

# Health Belief Model and Behavioural Usage of Respiratory Protective Equipment among Sugarcane Workers in Northeast of Thailand: A Cross-sectional Analytical Study

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## ABSTRACT

**Introduction:** Workers in developing countries face as many difficulties particularly occupational health hazards as their counterparts in industrialised nations. The Health Belief Model (HBM) encourage workers to use Respiratory Protective Equipment (RPE) that could protect them from risks of environmental health and work-safety caused by bagasse dust.

**Aim:** To investigate the relationship between HBM and behavioural usage of RPE among Sugarcane Factory Workers (SFW) in Thailand.

**Materials and Methods:** A Cross-sectional analytical study was conducted among 588 SFW in Northeast, Thailand by using multistage sampling to select the sample size. The structured questionnaire was comprised of perceived susceptibility, perceived severity, perceived benefits and perceived barriers. The content validity of questionnaire was tested by 3 experts and had a Cronbach's alpha coefficient of 0.86. The data were presented as proportions, mean±standard

deviation or median and range as in descriptive statistics. In addition, associated factors with behaviour using RPE were analysed by multiple logistic regression showing 95% CI and  $p < 0.05$  was statistically significant.

**Results:** Most workers had good level of behavioural usage of RPE (64.80%, 95%CI: 60.92-68.67). The common types of RPE usage were cotton masks (94.56%). The sources of information on RPE usage as provided by safety officers were 77.89%, by supervisors (70.41%) and by knowledge boards in factories (37.24%) respectively. Additionally, workers who had good level of HBM in perceived benefits were 2.67 times more likely to have good behaviour in usage of RPE when compared with those who had poor level of HBM in perceived benefits (Adjusted OR=2.66, 95% CI=1.53 to 4.62,  $p=0.001$ ).

**Conclusion:** More than half of SFW had good level of usage of RPE. HBM in perceived benefits had influenced on good level of usage of RPE of workers. Therefore encouraging workers to use RPE can prevent work related respiratory diseases by strict regulation and enforcement of occupational laws.

**Keywords:** Health behavioural, Personal protective, Questionnaire

## INTRODUCTION

Thailand was recognised as the world's second-largest exporter of sugar after Brazil that as much as 70-75% of total domestic sugar is major export where destinations are within the ASEAN markets. Sugarcane is one of Thailand's most imperative agricultural crops in terms of economy. The sugarcane resource chain-comprising of the growers, millers and associated logistics personnel-offers occupations for more than 1.5 million individuals and produces almost \$6 billion USD per year [1]. In Thailand, sugarcane is cultivated in 47 provinces and covers about 8% of the total agricultural land [2]. The sugarcane production is divided into 93% of the plantation for sugarcane factories to produce raw or white sugar and 7% of the plantation for seedlings [3]. Sugarcane factory in Thailand employ an estimated 50,000 workers in 27 different provinces. The majority (nearly 75%) are in the Central and North-eastern regions [1].

At the same time, occupational health problems in the sugarcane factory had existed in more than 40 countries around the world [4]. In relation to the sugar industry in Thailand, the workplace presents multiple health-risk situations, which are similar to the risks faced by rural workers in general. For instance risks called respiratory diseases (i.e., asthma, chronic bronchitis, lung cancer). The occupational health problems in various processing units of the sugar industry are enormous, high concentration of dust in cane yard, bagasse dust in a mill and bagasse baling section are the primary reasons of respiratory problems amongst labours [5]. Bagasse dust is the fibrous residue of sugarcane after the sugar has been extracted and characterised as affecting physical health, irritation, coughing,

sneezing, as well as increased respiratory diseases (i.e., asthma, chronic bronchitis, lung cancer) [6]. In such a poor working condition, wearing the respiratory protective equipment is helpful to reduce the risk of lung cancer and other respiratory diseases [7].

To promote workers for the usage of RPE is an important protection in occupational setting in many organisations [8]. PPE are very operational in decreasing occupational damages, accidents, and other hazards which else lead to considerable manpower and financial losses [9]. Therefore, the main protective equipment includes a type of respirators, cotton disposable mark, eye protection glass, hearing protection including earplugs and earmuffs, and protective clothing which could cover the face and body. Protective equipment is necessary to protect emergency workers from various routes of exposure including inhalation, dermal contact, ingestion [10] that express patterns of worker bio-psychological exhaustion and have been classified as: 1) physical hazards (i.e., solar radiation, rain, wind, extreme temperatures, noise and vibrations caused by the machines' movements); 2) chemical hazards (i.e., dust, soot, pesticide residues); 3) biological hazards (i.e., venomous animals) [11].

Health behaviours occur due to the change in human behaviour caused by learning, perception, attitudes, values, imitation, and compulsion [12]. Lacking of health beliefs model's knowledge lead to poor practices in workplace and expose to high level of bagasse dust which is a risk of respiratory diseases (i.e., asthma, Chronic Obstructive Pulmonary Disease (COPD), Allergic rhinitis and other chronic respiratory diseases [13].

