak S, Ekachampaka P, Wattanamano N. Thailand Health Profile 1997–1998. Ministry of Public Health, Jan 2002 [database on the Internet]. Thailand Health Profile. 2002 [cited 2011 Jan 1]. Available from: [http://www.moph.go.th/ops/thealth\\_44/index\\_eng.htm](http://www.moph.go.th/ops/thealth_44/index_eng.htm). Accessed Apr 7, 2011.
- Glanz K, Lewis FM, Rimer BK. Linking theory, research and practice. In: Glanz K, Lewis FM, Rimer BK, editors. *Health Behavior and Health Education: Theory, Research, and Practice*. 2nd ed. San Francisco: Jossey-Bass; 1997:19–35.
- Sunthonchai S, Phoolpoksins W. Health and Environment Protection of Waste Picker and related Labors. Complete report RA427.8, 2006. [database on the Internet waste picker and related labors 2006]. 2011 [cited 2011 Jan 5]. Available from: <http://www.stou.ac.th/.../shs/.../> and [http://www.google.co.th/#hl=th&output=search&scient=psy-ab&q=sarisak%2Cwaste+picker&oq=sarisak%2Cwaste+picker&gs\\_l=hp.12...3555.21972.1.25365.20.20.0.0.0.140.2227.5j15.20.0...0.0...1c.3qi7ylmykDg&psj=1&fp=1&biw=1600&bih=793&bav=on.2,or\\_r\\_gc.r\\_pwr.qf.&cad=b](http://www.google.co.th/#hl=th&output=search&scient=psy-ab&q=sarisak%2Cwaste+picker&oq=sarisak%2Cwaste+picker&gs_l=hp.12...3555.21972.1.25365.20.20.0.0.0.140.2227.5j15.20.0...0.0...1c.3qi7ylmykDg&psj=1&fp=1&biw=1600&bih=793&bav=on.2,or_r_gc.r_pwr.qf.&cad=b). Accessed Feb 23, 2011.
- Khalil A, Milhem M. *Investigation of Occupational Health and Safety Hazard Among Domestic Waste Collectors in Bethlehem and Herbron Districts*. Faculty of Graduate Studies at An – Najah, National University, Nablus, Palestine; 2004. [database on the Internet]. 2004 [cited 2011 Jan 5]. Available from: [http://www.najah.edu/sites/default/files/Centers\\_document/Document/Investigation\\_of\\_Occupational.pdf](http://www.najah.edu/sites/default/files/Centers_document/Document/Investigation_of_Occupational.pdf). Accessed Apr 7, 2011.
- Ray MR, Mukherjee G, Roychowdhury S, Lahiri T. Respiratory and general health impairments of rag pickers in India: a study in Delhi. *Int Arch Occup Environ Health*. 2004;77:595–598.
- Oyelola OT, Babatunde AI, Odunlade AK. Health implications of solid waste disposal: case study of Olusosun dumpsite, Lagos, Nigeria. *Int J Pure Appl Sci*. 2008;3(2):1–8.
- Pisutthanon W. *Health Risk Behavior of Personnel and Local Residents Involved in Solid Waste Disposal Site in Nonthaburi Province*. Bangkok: Faculty of Graduate Studies, Mahidol University; 2004.
- Wilson DC, Velis C, Cheeseman C. Role of informal sector recycling in waste management in developing countries. *Habitat Int*. 2006;30:797–808.
- Zejda JE, Jarosinska D, Biesiada M. Results of the health survey of a population living in a vicinity of a large waste site (Warsaw, Poland). *Cent Eur J Public Health*. 2000;8:238–244.

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