OSIR

Outbreak, Surveillance, Investigation and Response

Volume 16, Issue 3
September 2023
https://he02.tci-thaijo.org/index.php/OSIR/index

ISSN: 2651-1061

The Outbreak, Surveillance and Investigation Reports (OSIR) Journal was established in 2008 as a free online publication in order to encourage and facilitate communication of health information and disease reporting across Asia and the Pacific. In September 2018, the journal is retitled as the "Outbreak, Surveillance, Investigation & Response" while maintaining the same abbreviation as OSIR.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Tiwanond Road, Talad Kwan Subdistrict, Muang District, Nonthaburi 11000, Thailand

Tel: +662-5901734, Fax: +662-5918581, Email: osireditor@osirjournal.net

Website: <**http://www.osirjournal.net**>

Volume 16, Issue 3, September 2023

Contents

Outbreak, Surveillance, Investigation & Response (OSIR) Journal

Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Editorial

Malnutrition Burden among Thai Children that Society Must Bear

Kanitta Bundhamcharoen, Senior Researcher of International Health Policy Program (IHPP)

Naruemon Sikhiwat, Researcher of International Health Policy Program (IHPP)

Thailand has experienced a very low fertility rate, approximately 1.2 children per woman or just over 500,000 births in 2022.[1,2] Thus, child and maternal health is critical to the country's development. Losing this population group would potentially lead to a bleak future for Thailand in the years to come.

A 2019 national burden of disease study of Thai population reveals that crucial risk factors in children include malnutrition, suboptimal breastfeeding, child growth failure (stunting, wasting, and underweight), low birth weight and short gestation.[3]

Low birth weight and short gestation are identified as significant risk factors for neonatal deaths in infants under the age of seven days, approximately attributed to 205 deaths and 23,722 Disability-adjusted life years (DALYs). Furthermore, infants under 6 months who receive non-exclusive breastfeeding accounted for approximately 127 deaths and 15,013 DALYs. Additionally, children under 5 years of age with wasting experienced approximately 413 deaths and a significant burden of about 56,049 DALYs, accounting for 8.6% of the DALY loss in this age group. Importantly, it is also found that the key risk factors leading to mortality and DALY loss due to lower respiratory infection and diarrhea are wasting and non-exclusive breastfeeding for infants under 6 months.

Malnutrition not only increases the rates of illness and death among Thai children but also has various other impacts. For instance, in children with low birth weight, it may lead to stunting or a shift in the pattern of disease occurrence, transitioning from acute infectious diseases to chronic diseases as they grow older.[4] Although Thailand has experienced an epidemiological transition, resulting in increasing life expectancy and reordering of the relative importance of different causes of death, the impact of malnutrition in early childhood could lead to higher chronic diseases burden in their older age.[5] As early childhood malnutrition have a long-lasting impact throughout the entire lifecycle, from infancy to adulthood, these significant losses can be prevented or even completely avoided if we reduce or eliminate these risk factors.

However, surveys from the Multiple Indicator Cluster Surveys (MICS) in Thailand, conducted in the fifth round in 2016 (B.E. 2559) and the sixth round in 2019 (B.E. 2562) by the National Statistical Office, indicate that both undernutrition and overnutrition trends are on the rise.[6,7] Stunting has increased from 10.5% to 13.3%, wasting has increased from 5.4% to 7.7%, underweight has increased from 6.7% to 7.7%, and overweight has increased from 8.2% to 9.2%. Therefore, it appears that the trends in health loss caused by these nutritional aspects may continue to rise.

Malnutrition is not only a public health issue but also a concern for the growth and quality of life of Thai children. Therefore, to reduce the disease burden resulting from malnutrition among Thai children, it is essential to have collaboration from all sectors in the society in developing the healthcare system. This will promote the health of Thai mothers and children to be well-prepared to address this situation in the long term, it also aims to provide Thai children with the opportunity to grow up healthy and become important contributors to the country's future development.

Reference

1. Institute for Population and Social Research. Mahidol Population Gazette [Internet]. Nakhon Pathom: Institute for Population and Social Research, Mahidol University; 2023 [cited 2023 Jul 22]. <https://ipsr.mahidol.ac.th/population-gazette/>
2. Official statistics registration systems, Bureau of Registration Administration. Bureau of Registration Administration (Thailand) 2022 [Internet]. Bangkok: Bureau of Registration Administration; 2023 [cited 2023 Jul 22]. <https://stat.bora.dopa.go.th/stat/statnew/stat MONTH/statmonth>. Thai.
3. Burden of Disease Research Program, International Health Policy Program. Burden of disease attributable to risk factors in Thailand 2019. Nonthaburi: International Health Policy Program; 2023. 89 p. Thai.
4. Administrative committee on coordination/subcommittee on nutrition. Low Birthweight: report of a meeting in Dhaka, Bangladesh on 14–17 June 1999. Pojda J, Kelly L, editors. Geneva: ACC/SCN in collaboration with ICDDR,B; 2000. 56 p.
5. McKeown RE. The epidemiologic transition: changing patterns of mortality and population dynamics. Am J Lifestyle Med. 2009 Jul 1;3(1 Suppl):19S–26S. doi:10.1177/1559827609335350.
6. National Statistical Office of Thailand; United Nations Children's Fund. Thailand Multiple Indicator Cluster Survey 2015–2016. Bangkok: National Statistical Office of Thailand; 2016. 313 p.
7. National Statistical Office of Thailand. Thailand Multiple Indicator Cluster Survey 2019, Survey Findings Report. Bangkok: National Statistical Office of Thailand; 2020. 291 p.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

