ORIGINAL ARTICLE

Comprehensive Measures for Prevention and Control of COVID-19 Outbreak in Factories in Thailand

Hansa Ruksakom, M.D., M.Sc., Thai Board of Occupational Medicine[1],
Thanawat Rattanawitoon, Ph.D. [2], Sutatip Buranasatitnon, M.Sc.[2]
[1]Office of Disease Prevention and Control Region 3 Nakhon Sawan, Department of Disease Control, Thailand
[2]Division of Occupational and Environmental Disease, Department of Disease Control, Thailand
Received: *December 19, 2025* **Revised:** *January 7, 2026* **Accepted:** *January 19, 2026*

ABSTRACT

BACKGROUND: The coronavirus 2019 pandemic has impacted health and the economy in Thailand, especially in factories, during 2021-2022. Suitable measures for use in the factories with no high investment or stopping of manufacturing process operations were required.

OBJECTIVE: This study aimed to develop and provide comprehensive measures for implementation in factories to prevent and control the COVID-19 outbreak in Thailand with no high investment or stopping of manufacturing process operations.

METHODS: An action research study was undertaken using four steps as follows: 1) Review measures and COVID-19 situation analysis; 2) design and development of measures; 3) implementation of measures; and 4) monitoring and evaluation concerning the application of the new measures. This research was conducted from May 2021 to December 2022, which proceeded with a short field study in purposive sampling voluntary factories in Bangkok (19 factories) and Tak Province (2 factories), pilot integration in Ayutthaya Province, and then implementation in factories in Thailand.

RESULTS: The "Measures of Bubble and Seal for Factories (MBBSF)" include comprehensive measures for factories, which apply the epidemiological principles of early detection, early control, and consideration for balancing economic recovery. The measures consist of two programs comprising 1) a prevention program for the factories that are COVID-19-free, and 2) a control program for the factories experiencing COVID-19 based on three levels of COVID-19 outbreak, including 1) low-level control (COVID-19 prevalence <10 per cent); 2) moderate-level control (COVID-19 prevalence ≥10 per cent); and 3) high-level control (at least two out of three criteria, i.e., the COVID-19 prevalence >10 per cent, cases among more than 100 workers, and factories continually found cases in 14 days out of 28 days). After implementing and evaluating the MBBSF at factories, it was found that factories could adapt the MBBSF to their factory contexts for the prevention and control of COVID-19 outbreaks.

CONCLUSION: The MBBSF can prevent and control COVID-19 outbreaks without the need to stop manufacturing process operations. These measures may be applicable to emerging infections for workers' occupational health. Lessons learned, and a value-based evaluation should be conducted in future studies.

KEYWORDS: comprehensive measures, COVID-19 outbreak, prevention and control, factories

Thaiclinicaltrials.org number, TCTR20260110001

INTRODUCTION

A novel coronavirus 2019 officially emerged in Wuhan, China, in December 2019[1], causing the coronavirus disease of 2019 (COVID-19)[2]. This disease rapidly spread to other nations worldwide, including Thailand, and led to adverse health outcomes ranging from asymptomatic symptoms to severe respiratory infections and deaths.[1,3-4] The Thai government created policies and interventions to control the outbreak by enhancing people's awareness and implementing regulations.[5-6] The first big wave started at the beginning of 2021. There was a report of a significant outbreak at a local market, namely the "Shrimp Market" in Samut Sakhon Province.[7] Consequently, the Thai Ministry of Public Health (MOPH) controlled this outbreak by locking down the camps around the shrimp market. Ultimately, this outbreak was controlled and cases declined significantly within one month, after which they reopened the market. This lockdown was a strict control measure. However, the outbreak eventually spread to communities in all regions of Thailand, particularly in the industrial sectors, due to people commuting from crisis areas to other provinces.[8-9] The new outbreak in factories happened in May 2021. This rapidly caused not only adverse health outcomes but also economic loss[2,10] due to the lockdown and national restrictions.[8] During the same period, Thailand's economic growth dropped from 4.2 percent in 2019 to 2.2 percent in 2021[10] and the country faced an extreme loss of revenue, particularly in the industrial sectors.[11] The lockdown measure was not adopted for use in factories because it was not suitable for controlling the COVID-19 outbreak in factories due to the very high investment. This study aimed to provide comprehensive measures for the prevention and control of the COVID-19 outbreak in factories during the COVID-19 pandemic in the years 2021-2022.

