

The situation of work-related COVID-19 infection and occupational health and safety measures in Thailand

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Abstract. *Introduction:* The pandemic of COVID-19 infection is the worst public health problem worldwide. Globally, most of cases are among working population. The aims of this study are to describe the situation of work-related disease in Thailand and currently implemented preventive and control measures. *Methods:* The data from the Situation Awareness Team under the Department of Disease Control (DDC) were collected and analysed in September 2020. The Monitoring and Evaluation Team under DDC also conducted a rapid survey to identify any measures enterprises had implemented to protect their employees from the disease. The checklists were applied from the ILO guideline. The survey was conducted via an on-line questionnaire using Google Form and sent to enterprises and the network of safety officers during 13th -17th April 2020. Fisher's Exact test with p-value was used to compare the percentage of enterprises reported implementation of measures. *Results:* Until the end of September, total cumulative number of COVID-19 infection in Thailand were 3,519 cases (approximately 5.29 per 100,000 populations) and 2,445 cases (69.5%) were domestic infection. Among this group, 2,258 persons (92.4%) were working population, aged 18-60 years. 484 domestic cases (21.4%) were classified as work-related COVID-19 infection. The highest number of work-related infection (122 cases) were among workers who worked in entertainment sector. Regarding the calculation for proportions of number of work-related infection and total number of infected cases in each occupation, almost drivers got infection from their jobs. Other high risk occupations included masseurs (90.9%), flight attendants (87.5%), priests (all religions) (80.0%), and airport staff (78.6%). Regarding the rapid survey, 101 samples responded. Almost all enterprises reported having a policy and implementation of preventive and control measures. Implemented measures included health screening of their workers (97%), work arrangement, e.g., work from home (75.2%), area arrangement for work/social distancing (81.2%), ventilation improvement (59.4%), and provision of masks (100%). *Conclusions:* Most of domestic COVID-19 infection were among working age. Approximately one-fifth of them got infection from work. Occupations, especially working with or contact with foreigners and working in a high density of people, were high-risk factors. Several enterprises had implemented preventive and control measures. Prompt policy advocacy, knowledge-based recommendations and communication with target groups were essential.

Key words: work-related COVID-19 infection, occupational health and safety, Thailand, enterprises

Introduction

The pandemic of COVID-19 infection is one of the worst public health problems worldwide. At the end of September 2020, more than 32.7 million

people were infected with the disease and 991,000 died (WHO 2020c). In Thailand, 3,519 cases with COVID-19 infection had been reported since the first reported case in January until the end of September (TAT newsroom 2020). The peak of the outbreak was

on the 22nd of March 2020 with 188 new cases (WHO Thailand 2020a). After that time, number of new cases gradually decreased to zero number at the end of May 2020 (WHO Thailand 2020b). Since then, no locally infected cases had been reported except only 1 case in the mid of September (TAT newsroom 2020). Newly infected cases were only Thai people who came back from abroad and few foreigners who were allowed to enter the country.

Regarding WHO global surveillance for human infection with coronavirus disease (COVID-19), the majority (64%) of cases were age of 25–64 years (WHO 2020b). Almost of this group were working population and some of them may get infection from their work. Several studies and reports showed that workers who worked with or contacted with infected persons were very high risk groups (Koh 2020), (Marinaccio et al. 2020), (Agius et al. 2020), (Lan et al. 2020). These included health workers, airline personnel, transport workers, sales and service personnel. The international organizations, e.g. WHO and International Labour Organization (ILO), and several international/national agencies on occupational health and safety, e.g., the Collegium Ramazzini, ICOH, etc., encouraged national authorities and relevant agencies to set up policy and implement measures to protect workers from getting the COVID-19 infection urgently (WHO 2020a), (ILO 2020), (Ramazzini 2020a), (Ramazzini 2020b), (ICOH 2020). They also gave recommendations and technical guidance to prevent and control of the disease. The recommended measures include raising awareness of the disease among target populations, identification of high risk workers, modification of work practice and working environment, and PPE provision.