An Evaluation of National Capacity regarding Chemical Event Management under the International Health Regulations: a Case of Thailand, 2022

Hirunwut Praekunatham*, Kowit Boonmephong

Division of Occupational and Environmental Diseases, Department of Disease Control, Ministry of Public Health, Thailand

*Corresponding author email: phirunwut@gmail.com

Received: 23 Apr 2023; Revised: 8 Aug 2023; Accepted: 6 Sep 2023
https://doi.org/10.59096/osir.v16i3.262562

Abstract

Chemical hazard is deemed substantial for global health security. Effective emergency management could mitigate the adverse effects of chemicals or pollutants. This study aims to describe the country's capacity focusing on chemical events using the Joint External Evaluation (JEE) tool, and determine strengths and challenges to provide recommendations to improve chemical emergency management in Thailand. A descriptive qualitative study of the JEE process was conducted in 2022 using the JEE tool, third edition (2022). Chemical event was one of the 19 technical areas that had two indicators to be evaluated. Activities for JEE process included document compilation and an internal multi-sectoral self-assessment to discuss country capacities, strengths, and gaps before the JEE workshop with the external evaluators. The capacity scores of chemical events for the two indicators were 4 and 5 (out of 5), suggesting that Thailand had decent capacities in response to chemical emergencies at the national and intermediate levels; however, more strengthening was needed at the primary public health level and points of entry (POE). To achieve sustainable capacity, a national action plan for health security should be developed. Capacity building for chemical emergency response should be promoted among staff at the primary public health level and POE.

Keywords: evaluation, chemical event management, International Health Regulations, Thailand

Introduction

International Health Regulations (IHR) 2005 are a legally binding mechanism that addresses global health security among countries to help them develop and maintain capabilities to detect, assess, report, and respond to public health events, including chemical hazards.[1] In order to assess a country's public health capacity, the World Health Organization (WHO) developed the International Health Regulations (2005) Monitoring and Evaluation Framework, which consists of four components: States Parties Self-Assessment Annual Reporting, Joint External Evaluation (JEE), After Action Review, and Simulation Exercise (SimEx).[2] States Parties Self-Assessment Annual Reporting is mandatory, while the other three are voluntary. The JEE component is a multi-sectoral, comprehensive approach to evaluate and measure a country's capacity to prevent, detect and rapidly respond to public health threats according to 19 technical areas under four categories, namely prevent, detect, respond, and other IHR-related hazards and points of entry.[3–5]

Of the 19 technical areas, chemical event is deemed substantial for global health security since the production and use of chemicals is growing, resulting from economic prosperity.[6] In Thailand, the Division of Occupational and Environmental Diseases (DOED) reported a total of 236 chemical events, including 122 fires, 42 chemical spills 42 transportation events, 15 illegal dumping events, 14 explosions and one chemical contamination, in the past five years from 2018 to 2022.[7] The majority of the chemical events occurred in the eastern region of Thailand where many factories and industrial estates are located. Uncontrolled international movement of chemicals and their hazardous wastes or disposal could potentially pose a threat to global health.[8] Generally,

a chemical event is considered to be complex since effective chemical event management requires an active multi-sectoral collaboration among many related stakeholders from both health and non-health sectors to engage in widely distinctive activities in all stages of the chemical event management cycle (prevention, preparation, detection, response, and recovery). Additionally, many relevant policies and laws, such as licensing of hazardous sites and transport routes, labour health and safety, emergency planning and response, and control of contaminated environment, are involved in all chemical management activities to protect people from chemical hazards.