METHODS

This action research was part of the Ministry of Public Health policy conducted using purposive sampling and volunteer factories in Thailand from May 2021 to December 2022. This research was approved by the Chanthaburi Research Ethics Committee/Region 6, in compliance with Document COA No. 126/68. It is demonstrated by four steps as follows:

Step 1: Review measures and COVID-19 situation analysis (May 2021 to June 2021)

The research began with a literature review on the COVID-19 measures undertaken in Thailand and internationally, such as in France[12], Italy[13], China[13], and the United States of America.[14] Particularly, the measures used in the case of the "Shrimp Market" in Samut Sakhon Province and the measure of Good Factory Practice (GFP) by the Department of Health, Thailand were specific to the factories and therefore also reviewed. Then, a database was established to analyse the COVID-19 cases in factories, accompanied by setting up a "situation awareness team" of Division of Occupational and Environmental Disease, Department of Disease Control (DDC) by formal cooperation to link the "Application Programming Interface (API)" with the Department of Industrial Works, Ministry of Industry, in Thailand, and analyse the obtained data.

Step 2: Design and development of measures (June 2021 to July 2022)

To establish practical measures, this step proceeded with a short field study of the selected factories, comprised of Thai workers and migrant workers, in Bangkok (19 factories) and Tak Province (2 factories) using the GFP checklist, discussion, and received feedback. Next, new measures and pilot integration were designed in the voluntary target

factories in Ayutthaya Province, which was a central part of Thailand with a variety of factory types, sizes, and workers in urban and rural areas, and then comprehensive measures were developed to use in factories, namely "Measures of Bubble and Seal for Factories (MBBSF)". In addition, manuals and materials were produced to communicate with and distribute to various factories, such as short guidelines, infographics, posters, roll-up, and video clips to help them understand the MBBSF more easily.

Step 3: Implementation of the new measures (August 2021 to April 2022)

The initial phase of implementation focused on the top five ranking COVID-19 cases of factory types and medium and large-sized factories. Subsequently, the MBBSF would be applied to all factories in Thailand or as much as possible. It involved three main mechanisms as follows. First 1) is driving policy advocacy for the communication and dissemination of manuals, short guidelines, infographics, video clips, and all formal channels, such as YouTube, Facebook, and official documents, to the factories and related stakeholders, and to provide the "Knowledge Sharing Forum" among the network and stakeholders related to factories at all levels, while second 2) is establishing network collaboration to drive the MBBSF measures in factories passed by the Emergency Operations Centre (EOC), covering the department level, ministry level, and national level. In addition, the Office of Disease Prevention and Control Region 1-12 (ODPC 1-12), the Institute for Urban Disease Control and Prevention (IUDC), the provincial public health officers, and all relevant organisations both inside and outside the Ministry of Public Health of Thailand. Finally, 3) set up "Coaching Teams" at all levels and develop them through capacity building and an AI Chatbot, namely "DDC Coach Bot" for consultation.

Step 4: Monitoring and evaluation (October 2021 to December 2022)

After implementing the comprehensive MBBSF, a crucial process of the integration monitoring program included hosting an online meeting among ODPC 12 regions and IUDC to get feedback, suggestions, and After Action Review (AAR) every week. Similarly, information and the obtained results were reported weekly, which were passed by the Google application sheet and monitoring program. Moreover, it was planned by the research team and ODPC team to visit randomly selected factories, both online and on-site, 2-3 times a week. The main purposes of the visits were to discuss how to apply and control the outbreaks in the factories, raise issues found in the factories, and learn techniques for controlling the small bubble, as well as innovations for the application of this measure.