The Department of Disease Control (DDC) under the Ministry of Public Health (MOPH) in Thailand has set up the policy and prepared to tackle the pandemic since the early outbreak of the disease in China. The DDC set up the national Emergency Operation Center (EOC) to respond to the disease. The EOC consists of several teams including the situation awareness team (SAT), the operation teams, the risk communication team, and the monitoring and evaluation team. The main activities of these teams include disease surveillance, case investigation, and risk communication for further prevention and control of

the disease. The national EOC system was established in 2016 with technical support from international and national health institutions (CDC 2018). The DDC has experiences for preparedness and responding of several new or re-emerging diseases, such as SARS, MERS, and Avian and Human influenza. Regarding the COVID-19 infection, the Thai government and MOPH have implemented several preventive and control measures to protect people and the public, including both workers in enterprises and informal workers. The aims of this study were to describe the situation of work-related COVID-19 infection and to describe implemented preventive and control measures at enterprise level in the country.

Methods

This is a descriptive study. The data were collected and analyzed from the SAT and the operation team under the DDC. The data were collected from the surveillance and investigation of infected cases. The workflow activities of the surveillance, disease investigation, and reporting system, are as follows: once a person has respiratory infection-liked symptoms, such as fever. He can go to the hospital to ask for checking and treatment. The staff at the hospital will interview with questionnaire whether he meets the criteria for patient under investigation (PUI) or not. If yes, he will get laboratory test (RT-PCR) for COVID-19. Then he will get treatment if the result shows positive (+ve). After that, the investigation team will conduct case investigation and contact tracing to identify more cases for the outbreak control. The data from case investigation include general information of a patient such as name, age, contacted address, and occupation, and risk factors information for COVID-19 infection, e.g., having history of going abroad, or having history of contacting infected persons or foreigners.

In the study, work-related COVID-19 infection was defined as follows: firstly, a person had to have a +ve result for COVID-19 testing; secondly, that person was still working or had a job and had a history of COVID-19 exposure at work. For example, he had a history of contacting any co-worker(s)/customer(s) with the disease and had no history of COVID-19 infection among his own family member before getting

the disease. All of domestic cases were classified and counted for work-related infection. The categories of occupations were grouped together according to similarity of the jobs by researchers' opinion. Proportions of work-related cases and total number of cases in each occupation were calculated.

To achieve the second aim, the monitoring and evaluation team, especially the staff from the division of occupational and environmental diseases, conducted a rapid survey to identify any measures enterprises had implemented to protect their employees from the disease during the peak of an outbreak. A checklist questionnaire was applied from the ILO guideline under a project entitled, "Avian and Human Influenza in the Workplace (Thailand) Project" (Kawakami 2009). The aims of the project, with collaboration from the DDC, were to develop training materials and find good practices of pandemic human influenza preventive measures in enterprises in Thailand. For the purpose of the COVID-19 survey, the checklist questionnaire was improved and then was reviewed by other 2 experts.

The survey was conducted via an on-line questionnaire using Google Form and sent to enterprises directly and several networks of safety officers in April 2020. (The networks have been organized voluntarily to form groups of safety officers according to types of industries or manufactures where they have been working.) Representatives of each network were asked to distribute the questionnaire to several enterprises as many as possible within short period of time in order to get information for further governmental policy

development and support. Implemented measures were analyzed by size of enterprises. Fisher's Exact test with p-value was used to compare the percentage of enterprises reported implementation of measures. P-value < 0.05 was considered to be statistically significant. All statistical analyses were performed using R software package.

Results

Until the end of September, total cumulative number of COVID-19 infection in Thailand were 3,519 cases (approximately 5.29 per 100,000 populations) and 2,445 cases (69.5%) were domestic infection. Among local infection group, 2,258 persons (92.4%) were working-age population, aged 18-60 years. On the other hand, 1,074 cases (almost Thai) got infection from doing jobs or activities while staying abroad. Among this group, 771 persons (71.8%) aged 18-60 years. The highest number of Thai people (251 cases or 23.4%) who got infection from abroad were students.