In 2017, Thailand hosted the first one-week workshop on the JEE component of IHR from 26–30 Jun 2017 where a group of external experts from around the world assessed Thailand's public health capacities.[9] Two indicators regarding the technical area of chemical events (CE) were evaluated. The first indicator (CE1) aimed to assess mechanisms established and their functionality for detecting and responding to chemical events or emergencies, while the second indicator (CE2) focused on enabling environments for chemical event management. The levels of capacities were given a score of 4 out of 5 for both indicators, suggesting Thailand had demonstrated sufficient capacity on chemical event management. The priority actions focusing on improving information-sharing mechanisms, strengthening the national preparedness system, and integrating all plans into a single national chemical management plan, were recommended.[9]

In 2022, the second JEE event in Thailand was conducted from 31 Oct to 4 Nov 2022. Since studies concerning chemical emergency management in Thailand remained limited, this study aimed to describe the country's capacity regarding chemical events using the JEE tool, determine strengths, gaps and challenges to provide recommendations to improve chemical emergency management in Thailand.

Methods

Study Design and Tool

A descriptive qualitative study of the JEE process (see Figure 1) was conducted in Thailand in 2022 using the JEE tool, third edition (2022).[3] The tool is composed of 19 technical areas, and 48 indicators. The measurement of each indicator was performed using a capacity score criteria ranging from 1 to 5: 1=no capacity, 2=limited capacity, 3=developed capacity, 4=demonstrated capacity, 5=sustainable capacity. A chemical event (CE) was one of the 19 technical areas that had two indicators—namely CE1 and CE2, to be evaluated. The capacity level criteria of the two indicators, and contextual and technical questions for chemical event are shown in Supplementary table 1 and 2.

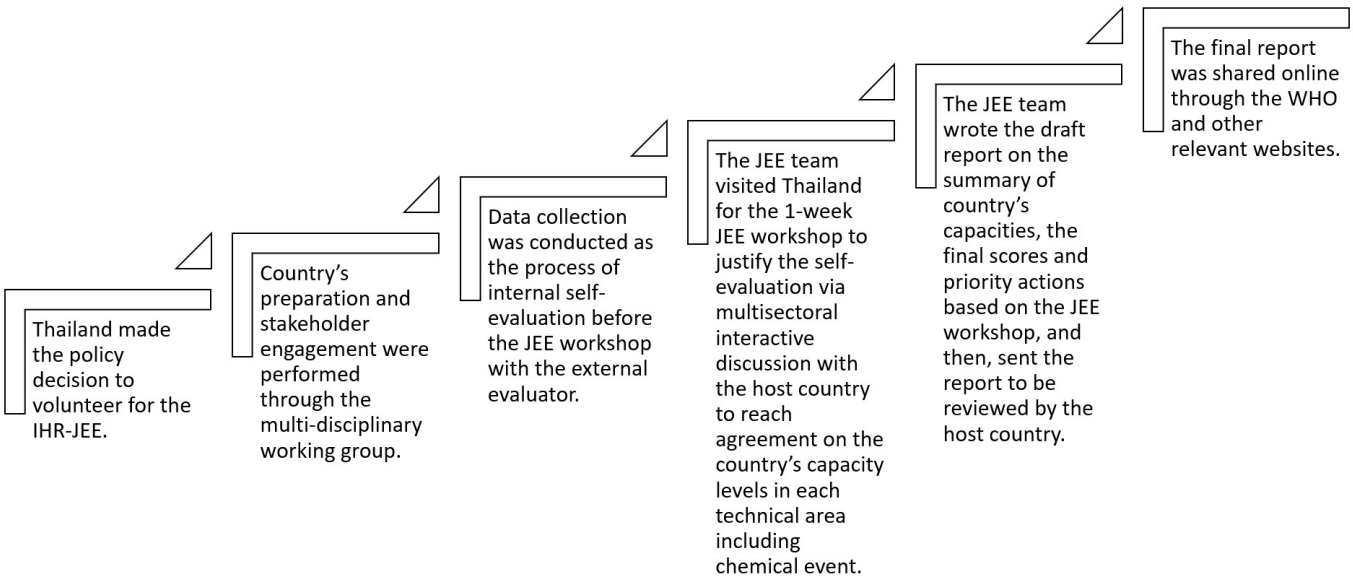


Figure 1. The steps of the International Health Relations Joint External Evaluation (IHR-JEE) process in Thailand

Participant Selection

A multi-disciplinary working group for assessing technical areas of chemical events was established in order to exchange information regarding mechanisms and functions on chemical management among the relevant key stakeholders. The list of twelve chemical event-related organizations and their roles are shown in Supplementary table 3.

Data Collection

Data collection in the IHR-JEE process was started by the DOED, as the secretariat of the working group, sending the JEE tool regarding chemical events, which consisted of five contextual questions and 21 technical questions, to 12 organizations. After two months, the relevant data and related documents were collected from the stakeholders and were summarized by the DOED. For triangulation, meetings among the working groups were held twice to review and discuss the summarized data gathered and prepared. As suggested by some members of the working group, three other related organizations that might potentially have a role in chemical management in some specific industries, including Department of Agriculture, Department of Fisheries, and Department of Livestock Development, were furthered invited to be additional key informants at the meetings. After that, the DOED prepared and sent the country's internal evaluation report with the related documents to the external subject-matter experts to review prior to the IHR-JEE workshop.