The HBM, is a health behaviour change and psychological model has led to the development of an environmentally healthy working place [14]. Four aspects of perception in HBM: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers were applied to measure the behaviour change of worker. The literature review found that persons are more probable to wear facemasks due to the perceived susceptibility and perceived severity of being troubled with a life-threatening disease. This highlights a prerequisite to reveal the causes of mask-wearing, in order to identify the issues and overcome the barriers linked with mask-wearing compliance [15]. However, it still lacks information on HBM which is related to behavioural usage of RPE among SFW. Therefore, this study aims to investigate the relationship between HBM and behavioural usage of RPE among SFW in Thailand.

## MATERIALS AND METHODS

### Study Design and Sampling

A cross-sectional analytical study was conducted among 588 Sugarcane Factory Workers in Northeast of Thailand. Data were collected from December 2017 to April 2018. The sample size was calculated based on Hsieh FY et al., for multiple logistic regression formula [16] which was used to identify the correlation in the multivariable analysis by using multilevel logistic regression. The approximate sample size was 327 which were further adjusted to control the over-fitting using the rho ( $\rho$ ) of 0.50 and Variance Inflation Factor (VIF) equal to 2.00. Therefore, the total number of the sample was 588. Data sampling processes were used as a multistage sampling technique. Firstly, 4 factories in the Northeast of Thailand were randomly selected. Then 3 departments facing high concentrations with bagasse dust at the working area were drawn. Then, 588 samples were selected from the total 7,965 sugarcane factory workers registered at the department of industrial work by applying systematic random sampling technique among those 3 departments in proportion to size of the population. The inclusion criteria of the respondents were workers who were 18 years of age or older, Thai nationality, willing to participate in the study, having no communication problems with the research. Those suffering from the respiratory diseases including allergies, asthma, and emphysema, were excluded.

### Questionnaire Used

Structured questionnaire was developed based on the research questions. The content validity of questionnaire was tested by 3 experts and had a Cronbach's alpha coefficient of 0.86. The questionnaire consisted of 3 parts as follows: 1) Demographic characteristics include sex, age, education, marital status, income, type of RPE used and information on the usage of RPE; 2) HBM include Perceived susceptibility; refers to one's perception of the risk or the chances of contracting a health disease or condition (had 5 questions), Perceived severity; refers to a person's feelings on the seriousness of contracting an illness or disease (had 5 questions), Perceived benefits; refers to a person's perception of the effectiveness of various actions available to reduce the threat of illness or disease (had 5 questions) and Perceived barriers; refers to a person's feelings on the obstacles to performing a health action (had 5 questions) and was interpreted as good level (18.4-25 scores), moderate level (11.7-18.3 scores) and poor level (5-11.6 scores). 3) The behavioural usage of the RPE, behaviour of using RPE before working, while working and after work, had 15 questions and was interpreted as good level (35.4-45 scores), moderate level (25.2-35.3 scores), poor level (15-25.1 scores).

### Ethics Committee

Ethical approval for this study was obtained from the Khon Kaen University Ethics Committee for Human Research (HE602331). The research participants were enrolled in the study after written informed and voluntary consent.

## STATISTICAL ANALYSIS

Descriptive and analytical statistical data were analysed with STATA® (version.13; College Station, TX, USA: Stata Corp). Demographic characteristics of the participants were described as frequency and percentage for categorical data; mean and standard deviation for continuous data. Inferential statistics, a simple logistic regression, was used for bivariate analysis to identify individual factors associated with good behaviours for the usage of RPE. All statistically significant variables in bivariate logistic regression having p-value less than 0.25 were processed into the multiple logistic regressions. Crude Odds Ratios (ORs) and Adjusted Odds Ratio (AORs) were calculated and reported with a 95% confidence intervals. All statistical tests were two-sides and p-value less than 0.05 were considered statistically significant.

## RESULTS

### Demographic Characteristics

The result in this study indicated, 71.94% of SWF were males with an average age of 38 years and average income of 10,146 Thai baht (THB) per month. The most common type of RPE used was cotton masks 94.56%. The information on the usage of RPE as obtained from the safety officers was 77.89%, from supervisors was 70.41% and knowledge boards in factories was 37.24% [Table/Fig-1].