RESULTS

Review of the measures, regulations, and situations of COVID-19

After reviewing the COVID-19 measures and regulations in Thailand and around the world, results were obtained and illustrated, as shown in Table 1 below:

Table 1 Summarised review of COVID-19 measures and regulations

Country	Measures and Regulations for COVID-19 Prevention and Control
France	The French government started to quarantine people for 14 days who were travelling from Wuhan City, P.R. China, and other people suspected of being COVID-19-infected. It also implemented community measures for social distancing and mask wearing in public areas, closed schools, and set up online learning. On March 14, 2020, the national lockdown and the closing of borders were regulated. [12]
Italy	The Italian government set up working groups in order to respond to COVID-19. Later, a nationwide lockdown, including the closure of schools, universities, and non-essential businesses, went into effect, and travel restrictions between regions were regulated. In March 2020, the country was divided into red, yellow, and safe zones. The red zone referred to implementing quarantine measures for cases and close contact people, while the yellow zone referred to implementing social distancing measures, including the closing of bars and restaurants, as well as limitations on the number of people gathering in certain public areas. [13]
China	The P.R. of China government implemented strict quarantine and isolation measures to separate COVID-19-infected people from the general population and quarantine, including travel restrictions. In addition, measures of contact tracing and widespread testing for COVID-19 infection and the development of the COVID–19 vaccine were regulated. [13]
The United States of America	The US government mandated measures to regulate mask wearing [14], maintain social distancing in public areas, and close schools at all levels and non-essential businesses. [15] People infected with COVID-19 were recommended to self-quarantine at home, isolate and quarantine, and self-test for COVID-19 for at least two weeks. Travel restrictions were also regulated [16] by quarantining passengers from the mainland of China, Iran, Ireland, and the United Kingdom entering the country for 14 days. Moreover, the policy, namely the "travel ban", was for people who originated from designated countries that had reported high numbers of COVID–19 cases.[16] In addition, the US government developed COVID-19 vaccines to build immunity and prevent the spread of the pandemic.
Thailand	The Thai government implemented social measures, including a full-scale national lockdown, a 14-day mandatory quarantine for international travellers, and curfews throughout Thailand.[17] In addition, social measures, hand washing, mask wearing, and keeping social distancing were regulated and encouraged.[18] All non-essential businesses were closed. At the community level, village health volunteers were tasked with action to educate villagers on how to prevent themselves from getting the diseases.

The results of data analysis from the linkage between API and the Department of Industrial Works of Thailand indicated that the top-five-ranking COVID-19 cases among factories were from the manufacturing of food and beverages [15,657 cases (27.6%)], manufacturing of computers and electronic products [9,375 cases (16.5%)], manufacturing of construction projects [9,175 cases (16.1%)], manufacturing of rubber and plastic products [3,720 cases (6.6%)], and manufacturing of textiles/clothing [3,315 (5.8%)], respectively, as shown in Table 2. Therefore, the first stage of control measures for COVID-19 outbreaks was implemented in these top-five-ranking COVID-19 cases of factories, and the subsequent stage was to expand the control measures for COVID-19 outbreaks to other types of factories.

Table 2 Top Five Highest Numbers of COVID-19 Cases in Factories Based on Cumulative Data for May–July 2021, Classified by Types of Factories

Types of Factories	Cases (%)
Manufacturing of food and beverages	15,657 (27.6)
Manufacturing of computers and electronic products	9,375 (16.5)
Manufacturing of construction projects	9,175 (16.1)
Manufacturing of rubber and plastic products	3,720 (6.6)
Manufacturing of textiles/clothing	3,315 (5.8)

Comprehensive measures for the COVID-19 outbreak in factories

The results of a field study at 19 factories in Bangkok, 2 factories in Tak Province, and a local lockdown area at a shrimp market in Samut Sakhon Province indicated that there was a variety of contexts in each factory, in which high investment in a seal route measure was found, and was not available for the majority of factories. New measures were developed using the application of epidemiologic principles, early detection and early control, accompanied by knowledge of occupational medicine, the health worker effect, and economic equilibrium to be the new measure under the conceptual framework, "small group for quickly control, decrease pandemic, and no income lost," by arranging a "Small Group," which was called "Small Bubble," and controlling working and daily activities by the head of the plant. Thus, the risk group exposed to COVID-19 and the COVID-19-infected workers were detected early and treated promptly, accompanied by cleaning workplaces. Because of the close observations by the head of the plant, the COVID-19-infected workers who had no severe symptoms would be promptly contained by isolating them to work in the same small group and the same small bubble, but not stopping work. This new measure was available for the level of the COVID-19 outbreak in factories; factories could apply the new measure to complement their resources and preparedness. The new measure was called "Measure of Bubble and Seal for Factories (MBBSF)".