Among locally-infected cases in working population, 332 persons (14.7%) were general freelance, self-employed or temporary workers (table 1). The high number of infected cases were also found in trade/business (12.5%), factory employees (10.5%), and workers in entertainment sectors (8.7%). Unfortunately, we did not have information of 502 persons (22.2%) about their occupations. Regarding cases with infection from

Table 1. Number of COVID-19 cases by occupations between domestic infection and infection from abroad among Thai working population

Occupations	Domestic infection Number (%)	Imported Infection Number (%)
General freelance/temporary jobs	332 (14.7%)	172 (22.3%)
Trade/business	282 (12.5%)	98 (12.7%)
Factory employees	236 (10.5%)	81 (10.5%)
Entertainment sectors e.g. working in pubs/bars	197 (8.7%)	3 (0.4%)
Government services	153 (6.8%)	20 (2.6%)
Healthcare services	118 (5.2%)	1 (0.1%)
Others	438 (19.4%)	228 (29.6%)
No data	502 (22.2%)	168 (21.8%)
Total	2,258 (100%)	771 (100%)

Table 2. Proportion of number of work-related COVID-19 infection cases (N= 484) among total number of domestic cases by occupations

Occupations	No. of cases	No. of work-related cases	% of infection from work
Drivers (taxi, bus, etc.)	30	29	96.7
Masseurs	11	10	90.9
Flight attendants	8	7	87.5
Priest (all religions)	5	4	80.0
Airport staff	14	11	78.6
Health workers	118	92	78.0
Tourist guidance	12	9	75.0
Hotel staff	40	26	65.0
Restaurant staff	22	14	63.6
Entertainment sectors	197	122	61.9
General freelance/temporary jobs	332	85	25.6
Government officers	153	24	13.1
Factory employees	236	31	13.1
Trade/business	282	19	6.7
Farmers	62	1	1.6
Total	1,522	484	31.8

abroad in working population, most of them were general freelance or self-employed workers (22.3%). The rest include trade or businessmen (12.7%) and factory employees (10.5%). In addition, 168 persons (21.8%) had no information about occupations.

According to the case investigation, 484 domestic cases (21.4%) were classified as work-related COVID-19 infection from case definition criteria. Among these, the two highest number of work-related infection were among workers who worked in entertainment sector (122 cases) and health workers (92 cases) respectively (table 2). Regarding the calculation for proportions of number of work-related infection on total number of infected cases in each occupation, almost drivers got infection from their jobs. In addition, other high risk occupations included masseurs (90.9%), flight attendants (87.5%), priests (all religions) (80.0%), and airport staff (78.6%). Approximately 78% of health workers were reported with work-related infection. Although total numbers of COVID-19 cases were very high among general freelance/temporary jobs, government officers, factory employees, and trade/business, the proportion of number of work-related cases on total number of cases in each occupation were less than 50%.

The situation of implemented preventive and control measures in enterprises

According to the survey of implemented measures, 101 enterprises responded. Most of respondents (58.4%) were safety officers. The others included managers (10.9%), human resource managers (6.9%) and others (23.8%). In addition, most of respondents were from medium enterprises having 50-200 employees (according to Thai Labour Law's classification) (37.6%) and from large enterprises having 200-1,000 employees. Only 7.9% of respondents were from small enterprises having less than 50 employees and 16.8% were from very large enterprises with employees more than 1,000 persons. The types of enterprises included food/beverage manufacturing (18.8%), petro-chemical manufacturing (8.9%), automobile factories (5.9%) and large trade service companies, e.g., superstore (5.9%).

During the outbreak, almost companies reported they had action packages to protect their workers from the disease (table 3). Most of them arranged responsible persons or team to be in charge of this mission. They received the COVID-19 information and policy from the government and implemented

Table 3. Number of enterprises reported implementation of measures for COVID-19 protection by size of enterprises (number of employees)

