



Contents lists available at ScienceDirect

## Safety and Health at Work

journal homepage: [www.e-shaw.org](http://www.e-shaw.org)

## Short Communication

## Young Adult Street Vendors and Adverse Respiratory Health Outcomes in Bangkok, Thailand

Saisattha Noomnuai<sup>1,2</sup>, Derek G. Shendell<sup>1,2,3,\*</sup><sup>1</sup> Rutgers School of Public Health, Center for School and Community-Based Research and Education (NJ Safe Schools Program), New Brunswick, NJ, USA<sup>2</sup> Department of Environmental and Occupational Health, Rutgers School of Public Health, Piscataway, NJ, USA<sup>3</sup> Exposure Measurements and Assessment Division, Environmental and Occupational Health Sciences Institute, Rutgers Robert Wood Johnson Medical School, Piscataway, NJ, USA

## ARTICLE INFO

## Article history:

Received 22 July 2016

Accepted 11 February 2017

Available online 20 February 2017

## Keywords:

respiratory protective masks

respiratory symptoms

street vendors

Thailand

urban environment

## ABSTRACT

Air pollutants of concern include traffic-related air pollution, including particulate matter in respirable coarse and fine size fractions. There are no critical studies to date into associations between knowledge, awareness, and attitudes in using proper respiratory masks and prevalence of respiratory symptoms among urban street vendors in Thailand. In this study, we estimated adverse respiratory health outcomes among street vendors, in particular young adults, in Bangkok, Thailand, using a self-report questionnaire. Street vendors, who were not currently smoking and not having known diagnosed respiratory diseases, were recruited. They were selected from selected roadsides at Chong Nonsi, Bangkok. Participants ( $n = 30$ ) reported having lower respiratory (50%), upper respiratory (37%), and other symptoms (70%). Also, 53% of participants had never used respiratory personal protective equipment (PPE: masks). Among those using PPE, all used masks not proper for particulate matter. Results suggested knowledge, awareness, and attitudes concerning proper PPE use needs to be increased among street vendors in Bangkok, Thailand.

© 2017 Occupational Safety and Health Research Institute, Published by Elsevier Korea LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

Traffic-related air pollution (TRAP) is a mixture of compounds generated by vehicle exhaust emission. TRAP is known as one factor potentially causing exposure effects on human health and environment [1]. Bangkok, Thailand, is a mega-city and one of the major urbanized areas in Southeast Asia. The number of vehicles being driven has increased every year [2], and has led to severe traffic congestion, causing high amounts of multiple pollutants to be emitted into the outdoor air. Previous studies suggested that TRAP exposure can cause adverse health outcomes, especially respiratory problems [3–10]. Street vendors, who mostly work and spend time outdoors at ground-level, are one important susceptible and vulnerable population subgroup who are at risk to exposures and adverse risks associated with TRAP. Young adult street vendors, who are typically aged 18–34 years, but who also include 35–44-year-olds, are considered as an even more vulnerable subgroup of

workers given their remaining years of life expectancy, child-bearing age, etc. The proper use of respiratory masks regarding types of masks and how to wear masks is known as a way to reduce exposure to TRAP including particulate matter.

The association between respiratory symptoms and TRAP (i.e., respirable coarse and fine particulate matter, PM<sub>10</sub> and PM<sub>2.5</sub>, respectively) exposure as well as the knowledge, awareness, and attitudes (KAAs) of proper respiratory personal protective equipment (PPE, or masks) use need to be addressed. The goals of this study were to estimate the prevalence of respiratory and other symptoms and to assess KAAs of health in proper mask use among Thai street vendors in Bangkok. The proper mask identified in this study is N-95, which is proper for particulate matter (PM) protection. Another part of this study was presented elsewhere (measured roadside PM concentrations, temperature, and relative humidity experienced during the day and night among street vendors in these different sections of Bangkok, Thailand) [11].

\* Corresponding author. Rutgers School of Public Health (SPH), Department of Environmental and Occupational Health, 683 Hoes Lane West, 3rd Floor SPH Building, Piscataway, NJ 08854-8020, USA.

E-mail address: [shendedg@sph.rutgers.edu](mailto:shendedg@sph.rutgers.edu) (D.G. Shendell).

## 2. Methods

This was a pilot cross-sectional field study approved by the Rutgers Biomedical and Health Sciences Institutional Review Board (Protocol #Pro20150002691). This study was approved with informed consent without written documentation to keep responses anonymous for a de-identified data set for analyses.

There were 45 street vendors from selected roadsides at Chong Nonsi, Bangkok, Thailand initially approached. The inclusion criteria were: (1) either literate and/or communicated verbally in English or Thai language for clarification as needed; (2) not currently smoking; and (3) no known diagnosed respiratory diseases (i.e., asthma, allergies, tuberculosis, or chronic bronchitis). The potential participants (i.e., street vendors) were randomly interviewed on the first day each site was visited as a prescreening. They were provided the information about the study and informed consent by the researcher and asked for voluntary participation. They were asked to complete the questionnaire, providing anonymous answers for immediately de-identified data, in paper format.