The "MBBSF" was developed and consisted of two parts. In Part One (Part I), "Bubble and Seal for Prevention," the important mechanisms were defined as small groups and DMHTTA with no COVID-19. In Part Two (Part II), the "Bubble and Seal for Control" was applied to the factories experiencing COVID-19 by being classified into three levels as follows: 1) "Low-level Control" was applied to the factories with COVID-19 prevalence <10 per cent; 2) "Moderate-level Control" was mandated for the factories with COVID-19 prevalence ≥10 per cent; and 3) "High-level Control" was used for the factories with at least two out of three criteria (COVID-19 prevalence >10 per cent, cases in more than 100 workers, and factories that continually found cases in 14 days out of 28 days). The details of two parts of MBBSF are shown in Figure 1.

Part I

Bubble and Seal for Prevention Programme for Factories with COVID-19 Free

Fundamental Measures

1. Screening before entering the factories every day
2. Implementing D M H T T A
3. Improving the environment for disease control
4. For recruiting new employees, 14 days of quarantine and examine COVID-19 test
5. Providing vaccine to at least 70% of employees.

Implementation

1. ***Creating employee name list and divide into subgroups***, particularly susceptible populations such as elderly people, pregnant women and those with underlying diseases.
2. ***Setting up small bubbles*** for employees based on their subgroups and working areas with conditions to work and do activity in their own groups, not crossing other groups.
3. **Risk communication** about COVID-19
4. **For accommodation**
   - 4.1 For employees who stay in the factories,
     - In a small bubble, putting employees working in the same groups in the same areas in a dormitory.
     - Providing food and consumers products.
   - 4.2 For employees who stay at home.
     - Follow social distancing, mask wearing and hand washing (D M H)
   - 4.3 For employees who stay in a dormitory in the community.
     - Staying in their own bubbles.
     - Engaging the D M H.

*** Avoid socializing and gathering with other people***

5. **For transportation**
   - 5.1 If the factories provide a bus,
     - Arranging pick-up areas
     - Screening before getting on the bus
     - Engaging the D M H.
     - Monitoring by assigned group leaders.
   - 5.2 For employees using their own vehicle and public transport, engaging the D M H.
6. **For ATK testing,** randomly select employees in small bubbles using the criteria. For example, in factories with 1,000 employees, examine ATK for 150 employees. After the test, separate the case from the bubbles and the rest can still work.

Part II

Bubble and Seal for Control for Factories Experiencing COVID-19

Every factory is required to implement fundamental measures as Bubble and Seal for Prevention.

"Low-level control" (*COVID-19 prevalence < 10 per cent)*

Implementation

1. Isolating infected employees to a hospital / home isolation / community isolation
2. Examining suspected cases in a susceptible population using ATK/RT-PCR tests. For positive tests, isolating to hospitals.
3. Separating employees who are at high-risk of exposure for factory quarantine, working in their bubbles and not crossing groups.
4. Managing the scheduling time for breaks and use of common areas, such as canteens and resting areas.

"Moderate-level control" (COVID-19 prevalence ≥ 10 per cent)

Implementation

1. As the implementation is for low-level control, the factories need to prepare factory quarantine (FQ), factory accommodation isolation (FAI) and transportation for employees.

"High-level control" (at least two out of three criteria including COVID-19 prevalence > 10 per cent, cases among more than 100 workers, and the factories continually found cases in 14 days out of 28 days.)

Implementation

1. As the implementation is for moderate-level control, factories need to provide FAI for infected employees, FQ for suspected cases, hospitals and transportation.
2. Applying "seal route" for transportation to strict routes from a dormitory to the factories and engage D M H of employees while commuting.
3. Collaborating with stakeholders in assisting the factories to control the outbreaks such as village health volunteers, policemen and soldiers.
4. Providing a consulting system regarding mental issues.
5. Providing food and consumer products in the factories.
6. Strictly enforce the rule of no socializing and gathering among employees.
7. Subsidizing vaccines for all employees, particularly those susceptible populations.

Notes: DMHTTA means D = Distancing; M = Mask wearing; H = Handwashing; T = Temperature; T = Testing of COVID-19; and A = Application ATK means A = Antigen; T = Test; K = Kit (rapid test kit for COVID-19 antigen detection)

Figure 1 Details of Part I and Part II of the MBBSF, Including BBS for Prevention and Control

Collaboration with stakeholders

The results for disseminating the MBBSF for collaboration with stakeholders can be shown as follows.