In Thailand, the second IHR-JEE workshop to discuss in detail about country's capacities between the external experts and the host country was held from 31 Oct to 4 Nov 2022. The external evaluators consisted of 24 members from renowned agencies as shown in Supplementary table 4. Regarding chemical events, an expert on chemicals and poisons from United Kingdom Health Security Agency was designated to be the team leader. The session for scientific discussion and debate on chemical events was held on 3 Nov 2022. At the beginning of the session, the DOED gave a 10-minute presentation summarising chemical event management covering background information, key implemented activities, resources, strengths and gaps in Thailand including the scores for CE1 and CE2 proposed by the internal stakeholders. Any unclear points of discussion on chemical events were raised by the external evaluators. The internal stakeholders collaboratively provided additional information for further clarification. At the end of the session, the capacity scores for the two indicators for chemical event (CE1 and CE2) were graded based on a complete agreement between the external and internal stakeholders using the criteria shown in Supplementary table 1. Priority areas for action and recommendations were also concluded.

Data Analysis

The summarized data to answer the contextual questions and technical questions for CE1 and CE2, prepared by the DOED, and the contents discussed and debated among the internal key stakeholders and the external evaluators during the JEE workshop were reviewed. Data analysis was performed through a description of overall chemical management in Thailand as a case study using an inductive approach. The findings were concluded based on four categories: (1) background information or context, consisting of national plans, legislative control and related international agreements, (2) key implementation activities, (3) strengths, and (4) strengthening needed and challenges. Additionally, the JEE final scores for chemical events, discussed until an agreement was reached by both external evaluators and key internal stakeholders, were also reported.

Results

Background Information or Context

National plans

The National Disaster Risk Management Plan 2021–2027 was developed to be a comprehensive incident management strategy with all relevant agency involvement, providing well-defined roles in the national response plan in Thailand.[10] Furthermore, this plan would serve as a master plan to formulate the disaster risk management plans or multi-hazard specific plans at the provincial or district levels.

Legislative control

Chemical safety assessment has been carried out for more than five years under the relevant laws, including the Hazardous Substance Act B.E. 2535 (1992), the Factory Act B.E. 2535 (1992), the Drug Act B.E. 2510 (1967), the Food Act B.E. 2522 (1979), the Enhancement and Conservation of the National Environmental Quality Act B.E. 2535 (1992), and the Occupational Safety, Health and Environment Act B.E. 2554 (2011).[11–15] Moreover, the Control of Occupational Diseases and Environmental Diseases Act B.E. 2562 (2019) was passed in order to provide care to those who are exposed to environmental pollutants.[16] Thailand conducted basic public health assessments to support responses to chemical incidents. A brief description of Thailand's laws and regulations related to chemical event management is shown in Table 1.

International agreements

Thailand has ratified and entered into force the Rotterdam-Stockholm-Basel Conventions, and the Minamata Convention on Mercury.[8,17–19] Besides, Strategic Approach to International Chemicals Management was adopted for strengthening chemical safety.[20]

Table 1. Brief descriptions of Thailand's laws and regulations related to chemical event management

Law and legislation	Construction/ Principle	Governance (Responsible organizations)	Substance
Hazardous Substance Act B.E. 2535 (1992)	Control and trade of hazardous substances	Ministry of Industry	Four chapters divided into 93 sections Chapter 1: the establishment of the Committee on Hazardous Substances Chapter 2: hazardous substance control Chapter 3: duties and civil liabilities Chapter 4: penalties
Factory Act B.E. 2535 (1992)	Prescription in Ministerial Regulations categorizing factory of any type, kind, or size	Ministry of Industry	Three chapters divided into 65 sections Chapter 1: factory operation Chapter 2: factory supervision Chapter 3: penalties
Drug Act B.E. 2510 (1967)	Provisions for the issuance of licences to produce or sell drugs	Ministry of Public Health	Fourteen chapters divided into 126 sections Chapter 1: drug board Chapter 2: application for and Issue of a licence concerning modern drug Chapter 3: duties of a licensee concerning modern drugs Chapter 4: duties of a pharmacist a first - class modern medical practitioner in the branch of medicine, dentistry, midwifery of nursing, or a veterinary practitioner Chapter 5: application for and issue of a licence concerning traditional Drugs Chapter 6: duties of a licensee concerning traditional drugs Chapter 7: duties of a traditional medical practitioner Chapter 8: fake drugs, sub-standard drugs, deteriorated drugs Chapter 9: notices Concerning drug Chapter 10: registration of a drug formula Chapter 11: advertisement Chapter 12: officials Chapter 13: suspension and revocation of a licence Chapter 14: penalties
Food Act B.E. 2522 (1979)	Food safety and hygiene, food production, trade in food	Ministry of Public Health	Eight chapters divided into 78 sections Chapter 1: food commission Chapter 2: applications for licences and the granting of licences Chapter 3: duties of a licencee concerning food Chapter 4: control of food Chapter 5: product registration and advertisement of food Chapter 6: competent officer Chapter 7: suspension or revoke of licence Chapter 8: punishment
Enhancement and Conservation of the National Environmental Quality Act B.E. 2535 (1992)	Measures on environment protection and control of various forms of pollution	Ministry of Natural Resources and Environment	Seven chapters divided into 115 sections Chapter 1: national environment board Chapter 2: environmental fund Chapter 3: environmental protection Chapter 4: pollution control Chapter 5: promotional measures Chapter 6: civil liability Chapter 7: penal provisions