The questionnaire was developed from the peer-reviewed literature [3,4] including nine questions about demographic information, respiratory and other symptoms, and frequency and type of respiratory protective mask use.

The percentage of participants who reported they had symptoms in each category of total participants, and the percentage of participants who knew or used proper respiratory protective masks in each selected study location, were computed. In this study, we identified the relationship between use of proper respiratory masks during work and adverse health outcomes. The prevalence values were calculated as percentages of the number of street vendors who reported symptoms divided by the total number of participants who reported no use or use of respiratory masks categorized by types of masks. In addition, we tried to link between adverse health outcomes and street vendor exposure to TRAP given concentrations varied between different study sites as reported in another part of the study [11].

Study data were entered from the questionnaires into Microsoft Excel for initial management and review, and then analyses were completed in SPSS versions 21–22.

## 3. Results

Of 45 initially approached, 30 street vendors at the selected roadsides participated. The participation rate was 74% for women and 56% for men. Participants were mostly female (67%), aged > 35 years (67%), and Thai (93%). Participant education level was most frequently primary and secondary school (40%), with work experience of > 10 years (60%) and work shifts durations > 8 h/d (57%). These data and more are summarized in Table 1.

The symptom results suggested that other symptoms (i.e., headache, fever, fatigue, eye irritation, and dizziness) were the major symptoms the participating street vendors experienced (70%), followed by lower respiratory symptoms (50%) and upper respiratory symptoms (37%). The specific symptoms reported by adult Thai street vendors were fatigue (37%), cough (27%), dizziness (23%), eye irritation (20%), headache (20%), and nasal congestion (20%). The results of self-reported and field observations of use of street vendor respiratory PPE or masks used suggested 53% of participating street vendors had never used respiratory masks. Some of them used PPE rarely (27%) or just sometimes (17%). Only 3% usually used PPE. The types of masks they used more often were hygiene/surgical or antidust/cotton masks. These results are summarized in Table 2.

The percentage of street vendors who reported they had symptoms was higher among individuals who used hygiene/

**Table 1**  
Characteristic of participating street vendors

Characteristics	n	%
Sex		
Male	10	33
Female	20	67
Other/do not want to respond	0	0
Age (y)		
18–24	6	20
24–35	4	13
>35	20	67
Nationality		
Thai	28	93
Burmese	0	0
Other/do not want to respond	2	7
Education		
No school	1	3
Primary school	12	40
Secondary school	12	40
High school	1	3
Higher education	3	10
Other/do not want to respond	1	3
Work experience (y)		
<1	0	0
1–5	8	27
6–10	3	10
>10	18	60
Other/do not want to respond	1	3
Work shift duration (h/d)		
<3	0	0
3–5	4	13
6–8	9	30
>8	17	57

surgical mask (38%) than those used antidust/cotton mask (12%). The highest percentage of street vendors who reported they had symptoms were those who never used mask (50%); this subgroup was followed by the subgroups who rarely (31%), sometimes (15%), and usually (4%) used respiratory masks, respectively. The results suggest that street vendors who used respiratory masks wore

**Table 2**  
Self-reported respiratory symptoms and respiratory protective mask used among street vendors at roadsides.

Self-report measurement	n	%
Symptoms		
Lower respiratory symptoms	15	50
Cough	8	27
Phlegm	4	13
Wheeze	1	3
Chest tightness	3	10
Shortness of breath	2	7
Upper respiratory symptoms	11	37
Nasal congestion	6	20
Sore throat	2	7
Cold	5	17
Other symptoms	21	70
Headache	6	20
Fever	2	7
Eye irritation	6	20
Dizziness	7	23
Fatigue	11	37
Other/do not respond	4	13
Respiratory personal protective equipment		
Frequency of use (n = 30)		
Always	0	0
Usually	1	3
Often	0	0
Sometimes	5	17
Rarely	8	27
Never	16	53
Type of personal protective equipment (n = 14)		
Hygiene/surgical mask	10	71
Antidust mask/cotton material	4	29
Carbon/charcoal mask/chemical filtering type respirator	0	0
N-95 type respirator	0	0

improper masks (i.e., hygiene/surgical or antidust/cotton masks). In addition, no-one used the proper mask for particulate matter (i.e., N-95). There was similar prevalence of reported symptoms among participants who used and did not use masks (50% in both groups).