1) Distribute manuals, guidelines, and infographics to around 5,000 factories throughout Thailand.

2) Set up a conference to promote measures under the title "Collaboration among Stakeholders to Fight COVID-19" on September 3, 2021, through Facebook Live and YouTube platforms. Eventually, more than 2,000 people participated in this conference via the online system, and more than 51,000 people accessed it on YouTube.

3) Post media related to the measures, such as the manual, roll-up, posters, VDO clips, and DDC Chat Bot, as well as feedback from users via the website of the DDC.[19] Consequently, the factories in Thailand and interested people accessed and downloaded these documents 22,851 times. The majority of access to media was posted 7,145 times (31%), followed by the manual and roll up 7,030 times (30.9%) and 4,170 times (18.0%), respectively. In addition, 335 factories accessed the DDC Chatbot.

Regarding the implementation of the coaching system, the teams set up regular meetings once a month between August 2021 and April 2022, with 9 meetings in total. The number of coaching team members increased from 17 to 876.

Monitoring and Evaluation

The study revealed that about 2,861 factories out of a total of 14,553 medium and large-sized factories around Thailand applied the MBBSF in their factories by integrating it into occupational health and safety measures from October 2021 to December 2022. Monitoring and evaluation were conducted by the coaching teams, which followed up and visited around 390 factories in Thailand, both online and on-site. The obtained results illustrated that factories also gave feedback and reflections regarding the application of the measures and issues found, as well as recommendations. Most factories had a policy and set up a team to control outbreaks. Some factories experiencing COVID-19 outbreaks reported that this strategy helped them investigate the cases and close contacts efficiently. Most factories used media such as the platforms of boards, posters, announcements, and line groups in order to communicate with employees. This was used to enhance knowledge about COVID-19 prevention and control, as well as to raise awareness among employees. Furthermore, the factories revealed the advantages of using the measure, such as small bubbles that helped them to rapidly separate employees from the cases. This also assisted them in more quickly detecting close-contact employees. Using the guidelines for an ATK test helped the factories to randomly identify cases in the factories and control the disease rapidly, resulting in a decline in prevalence in their factories. In addition, it was found that the best practice factories created innovative working methods, i.e., using face scanning instead of writing or touching the equipment for recording evidence of entering and exiting work.

After monitoring and evaluation, a lesson-learned meeting among the research team, collaborating network, and stakeholders was organised in Thailand in June 2022 to obtain the opinions for developing the new measure and driving the specific mechanisms for scaling up to the national policy for controlling COVID-19 cases by the new development measure.

DISCUSSION

The novel coronavirus has led to tremendous adverse outcomes, not only in health but also in

social and economic areas.[3,10,11] At the beginning of the outbreaks, countries worldwide created effective policies and regulations as well as measures to mitigate problems, which mainly involved locking down the country, travel restrictions, and the closure of schools, universities, and non-essential businesses, as well as promoting mask wearing, handwashing, and social distancing.[14,15] Thailand also faced COVID-19 issues all over the country, particularly in the factory setting, which produces a majority of revenue for the country.[11] This study applied information from the literature reviews and the concept of early control and economic recovery to establish the MBBSF. In a crisis, countries should create measures or regulations that are relevant to their situations. In this study, the MBBSF was developed to be an innovative measure that is practical and durable and can be applied to factories throughout Thailand, both factories experiencing COVID-19 and factories with no COVID-19. Consequently, factories can select appropriate measures to prevent or control outbreaks in their factories.

Using small bubbles to limit the outbreak areas is an effective strategy to overcome the issues. In this study, the factories reported that they applied small bubbles by putting employees in groups and mandating them to work and do activities in their groups that help them detect cases and close contact with people faster. When an outbreak occurs, the rest of the members and employees in other groups can still work routinely, and the factories can still operate as usual. This also helps prevent the loss of revenue for the factories. Moreover, the factories asserted that this assisted them in identifying cases rapidly and controlling outbreaks efficiently. Interestingly, the MBBSF concepts were similar to the National Basketball Association (NBA) bubble regulations by testing the players before entering games, isolating the basketball teams before games, having no travel restrictions between the teams, and putting the teams in separate zones.[20] These precautions helped reduce the transmission of the disease.