Table 1. Brief descriptions of Thailand's laws and regulations related to chemical event management (cont.)

Law and legislation	Construction/ Principle	Governance (Responsible organizations)	Substance
Occupational Safety, Health and Environment Act B.E. 2554 (2011)	Measures to control, supervise and manage safety, occupational health and working environment for employees	Ministry of Labor	Eight chapters divided into 74 sections Chapter 1: general provisions Chapter 2: administration, management and operation on occupational safety, health and environment Chapter 3: occupational safety, health and environment committee Chapter 4: control, supervision and administration Chapter 5: safety inspector Chapter 6: occupational safety, health and environment fund Chapter 7: occupational safety, health and environment promotion institute Chapter 8: penal provisions
Control of Occupational Diseases and Environmental Diseases Act B.E. 2562 (2019)	Surveillance, early detection, prevention and control of certain occupational and environmental diseases	Ministry of Public Health	Eight chapters divided into 115 sections Chapter 1: general provisions Chapter 2: occupational disease and environmental disease control commission Chapter 3: provincial occupational disease and environmental disease control committees and Bangkok metropolitan occupational disease and environmental disease control committee Chapter 4: occupational medicine and environmental medicine Chapter 5: surveillance of occupational diseases and environmental diseases Chapter 6: prevention and control of occupational diseases and environmental diseases Chapter 7: officer Chapter 8: penalties

The contents in the table were compiled based on the original statements of each act.

Key Implementation Activities

Laws and regulations

Laws and regulations: Thailand has undergone implementation through law enforcement in accordance with the acts mentioned in the previous section, including factory inspections, self-declaration by factories, chemical risk assessment and management. Several inter-ministerial committees, aiming to implement chemical management activities, were established to promote coordination among various agencies via two mechanisms as follows:

- Inter-ministerial bodies, appointed by the cabinet to perform policy formulation, monitoring and evaluation, and decision-making of particular chemicals. The National Coordinating Committee on Chemical Safety is an example of the inter-ministerial body in charge of developing a national master plan for chemical management.
- Standing Committees, established by the relevant acts to regulate and manage chemicals in various facets covering all parts of chemical life cycle, such as the Hazardous Substances Committee, the National Environment Board, and the subcommittees are also set up under each Standing Committee to perform specific activities and deal with problematic issues.

Chemical emergency preparedness and response

To deal with chemical emergencies, Thailand used a prevention, preparedness, response and recovery approach for chemical event management.[21] Moreover, Thailand developed occupational and environmental health services at all levels of healthcare facilities to take care of persons suffering from diseases or conditions after being exposed to toxic chemicals.[22]

Surveillance

Theoretically, comprehensive surveillance and monitoring systems related to chemicals in Thailand were developed based on a source-pathway-receptor model, consisting of (1) hazard surveillance (the continuous measurement or monitoring of chemicals or pollutants in the environment), (2) exposure surveillance aiming to determine the amount of chemicals that at-risk populations are exposed to, (3) health surveillance, e.g., health check-ups for workers based on their risk of exposure to toxic chemicals, and (4) epidemiological surveillance, e.g., implementing a reporting system for poisoning cases or chemical events.[23] Also, Thailand developed occupational and environmental health profiles, by linking the aforementioned four kinds of surveillance together to comprehensively assess the situation and chemical risk at the local level. In other perspectives, chemical incident surveillance can be divided into four main sectors as shown in Supplementary table 5.[24]

Human resource development and empowerment

Thailand provides several training courses for public health staff at the local level, for example, control of occupational and environmental diseases, chemical emergency response, and the safety of officers working in factories.