#### 4. Discussion

The respiratory symptoms and other symptoms reported among adult street vendors in Bangkok, Thailand, were related to exposure to TRAP, in particular PM10 and PM2.5. The findings from this study is supported by previous studies conducted in Bangkok, Thailand [3,4]. The new finding provided in this study was the trends between KAAs of health in using proper PPE like respiratory masks and adverse health effects among street vendors in Bangkok, Thailand. These findings suggest that KAAs concerning health and using proper respiratory protective masks among street vendors in Bangkok, Thailand was low; among participants using masks, none used proper masks specifically for PM10 and PM2.5, i.e., masks used mostly serve to protect others from an airborne virus or bacteria they might have. In this study, we did compare the difference between the prevalence of reported symptoms among participants who used and did not use masks. The results from this study suggest that incorrect selection of PPE may provide ineffective protection, i.e., higher prevalence of reported symptoms among participants who used respiratory masks. The strength of this study is that it increased knowledge from previous studies and focused more on TRAP exposure reduction in terms of individual worker protection. However, this study's sample size was small and it only served as pilot study. Other potential confounders were unable to be addressed in this study, i.e., work load, ergonomic issues, hypersensitivity, cardiovascular, and possibly psychosocial/mental health. In addition, participants might not pay attention to their symptoms or might not be willing to answer truthfully about their symptoms.

In conclusion, this pilot field study presented new data on respiratory health outcomes among adult street vendors in Bangkok, Thailand, working in close proximity to TRAP including PM10 and PM2.5, which are global urban exposure concerns for human health—both outdoor workers and community members—and environment or ecosystem health. Future research is needed with quantitative measures including personal air monitoring, time–activity patterns, biomarkers, and interventions tested.

#### Conflicts of interest

All authors have no conflicts of interest to declare.

#### Acknowledgments

Funding for this work was via Rutgers University GAIA Centers Interdisciplinary Team Planning Award 2015–2017 strategic university-wide initiatives around global health and global urbanism.

#### References

- [1] Health Effects Institute. Traffic-related air pollution: a critical review of the literature on emissions, exposure, and health effects; HEI panel on the health effects of traffic-related air pollution. HEI Special Report 2010;17.
- [2] Praditphet C [Internet]. Office of Transport and Traffic Policy and Planning, Ministry of Transport, Thailand. Thailand's experience on emission measurement and mitigation policy. 2013 [cited 2016 July 22]. Available from: <http://www.uncece.org/fileadmin/DAM/trans/doc/themes/ForFITS/3.9.Thailand.pdf>.
- [3] Vichit-Vadakan N, Ostro BD, Chestnut LG, Mills DM, Aekplakorn W, Wangwongwatana S, Panich N. Air pollution and respiratory symptoms: results from three panel studies in Bangkok, Thailand. *Environ Health Persp* 2001;109(Suppl 3):381–7.
- [4] Kongtip P, Thongsuk W, Yoosook W, Chantanakul S. Health effects of metropolitan traffic-related air pollutants on street vendors. *Atmos Environ* 2006;40:7138–45.
- [5] Kongtip P, Thongsuk W, Yoosook W, Chantanakul S, Singhanityom S. Health effects of air pollution on street vendors: a comprehensive study in Bangkok. *Thai J Toxicol* 2008;23:5–14.
- [6] Kim JJ, Smorodinsky S, Lipsett M, Singer BC, Hodgson AT, Ostro B. Traffic-related air pollution near busy roads: the East Bay Children's Respiratory Health Study. *Am J Respir Crit Care Med* 2004;170:520–6.
- [7] Jung DY, Leem JH, Kim HC, Kim JH, Hwang SS, Lee JY, Kim BJ, Hong YC, Hong SJ, Kwon HJ. Effect of traffic-related air pollution on allergic disease: results of the Children's Health and Environmental Research. *Allergy Asthma Immunol Res* 2015;7:359–66.
- [8] Janssen NA, Brunekreef B, van Vliet P, Aarts F, Meliefste K, Harssema H, Fischer P. The relationship between air pollution from heavy traffic and allergic sensitization, bronchial hyperresponsiveness, and respiratory symptoms in Dutch schoolchildren. *Environ Health Persp* 2013;111:1512–8.
- [9] Esposito S, Galeone C, Lelii M, Longhi B, Ascolese B, Senatore L, Prada E, Montinaro V, Malerba S, Patria MF, Principi N. Impact of air pollution on respiratory diseases in children with recurrent wheezing or asthma. *BMC Pulm Med* 2014;14:1–9.
- [10] Guo Y, Li S, Tawatsupa B, Punnasiri K, Jaakkola JJ, Williams G. The association between air pollution and mortality in Thailand. *Sci Rep* 2014;4:5509.
- [11] Noomual S, Shendell D. Risk of adult street vendor exposure to traffic-related air pollution in Bangkok, Thailand. *Hum Ecol Risk Assess* 2016. <http://dx.doi.org/10.1080/10807039.2016.1247257>.