Besides creating small bubbles in this study, the authors applied fundamental measures such as screening before entering the factories, implementing mask wearing, handwashing, social distancing, temperature checking, improving the working conditions in the factory for disease control, providing vaccines, accommodation and transportation, detecting cases using ATK or RT-PCR tests, and supporting hospital fields, factory isolation, and quarantine, as shown in Figure 1. These are crucial components in the MBBSF. In addition, collaborating with the coaching team and related stakeholders is key to the success of this study. Once the factories understand the MBBSF, they will be able to apply it to their factories.

Based on the most recent pandemic, this was the first study to control COVID-19 in factories in Thailand. Therefore, the situations that impacted the study time limitations to establish the MBBSF, not having permission to visit the factories, having online training causing misunderstandings sometimes, limitations of budget allocation, and a lack of public health workers to conduct onsite visits in the factories. However, the study has a number of strengths. This measure is a national policy. Therefore, the MOPH could collaborate with other stakeholders, particularly the Ministry of Industry and the Ministry of Labour, to disseminate the measure and closely monitor the factories. Presently, the MBBSF is the national measure by government policy.

To mitigate COVID-19 issues, a comprehensive MBBSF helped to control the pandemic in factories, which was practical, flexible, and could be developed into an innovative measure applied to factories. Moreover, these measures may be

applicable to emerging infections for workers' occupational health. The announcement of the best practice factories used to be the incentive method to sustainably process the MBBSF. The three important mechanisms were knowledge dissemination, high-potential coaching teams, and monitoring and evaluation of the implemented factories. Therefore, the lessons learned and quality evaluation should be included in future studies to update the new measure and accommodate the changing period.

ACKNOWLEDGEMENTS

The authors would like to thank the executives and staff at the Ministry of Public Health, the Ministry of Industry, and the Ministry of Labour of Thailand for their support and facilitation during data collection and implementation. The authors are also grateful to all factory collaborators and research participants for completing the research. Besides, thanks are also extended to Dr Nalinee Sripaung, Division of Occupational and Environmental Diseases, Department of Disease Control, for her support and suggestions on various important issues.

FUNDING

This study was financially supported by the Department of Disease Control, Ministry of Public Health, Thailand.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

1. Prem K, Liu Y, Russell TW, Kucharski AJ, Eggo RM, Davies N, et al. The effect of control strategies to reduce social mixing on outcomes of the COVID-19 epidemic in Wuhan, China: a modelling study. Lancet Public Health 2020;5:e261-e270.
2. Zhang H, Shang W, Liu Q, Zhang X, Zheng M, Yue M. Clinical characteristics of 194 cases of COVID-19 in Huanggang and Taian, China. Infection 2020;48:687-94.
3. Mallah SI, Ghorab OK, Al-Salmi S, Abdellatif OS, Tharmaratnam T, Iskandar MA, et al. COVID-19: breaking down a global health crisis. Ann Clin Microbiol Antimicrob [Internet]. 2021 [cited 2022 Aug 13];20(1):35. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8129964/pdf/12941_2021_Article_438.pdf
4. Dhama K, Khan S, Tiwari R, Sircar S, Bhat S, Malik YS, et al. Coronavirus disease 2019-COVID-19. Clin Microbiol Rev [Internet]. 2020 [cited 2022 Dec 8];33(4):e00028-20. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7405836/pdf/CMR.00028-20.pdf
5. Marome W, Shaw R. COVID-19 response in Thailand and its implications on future preparedness. Int J Environ Res Public Health [Internet]. 2021 [cited 2022 Nov 11];18(3):1089. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7908435/pdf/ijerph-18-01089.pdf
6. Nittayasoot N, Suphanchaimat R, Namwat C, Dejburum P, Tangcharoensathien V. Public health policies and health-care workers' response to the COVID-19 pandemic, Thailand. Bull World Health Organ 2021;99:312-8.
7. Thai PBS. High number of COVID-19 cases in Samut Sakhon [Internet]. 2021 [cited 2022 Jul 28]. Available from: https://news.thaipbs.or.th/content/300928.
8. Bureau of Information Office of the Permanent Secretary of MOPH. MOPH applied a Bubble and Seal measure to control COVID-19 in factories [Internet]. 2021 [cited 2022 Jul 28]. Available from: https://pr.moph.go.th/?url=pr/detail/2/04/153466/.
9. Department of Disease Control. Reports on COVID-19 in Thailand [Internet]. 2022 [cited 2022 Jul 29]. Available from: https://data.go.th/dataset/covid-19-daily.
10. World Bank Group. Thailand economic monitor: Thailand in the time of COVID-19. Washington: The World Bank; 2020.
11. United Nations Industrial Development Organization. Impact assessment of COVID-19 on Thailand's manufacturing firms. Vienna: United Nations Industrial Development Organization; 2021.
12. Or Z, Gandré C, Durand Zaleski I, Steffen M. France's response to the Covid-19 pandemic: between a rock and a hard place. Health Econ Policy Law 2022;17:14-26.
13. Wang X, Shi L, Zhang Y, Chen H, Sun G. Policy disparities in fighting COVID-19 among Japan, Italy, Singapore and China. Int J Equity Health [Internet]. 2021 [cited 2022 Oct 15];20(1):33. Available from: https://pmc.ncbi.nlm.nih.gov/ ar-