Resources

Human resources

Besides firefighters, police, and frontline rescuers working at the scene, in October 2021, Thailand had sufficient health and medical officers in response to chemical events, including 236 certified occupational medicine board physicians; 1,691 physicians completing a 2-month basic occupational medicine training course, 2,655 occupational health nurses and more than 34,000 public health technical officers.[25] Additionally, in response to various public health emergencies, the Surveillance and Rapid Response Team (SRRT) was set up consisting of at least one team per district. The SRRT's responsibilities include performing surveillance on unusual events that might pose a threat to public health, conducting field investigations, and taking immediate prevention and control measures. Most of the SRRT have more experience in terms of response to biological hazards than chemical hazards due to the higher number of infectious disease outbreaks in Thailand. However, a SRRT for chemical events, called the SRRT-C, was also set up in high risk areas, particularly eastern Thailand.

Finance

For emergency response, an emergency fund exists for any identified disaster in each province according to the Disaster Prevention and Mitigation Act B.E. 2550 (2007) and the Finance Department Notification on Emergency Funds for Disasters.[26] Thailand also has a Workmen's Compensation Fund aiming to give prompt and equitable protection against work-related injuries, disease, disability, and death.[27]

Facilities

All provincial hospitals in Thailand can provide diagnoses and treatment for those suffering from chemical poisoning. Thailand has several governmental agencies that can provide laboratories for testing both human and environmental samples. There are at least four governmental reference laboratories for testing chemicals from human samples, including (1) Chulabhorn Research Institute, (2) Faculty of Medicine, Ramathibodi Hospital, (3) Department of Medical Sciences, and (4) Division of Occupational and Environmental Diseases, Department of Disease Control.[28–31] Additionally, Thailand has two national poison centers: (1) Ramathibodi Poison Center and (2) Siriraj Poison Control Center, both of which can provide advice and toxicology treatment guidelines for other health facilities in Thailand.[29,32]

Strengths

1. Thailand has national policies, plans or legislations for chemical event surveillance, an alert and response system with a multisectoral coordination body, and collaboration among relevant agencies and networks.
2. There are sufficient resources such as manuals, guidelines, surveillance databases, poison centers, and health facilities for persons exposed to toxic chemicals.
3. Two national poison centers provide information services nationwide.
4. Environmental and occupational health services are implemented at all levels of public health care, including subdistrict health promotion hospitals, to care for persons exposed to toxic chemicals by giving first aid or primary care before referring to the nearest secondary or tertiary care hospital.
5. An Incident Command System is active for emergency responses at all levels.

6. A comprehensive surveillance and monitoring system related to chemical events that links data on hazards, exposure and health together at the local level exists, and surveillance data are shared online.
7. Community participation mechanisms are implemented through public hearings in the process of environmental impact assessment or environmental health impact assessment.

Strengthening Needed and Challenges

1. Chemical laboratories were set up in high-risk areas such as Bangkok, the eastern part of Thailand, and some large provinces such as Chiang Mai and Khon Kaen. However, chemical laboratories have not yet been set up to cover all risk areas.
2. Although environmental and occupational health services are implemented at all levels of health care, competencies of staff at the primary health care level are limited. In order to readily respond to chemical emergencies, specific training modules are required for them.

Final JEE Scores for Chemical Events

The indicator score for CE1 was 4 (demonstrated capacity), while the score for CE2 was 5 (sustainable capacity) out of 5.

Discussion

It is generally accepted among WHO member states and international agencies that JEE is an effective process that can help to determine a country's public health capacity including strengthening needed and challenges, and to monitor progression after IHR was implemented in the country. The Joint External Evaluation is a peer-to-peer review process, promoting transparency and a multi-sectoral approach between the host country and the external subject-matter expert team.[4,5] Although JEE is voluntary, over 100 WHO member states have accomplished the first JEE since 2016.[33] Likewise, after completing the first round in 2017, Thailand was ready for the second round in 2022 using the third edition of the JEE tool, published in 2022.[3,9]

Comparing the first and the second JEE in Thailand for the technical area of chemical events, the two indicators, CE1 and CE2, remained the same in terms of name, number and brief description of the indicators. However, a minor change was made on the capacity score criteria of 5 for CE1. In the JEE tool that Thailand used in 2017, the criteria of level 5 for CE1 was "Adequately resourced poison centre(s) are in place", whereas the criteria to reach level 5 for CE1 for the JEE in 2022 was "Adequately resourced poison centre(s) are in place and the country has a demonstrated ability to respond to chemical emergencies at national, intermediate and primary public health levels".[3,34]

Compared to the scores received from the JEE in 2017 of 4 for both CE1 and CE2, the final scores for chemical event concluded from the JEE workshop in 2022 were shown to be slightly elevated as 4 for CE1 and 5 for CE2. The finding suggested that the capacity on chemical emergency management in Thailand improved from the previous evaluation. Regarding CE1, based on the discussion in the workshop, Thailand has just two national poison centers, but can provide advice and toxicology treatment guidelines for other health facilities in Thailand 24 hours a day.[29,32] Additionally, Thailand has the ability to respond to chemical emergencies at national and intermediate levels; however, the country still needed strengthening at the primary public health level and points of entry.