Measures or activities	Number (%)				p-value
	< 50 employees (N=8)	50-200 employees (N=38)	>200 employees (N=55)	Total (N=101)	
Setting up of COVID-19 policy	7 (87.5%)	38 (100%)	55 (100%)	100 (99%)	0.079
Arrangement of responsible persons or team*	5 (62.5%)	36 (94.7%)	53 (96.4%)	94 (93.1%)	0.013*
Modification of working space for social distancing	6 (75.0%)	34 (89.5%)	42 (76.4%)	82 (81.2%)	0.197
Improvement of workplace ventilation	6 (75.0%)	27 (71.1%)	27 (49.1%)	60 (59.4%)	0.072
Frequently cleaning of working areas	6 (75.0%)	37 (97.4%)	51 (92.7%)	94 (93.1%)	0.114
Health screening of employees before entering workplaces*	6 (75.0%)	38 (100%)	54 (98.2%)	98 (97.0%)	0.016*
Work from home policy (if possible)	5 (62.5%)	27 (71.1%)	44 (80.0%)	76 (75.2%)	0.373
Training of COVID-19 prevention*	6 (75.0%)	37 (97.4%)	39 (70.9%)	82 (81.2%)	0.002*
Provision of mask	8 (100%)	38 (100%)	55 (100%)	101 (100%)	-
Stay at home for 14 days among suspected cases or sick employees	7 (87.5%)	38 (100%)	54 (98.2%)	99 (98.0%)	0.153
Hospital referral system for suspected cases	6 (75.0%)	37 (97.4%)	50 (90.9%)	93 (92.1%)	0.081

Note * p-value<0.05

preventive and control measures following health authority's recommendations. For example, more than 80% of enterprises conducted work and environment modification by using common recommended measures such as increasing work space for social distancing, and frequently cleaning of working areas. In addition, 75.2% of the companies also had work from home policy.

Many enterprises also adopted and conducted health screening for their workers and customers such as checking up of temperature before entering the workplaces. They also had a policy to allow workers with mild flu-like symptoms to stay at home. If workers had severe symptoms or were suspected to get COVID-19 infection, medical-care or hospital referral were arranged. Almost enterprises arranged the training course and exchanged the information about COVID-19 infection to their workers. Some factories conducted

activities, called "COVID talk" every morning before starting routine work in order to share information and monitor implemented measures. Interestingly, 100% of enterprises reported of 100% mask provision for their employees. Although almost companies tried to implement several preventive or control measures according to the recommendations of the government, their decision of implemented measures depended on their capabilities and resources. Small scale enterprises tended to conduct activities less than larger scale enterprises. For example, only 62.5% of small enterprises arranged responsible persons or team to respond for disease prevention while more than 90% of bigger enterprises did. The differences of some implemented measures, including arrangement of responsible persons or team, health screening arrangement, and training of COVID-19 prevention, among size of enterprises were statistically significant (table 3).

Discussion

The study showed the situation of COVID-19 infection, especially work-related infection in Thailand. From the study, the proportion of infected cases among working population (age 18-60 years) in the country (92.4%) was higher than average figure globally (approximately 73.6%) (WHO 2020b). This may be one reason why number of death cases were quite low (Yanez et al. 2020). The study also identified 484 cases of work-related COVID-19 infection among local transmission in working age population. The proportion of work-related disease (21.4%) in this group was similar to the number in Canada (20%) but was lower than the figures (30%) in both Italy and the Netherlands (Mustard et al. 2020), (Marinaccio et al. 2020), (Molen et al. 2020). The data on work-related infection in this study was based on national disease surveillance, contact tracing and disease investigation. The figure in Canada was used the combination of 2 sources from public health officials by contact tracing and compensation claims registered at the Workplace Safety and Insurance Board (WSIB). On the other hand, the study of Marinaccio and colleagues in Italy was based on workers' compensation claims while expert-based assessment and report system was conducted in the Netherlands.

The results also identified several high risk occupations such as drivers, masseurs, flight attendants and health workers. The early reported case of work-related disease in the country may be a taxi driver (Pongpirul et al. 2020). After the outbreak of the disease, many workers in several occupations had been infected and transmitted the infection to other persons. The findings were similar to other studies (Koh 2020), (Marinaccio et al. 2020), (Agius et al. 2020), (Lan et al. 2020). The characteristics of high risk jobs include working with physically close person to person contact, working in poor or closed ventilation, and working with infected persons. The study also showed that health workers were also a very high risk occupation. 78% of infected cases in health workers occurred during their work.