ticles/PMC7804586/pdf/12939_2020_Article_1374.pdf

14. Lyu W, Wehby GL. Community use of face masks and COVID-19: evidence from a natural experiment of state mandates in the US. Health Aff (Millwood) 2020; 39:1419-25.
15. Viner RM, Russell SJ, Croker H, Packer J, Ward J, Stansfield C, et al. School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. Lancet Child Adolesc Health 2020;4:397-404.
16. Congressional Research Service. COVID-19: Federal Travel Restrictions and Quarantine Measures [Internet]. 2020 [cited 2022 Dec 24]. Available from: https://www.congress.gov/crs-product/LSB10415
17. Rajatanavin N, Tuangratananon T, Suphanchaimat R, Tangcharoensathien V. Responding to the COVID-19 second wave in Thailand by diversifying and adapting lessons from the first wave. BMJ Glob Health [Internet]. 2021 [cited 2023 Feb 12];6(7):e006178. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8295022/pdf/bmjgh-2021-006178.pdf
18. The World Health Organization Thailand. COVID-19: WHO's action in countries [Internet]. 2020 [cited 2022 Dec 24]. Available from: https://www.who.int/docs/default-source/coronaviruse/country-case-studies/thailand -c19-case-study-20-september.pdf
19. Department of Disease Control. COVID-19 in Factories [Internet]. 2020 [cited 2022 Dec 24]. Available from: https://ddc.moph.go.th/doed/pagecontent.php?page=739&dept=doed
20. McHill AW, Chinoy ED. Utilizing the National Basketball Association's COVID-19 restart "bubble" to uncover the impact of travel and circadian disruption on athletic performance. Sci Rep [Internet]. 2020 [cited 2023 Jan 8];6(7):21827. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7732833/pdf/41598_ 2020_Article_78901.pdf

ORIGINAL ARTICLE

มาตรการสำคัญในการป้องกันควบคุมการแพร่ระบาดโรคโควิด-19 ในโรงงาน ประเทศไทย

หรรษา รักษาคม พ.บ., วท.ม.,ว.ว. เวชศาสตร์ป้องกันแขนงอาชีวเวชศาสตร์[1], ธนะวรรธน์ รัตนวิทูรย์ ปร.ด.[2], สุธาทิพย์ บูรณสถิตย์ วท.ม.[2]
[1]สำนักงานป้องกันควบคุมโรคที่ 3 นครสวรรค์ กรมควบคุมโรค., [2]กองโรคจากการประกอบอาชีพและสิ่งแวดล้อม กรมควบคุมโรค

บทคัดย่อ

ที่มาของปัญหา: การแพร่ระบาดของเชื้อไวรัสโคโรนา 2019 (โควิด-19) ส่งผลกระทบในวงกว้างทั้งต่อสุขภาพและเศรษฐกิจของประเทศไทยโดยเฉพาะอย่างยิ่งการแพร่ระบาดของโรคโควิด-19 ในโรงงานอุตสาหกรรมในช่วงปีพ.ศ.2564-2565 ซึ่งพบการระบาดสูงมาก จึงจำเป็นต้องมีมาตรการที่เหมาะสมสำหรับโรงงานเพื่อควบคุมการระบาดโดยที่โรงงานไม่ต้องหยุดหรือปิดกิจการ