To compare the capacity scores for chemical events among countries, the JEE mission reports published on the WHO websites were reviewed. However, most of the data are available for only the first round conducted during 2016–2019. Regarding the assessment of chemical emergency management capacities in Southeast Asia, four countries, namely Brunei Darussalam, Malaysia, Singapore, and Thailand, received scores of 4 to 5 for CE1 and CE2.[9,35–37] However, the remaining countries earned scores of 3 or below for chemical events.[38–44] Furthermore, some countries such as Australia, Belgium, and New Zealand, received scores of 5 for both CE1 and CE2 in the first round.[45–47]

The JEE process may have some limitations since the capacity grading was somewhat subjective depending on time limitations, in-depth discussion and debate among the external experts and the host country, or the related document provided. Additionally, the technical area of chemical events was quite broad and involved many organizations. The data gathered in this study mostly came from government agencies and academia. Thus, the perspectives from private sectors or non-governmental organizations remain limited. For example, the Thailand Environment Institute (TEI), which is a non-governmental organization, plays an important role in raising public awareness and helping communities on environmental sustainability. Additionally, TEI takes part in many environmental policy formulations and implementations in Thailand.

Public Health Action and Recommendations

Chemical hazard is considered as one of the most important issues for global health security. Competent chemical emergency management can alleviate the adverse effects caused by chemicals and pollutants. Thailand showed “demonstrated” to “sustainable” public health capacity to deal with chemical events based on the JEE scores. However, to improve its capacity, our recommendations for the Ministry of Public Health are as follows. A National Action Plan for Health Security (NAPHS) should be developed based on the JEE to be a roadmap for improving the country’s capacities across 19 technical areas, including chemical events. Continuous capacity building for chemical emergency response and essential resource allocation should be promoted at the primary public health level and points of entry. Exercises in chemical emergency preparedness should be conducted regularly in more diverse scenarios. Toxicological laboratories should be expanded to cover all high-risk areas. Finally, due to limited time to validate the self-evaluation by the external evaluator, the host country volunteering for a JEE should meticulously plan ahead accordingly. Self-assessment and related document preparation should be carried out early to provide considerable time for the external evaluator to conduct a thorough review before the JEE workshop in the host country.

Acknowledgements

We would like to express our sincere thanks to key stakeholders, namely Department of Industrial Work, Pollution Control Department, Department of Disaster Prevention and Mitigation, Department of Health (Bangkok Metropolitan Administration), Defence Science and Technology Department, Ramathibodi Poison Center, Siriraj Poison Control Center, Office of the Permanent Secretary Ministry of Public Health (represented by the Division of Public Health Emergency Management), Thai Food and Drug Administration, Department of Medical Sciences, Department of Medical Services, Department of Agriculture, Department of Fisheries, and Department of Livestock Development, for their assistance with preparation of relevant data regarding chemical emergency management.

Suggested Citation

Praekunatham H, Boonmephong K. An evaluation of national capacity regarding chemical event management under the International Health Regulations: a case of Thailand, 2022. OSIR. 2023 Sep;16(3):119–29. doi:10.59096/osir.v16i3.262562.

References

1. World Health Organization. International health regulations (2005) [Internet]. Geneva: World Health Organization; 2016 [cited 2023 May 1]. <https://www.who.int/publications/i/item/9789241580496>
2. World Health Organization. International health regulations (2005) monitoring and evaluation framework [Internet]. Geneva: World Health Organization; 2018 [cited 2023 May 1]. <https://www.who.int/emergencies/operations/international-health-regulations-monitoring-evaluation-framework>
3. World Health Organization. International health regulations (2005) joint external evaluation tool, third edition [Internet]. Geneva: World Health Organization; 2022 [cited 2023 May 1]. <https://www.who.int/publications/i/item/9789240051980>
4. Bell E, Tappero JW, Ijaz K, Bartee M, Fernandez J, Burris H, et al. Joint external evaluation-development and scale-up of global multisectoral health capacity evaluation process. Emerg Infect Dis. 2017;23(13):S33–9. doi:10.3201/eid2313.170949.
5. Kandel N, Sreedharan R, Chungong S, Sliter K, Nikkari S, Ijaz K, et al. Joint external evaluation process: bringing multiple sectors together for global health security. Lancet Global Health. 2017;5(9):e857–8. doi:10.1016/S2214-109X(17)30264-4.
6. World Health Organization. Health security [Internet]. Geneva: World Health Organization; [cited 2023 May 1]. <https://www.who.int/health-topics/health-security#tab=tab_1>
7. Division of Occupational and Environmental Diseases. Chemical incidents in Thailand [Internet]. Nonthaburi: Division of Occupational and Environmental Diseases; 2023 [updated 2023 Apr 22; cited 2023 May 1]. <https://lookerstudio.google.com/reporting/b63cd1a8-d48f-4582-ac5c-c95ae2e321b5/page/eEs4C>
8. United Nations Environment Programme. Basel Convention & Basel Protocol on Liability and Compensation [Internet]. Geneva: United Nations; 2020 [cited 2023 May 1]. <http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx>