The study can confirm the list of industries/occupations known to be associated with increased risk of COVID-19 and related mortality proposed by Technical Appendix: 24th Collegium Ramazzini (Ramazzini

2020a). For example, occupations which the proportion of work-related COVID-19 disease was more than 75% (e.g. health care workers, airline personnel, drivers, etc.). They were classified as very high risk group. Occupations with the proportions between 50-74% (e.g. hotel and food service workers) were similar to the list for high risk group category. However, the figures among government officers (13.1%) and trade/business (6.7%) in the study did not match for the very high risk group. This may be due to some differences in working conditions and environment. For example, Thai government officers when on duty had to comply with recommended preventive measures strictly, such as, wearing mask, hand cleaning with alcohol gel, and practicing of social distancing. Since the information in this study was received from reviewing the outbreak investigation report only and we could not conduct a survey to identify an attack rate of the disease among workers in each occupation, the exact incidence of the work-related disease in each job category could not be identified.

The study also showed that almost enterprises had tackled the COVID-19 infection very well. They used several preventive and control measures recommended by national and international health authorities. The implemented measures included setting of plans and policy, working environmental modifications, health screening and risk communication and training. The results from this study showed the percentage of enterprises with implemented prevention/control measures (99%) was higher than the figures from other studies (Waltenburg et al. 2020), (Sasaki et al. 2020b). For example, the survey in meat and poultry processing facilities in the US by Waltenburg et al. showed that 46% of facilities with reported cases were implemented interventions and preventive measures. Another study by Sasaki et al. found 79.9% of employees from companies reported that they received an announcement of measures about COVID-19 taken by their company. When each measure was considered, the differences in proportions were also found. For example, the percentages of implemented measures included health screening of employees before entering workplaces (97% Vs 80% (Waltenburg) Vs 48.5% (Sasaki)), modification of working space for social distancing (81.2% Vs 62% (Waltenburg)), training of COVID-19 prevention

(81.2% Vs 63% (Waltenburg) Vs 57.7% (Sasaki)), and provision of mask (100% Vs 77% (Waltenburg) Vs 80.2% (Sasaki)). In addition, the result of this study was similar to the study by Sasaki et al. in terms of the association of workplace implementation and the size of enterprises. Both studies showed that smaller enterprises tended to implement preventive/control measures less than larger enterprises did. Lack of resources in smaller enterprises was the main reason for the finding.

The higher percentage of implemented preventive/control measures in our study may be due to increased awareness of the COVID-19 disease among employers/employees in enterprises. Since the early reported cases in China and in Thailand, the Thai public health agency and the media have informed and communicated relevant information about the disease and preventive/control measures to the public frequently. On top of that, enterprises, especially food/beverage manufacturing, were afraid of financial impact from banning of their products if there were any reported cases in their companies. This may be explained by another study by Sasaki et al. (Sasaki et al. 2020a). The results showed that fear and worry about the disease among employees may increase awareness and resulted in taking the measures. However, our study had some limitations. Our results may face selection bias from the enterprises where they had already implemented measures and reported to us. From our rapid survey, we sent on-line questionnaire through our networks. Since our team wanted to get the information as much as we could within short period of time to formulate policy recommendations, we asked our networks of safety officers to assist to distribute the questionnaire. Therefore, we did not know exactly about the characteristics of the enterprises of which the questionnaire was sent and the response rate. In addition, we did not know the performance of the measures in terms of effectiveness and efficiency.

Conclusions

The number of COVID-19 infection in Thailand had been low since the first reported case until the end of the study. Most of them were among working

age. Approximately one-fifth of them got infection from work. Working with infected cases, contacting with foreigners at work, and working in high density of people were high risk factors. From the study, several enterprises responded to the disease very quickly. Almost implemented several prevention and control measures, such as, modification of work practice and working environment, health screening, training of employees, and PPE provision. The study showed that prompt policy and implemented several preventive and control measures at all levels were essential for disease protect among working population.

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Authors' contributions: SS was in charge of this study, of supervising the process, of analyzing of the whole data, and of writing the first draft of the manuscript. CS collected and analyzed the data of the first part of the study. RW collected and analyzed the data of the second part of the study. CT and WC ensured that information of any part of the work were correct and appropriate. All other authors revised the manuscript critically. All authors approved the final version of the manuscript.

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