Variable	Number (%)
<b>Gender</b>	
Male	423 (71.94)
Female	165 (28.06)
<b>Age (years)</b>	
≤30	131 (22.28)
31-39	204 (34.69)
40-49	155 (26.36)
≥50	98 (16.67)
Mean (±SD): 38.28 (±10.56) years Median (min : max): 37.00 (19.00:69.00)	
<b>Income per month (Thai baht; THB)</b>	
<8000-8999	67 (11.39)
9000-9999	302 (51.36)
≥10000	219 (37.24)
Mean±SD: 10146 (±2438.35) Baht, Median (Min, Max): 9000 (4800:23000)	
<b>Education</b>	
Primary school	190 (32.31)
High school	302 (51.36)
High vocational Certificate/Diploma	96 (16.33)
<b>Working period (years)</b>	
≤5	359 (61.06)
6-10	128 (21.77)
≥10	101 (17.17)
<b>Types of RPE</b>	
Cotton masks	556 (94.56)
N95 Masks	137 (23.30)
Shirts	132 (22.45)
Loincloth	15 (2.55)
<b>Source of information</b>	
Safety officer	458 (77.89)
Supervisor	414 (70.41)
Information board at the factory	219 (37.24)
Brochure/booklet	87 (14.80)
Internet	57 (9.69)

[Table/Fig-1]: Demographic characteristics of workers (n=588).

A moderate level of perceived susceptibility was found among 83.16% (95% CI 80.13-86.20), good level 10.37% (95% CI 7.90-12.84) and poor level 6.47% (95% CI 4.47-8.46).

A good level of perceived severity was observed among 54.80% (95% CI 50.04-58.12), moderate level 42.82% (95% CI 39.52- 47.56) and poor level 2.38% (95% CI 1.14-3.62).

About 89.46% (95% CI 86.97-91.94) of SFW noticed a good level of perceived benefits, moderate level 10.20% (95% CI 7.75-12.66) and poor level 0.34% (95% CI 0.13-0.81).

A max of 67.00% (95% CI 63.20-70.82) identified a moderate level of perceived barriers, poor level 20.41% (95% CI 17.14-23.68) and good level 12.59% (95% CI 9.90-15.27) [Table/Fig-2].

Variable	Number (%)	95%CI
<b>Perceived susceptibility (HBM)</b>		
Good	61 (10.37)	7.90-12.84
Moderate	489 (83.16)	80.13-86.20
Poor	38 (6.47)	4.47-8.46
Mean (SD)=13.90 (2.26); Median (Min: Max)=14 (5:20)		
<b>Perceived severity</b>		
Good	318 (54.80)	50.04-58.12
Moderate	256 (42.82)	39.52-47.56
Poor	14 (2.38)	1.14-3.62
Mean (SD)=19.59 (2.87); Median (Min: Max)=20 (8:25)		
<b>Perceived benefits</b>		
Good	526 (89.46)	86.97-91.94
Moderate	60 (10.20)	7.75-12.66
Poor	2 (0.34)	0.13-0.81
Mean (SD)=29.21 (3.33); Median (Min: Max)=28 (7:35)		
<b>Perceived barriers</b>		
Good	74 (12.59)	9.90-15.27
Moderate	394 (67.00)	63.20-70.82
Poor	120 (20.41)	17.14-23.68
Mean (SD)=18.76 (4.02); Median (Min: Max)=19 (6:28)		

[Table/Fig-2]: Prevalence of HBM-levels, classified by individual level.

### Prevalence of Behavioural Usage of the RPE Levels

The total 588 sugarcane factory workers, the majority of them has good behavioural usage of RPE in good level (35.4-45 scores) 64.80% (95%CI: 60.92-68.67) than in medium (25.2-35.3 scores) 33.16% and poor level (15-25.1 scores) 2.04% [Table/Fig-3].

Behaviour	Number (%)	95%CI
Good	381 (64.80)	60.92-68.67
Medium	195 (33.16)	29.35-36.98
Poor	12 (2.04)	0.89-3.19
Mean (SD)=40.71 (4.84); Median (Min: Max)=41 (20:48)		

[Table/Fig-3]: Prevalence of behaviour-levels in usage of the RPE.

### HBM Associated with the Behaviour of Usage of the RPE: Bivariate Analysis

Bivariate analysis on the association between each independent variable and good behavioural usage of RPE among SFW was performed by simple logistic regression presenting the crude OR with 95% CI, and p-value. All factors that had p-value <0.25 were proceeded to a multivariable analysis by using multiple logistic regression [Table/Fig-4].

Variable	Number of events	% of events	Odds ratio	95% CI	p-value
Overall good behaviour	381	64.8	N/A	60.92-68.67	N/A
<b>Perceived severity</b>					
Poor	270	62.22	1		0.229*
Good	318	66.98	1.23	0.88 to 1.73	
<b>Perceived benefits</b>					
Poor	62	43.55	1		<0.001*
Good	526	67.30	2.67	1.56 to 4.55	
<b>Perceived barriers</b>					
Poor	545	64.04	1		0.160*
Good	43	74.42	1.63	0.81 to 3.31	

[Table/Fig-4]: HBM associated with the behaviour of usage of the RPE: Bivariate analysis. p-value <0.25 has been considered as statistically significant (\*)

### HBM Associated with Behavioural Usage of RPE: Multiple Logistic Regression Analysis

Multiple logistic regression analysis by Backward elimination indicated that SFW who have group of perceived benefits in good level were 2.66 times more likely to have good behaviour in RPE usage when compared with those whose perceived benefits were of a poor level (Adjusted OR=2.66, 95% CI=1.53 to 4.62, p=0.001) [Table/Fig-5].