วัตถุประสงค์: การศึกษาครั้งนี้เพื่อกำหนดมาตรการใหม่ที่ครอบคลุมเฉพาะสำหรับโรงงานนำไปใช้ในการควบคุมและป้องกันการแพร่ระบาดของโรคโควิด-19 ในโรงงานในประเทศไทย

วิธีการศึกษา: การศึกษาวิจัยเชิงปฏิบัติการนี้มีดำเนินการเป็น 4 ขั้นตอน ดังนี้ 1) การทบทวนมาตรการและการวิเคราะห์สถานการณ์การติดเชื้อโควิด-19 2) การออกแบบและพัฒนามาตรการ 3) การนำมาตรการไปใช้ และ 4) การติดตาม ประเมินผล โดยคัดเลือกโรงงานแบบเจาะจงและสมัครใจ ศึกษานำร่อง 19 แห่งในกรุงเทพและ 2 แห่งในจังหวัดตาก ทดลองใช้มาตรการในจังหวัดอยุธยา และนำมาตรการไปใช้ทั่วประเทศ ระยะเวลาดำเนินการตั้งแต่เดือนพฤษภาคม 2564 – ธันวาคม 2565

ผลการศึกษา: มาตรการป้องกันควบคุมโรคในพื้นที่เฉพาะสำหรับโรงงาน "Measures of Bubble and Seal for Factories (MBBSF)" ได้ประยุกต์หลักการทางระบาดวิทยา ในแนวทางการตรวจจับเร็ว การควบคุมไว และคำนึงถึงความสมดุลและการฟื้นฟูทางเศรษฐกิจ มาตรการโดยประกอบด้วย 2 ส่วน คือ 1) มาตรการ Bubble and Seal เพื่อการป้องกันโรคกรณีที่ยังไม่พบผู้ติดเชื้อโควิด-19 ในโรงงาน และ 2) มาตรการ Bubble and Seal เพื่อการควบคุมโรคสำหรับโรงงานที่พบผู้ติดเชื้อโควิด-19 โดยแบ่งระดับการควบคุมเป็น 3 ระดับ คือ ระดับน้อย (ระดับที่มีอัตราการติดเชื้อน้อยกว่าร้อยละ 10) ระดับปานกลาง (ระดับที่มีอัตราการติดเชื้อมากกว่าหรือเท่ากับร้อยละ 10) และระดับมาก (หมายถึงระดับที่มีเกณฑ์การติดเชื้อ 2 ใน 3 ข้อดังนี้ (1) อัตราการติดเชื้อโควิด-19 มากกว่าหรือเท่ากับร้อยละ 10 (2) จำนวนผู้ติดเชื้อมากกว่า 100 คน (3) โรงงานพบผู้ติดเชื้อต่อเนื่อง 14 วันใน 28 วัน) หลังจากนำ MBBSF ไปใช้และติดตามประเมินผล พบว่าโรงงานสามารถนำมาตรการไปประยุกต์ใช้กับบริบทของโรงงานในการป้องกันและควบคุมการแพร่ระบาดของโรคโควิด-19 ในโรงงาน

สรุป: MBBSF เป็นมาตรการป้องกันและควบคุมโรคเฉพาะสำหรับโรงงานที่โรงงานสามารถนำไปใช้และปรับใช้ให้เหมาะสมกับโรงงาน เพื่อช่วยควบคุมการแพร่ระบาดของโรคโควิด-19 โดยไม่หยุดกระบวนการผลิตหรือปิดโรงงาน มาตรการเหล่านี้อาจนำไปใช้กับการติดเชื้ออุบัติใหม่เพื่อสุขภาพอาชีวอนามัยของคนงานต่อไปได้ ทั้งนี้ควรมีการถอดบทเรียนการนำมาตรการไปใช้และการศึกษาประเมินผลเชิงคุณค่าในการศึกษาครั้งต่อไป

คำสำคัญ: มาตรการสำคัญ, การระบาดของโรคโควิด-19, การป้องกันและควบคุม, โรงงาน