Variable	Number of events	% of Events	Crude odds ratio	Adjusted odds ratio	95% CI	p-value
<b>Perceived benefits</b>						
Poor	62	43.55	1	1		0.001*
Good	526	67.30	2.67	2.66	1.53 to 4.62	

[Table/Fig-5]: HBM associated with behavioural usage of RPE: Multivariate analysis. p-value <0.05 has been considered as statistically significant (\*)

## DISCUSSION

Our results indicated that most workers had good level of behavioural usage of RPE (64.80%) that about as high as (94.56%) use cotton masks as types of RPE usage. In addition, most of the sources of information on RPE usage provided by safety officers were (77.89%), by supervisors (70.41%) and by knowledge boards in factories (37.24%) respectively. The workers with good level of behavioural usage of RPE might have good practice of using that RPE to protect themselves from their work such as helmet, safety shoes, using boots and ear plug and ear muff depending on different working environment [11,17]. The respiratory protective equipment such as wearing facemasks have significant effects with perceived benefits with one of HBM components to protect from airborne contaminants and some of the infections [15,18,19].

Additionally, workers who had good level of HBM in perceived benefits were 2.67 times more likely to have good behaviour usage of RPE when compared with those who had poor level of HBM in perceived benefits (Adjusted OR=2.66, 95% CI=1.53 to 4.62, p=0.001). In addition, some research also reports the association between HBM and RPE, especially the good impact from the components of HBM (i.e., perceived susceptibility, perceived severity, perceived benefits and perceived barriers) has influence on RPE usage to protect their personal safety at work [15,20,21].

The HBM has been functional to the likelihood of an impressively broad range of health behaviours among a varied range of inhabitants. The HBM focused on two aspects of individuals' representations of health and health behaviour, perceived susceptibility to illness or health problems [22]. It was consistent to current study and found that the levels of perception of the HBM in perceived benefits were associated with the behavioural usage of RPE in good levels of 89.46% (95% CI: 86.97-91.94).



More interestingly, the results found that the SFW who have a good level of perceived benefits were 2.66 times more likely having a chance in behavioural usage of RPE than those SFW with perceived benefits at a poor level (Adjusted OR=2.66, 95% CI: 1.53 to 4.62,  $p=0.001$ ). The current study presents a similar result to a previous study on HBM related to self-care behaviour of patients at Sub-District Health Promoting Hospital [23,24]. Moreover, the perceived benefits refer to how effective facemasks are believed to be in preventing the spread of diseases by the community and/or individual [14], this result is consistent with the findings of Sim SW et al., [15]. Although perceived susceptibility seemed to be the most substantial aspect in determining compliance, perceived benefits of mask-wearing were set-up to have significant effects on mask-wearing compliance as well [24].

## LIMITATION

This study had some limitations. First, current study is focused and carried out in particular factory in a region, therefore it could not represent the whole population of SFW in Thailand. Second, as the current study was a cross-sectional analytical study, it could not infer causality; therefore, further study with experimental study design by input intervention on significant factors is recommended to provide the better understanding of the causal relationship between HBM and behavioural usage of RPE among SFW in Northeast of Thailand.

## CONCLUSION

This study shows that HBM has an important role to develop a healthy environmental workplace. The good-level of perceived benefits have a strong association with behavioural usage of RPE among SFW in North-eastern of Thailand. Therefore, the HBM in perceived benefits will be a strategy of an incentive for workers to practice with good behaviour in their workplace environment. The current study of cross-sectional design is the first finding of significant factors associated with obvious results. Then, further studies will follow the advice from the evidence that promotes safety behaviour change in real work situations.

## ACKNOWLEDGEMENTS

The authors are grateful to acknowledge the Research and Training Center for Enhancing Quality of Life for Working-Age People, Khon Kaen University, Thailand. The authors would also like to acknowledge the safety officer, the supervisor and the sugar factories' workers who have had a good collaboration with this research.

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### AUTHOR DECLARATION:

- Financial or Other Competing Interests: No
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

### PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: May 25, 2019
- Manual Googling: Nov 06, 2019
- iThenticate Software: Nov 29, 2019 (17%)

### ETYMOLOGY: Author Origin

Date of Submission: **May 25, 2019**  
Date of Peer Review: **Jun 12, 2019**  
Date of Acceptance: **Nov 08, 2019**  
Date of Publishing: **Dec 01, 2019**