9. World Health Organization. Joint external evaluation of IHR core capacities of the Kingdom of Thailand: mission report: June 26–30, 2017 [Internet]. Geneva: World Health Organization; 2017 Oct 26. 73 p. Contract No.: WHO/WHE/CPI/REP/2017.38.
10. Asian Disaster Reduction Center. Information on Disaster Risk Reduction of the Member Countries: Thailand [Internet]. Kobe: Asian Disaster Reduction Center; c2019 [cited 2023 May 1]. <https://www.adrc.asia/nationinformation.php?NationCode=764&Lang=en&NationNum=09>
11. Hazardous Substance Act B.E. 2535 (1992) [Internet]. Bangkok: Department of Industrial Works; [cited 2023 May 1]. 35 p. <https://www.diw.go.th/webdiw/law-haz/>
12. Factory Act B.E. 2535 (1992) [Internet]. Bangkok: Ministry of Industry; [cited 2023 May 1]. <http://law.industry.go.th/laws/detail/32669>
13. Food Act B.E. 2522 (1979). Nonthaburi: Thai Food and Drug Administration; [cited 2023 May 1]. 17 p. <https://www.fda.moph.go.th/sites/kbs/SitePages/Appoint_FDA_Food.aspx>
14. Enhancement and Conservation of the National Environmental Quality Act B.E. 2535 (1992) [Internet]. Bangkok: Pollution Control Department; [cited 2023 May 1]. 33 p. <https://www.pcd.go.th/laws/5406>
15. Occupational Safety, Health and Environment Act B.E. 2554 (2011) [Internet]. Bangkok: Office of the Council of State of Thailand; [cited 2023 May 1]. 26 p. <http://web.krisdika.go.th/data/outsitedata/outsite21/file/OCCUPATIONAL_SAFETY,_HEALTH,_AND_ENVIRONMENT_ACT,B.E._2554.pdf>
16. Control of occupational diseases and environmental diseases act, B.E. 2562 (2019) [Internet]. Nonthaburi: Department of Disease Control; [cited 2023 May 1]. 21 p. <https://ddc.moph.go.th/law.php?law=5>
17. Secretariat of the Rotterdam Convention. Rotterdam convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade: text and annexes (revised in 2019) [Internet]. Geneva: United Nations Environment Programme; 2020 Aug [cited 2023 May 1]. 52 p. <http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/>
18. Secretariat of the Stockholm Convention. Stockholm Convention on persistent organic pollutants (POPs): text and annexes (revised in 2019). Geneva: United Nations Environment Programme; 2020 Sep [cited 2023 May 1]. 77 p. <http://www.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>
19. United Nations Environment Programme. Minamata convention on mercury: text and annexes [Internet]. Geneva: United Nations; 2019 Sep [cited 2023 May 1]. <https://minamataconvention.org/sites/default/files/2021-06/Minamata-Convention-booklet-Sep2019-EN.pdf >
20. United Nations Environment Programme. Strategic Approach to International Chemicals Management [Internet]. Geneva: United Nations Environment; 2020 [cited 2023 May 1]. <https://www.saicm.org/>
21. World Health Organization. Emergency cycle [Internet]. Geneva: World Health Organization; [cited 2023 May 1]. <https://www.who.int/europe/emergencies/emergency-cycle>
22. Center of occupational and environmental health service development and accreditation. Occupational and environmental health services guideline for hospital in Bangkok Metropolitan area (health worker version) [Internet]. Nothaburi: Department of Disease Control; 2021 [cited 2023 May 1]. 73 p. <http://klb.ddc.moph.go.th/dataentry/handbook/form/127>
23. Binns J. Source-Pathway-Receptor from a pollution assessment and risk control perspective [Internet]. London: RRC International; 2021 May 6 [cited 2023 May 1]. <https://blog.rrc.co.uk/2021/05/06/source-pathway-receptor-pollution-assessment-risk-control-perspective/>
24. Division of Occupational and Environmental Diseases. Operating Guideline for Occupational and Environmental Health Profiles (OEHP). Nonthaburi: Division of Occupational and Environmental Diseases, Department of Disease Control, Ministry of Public Health; 2020 [cited 2023 May 1]. 76 p. <https://ddc.moph.go.th/uploads/publish/1319520220921081846.pdf>. Thai.

25. Strategy and Planning Division, Ministry of Public Health of Thailand. Information system for health resources [Internet]. Nonthaburi: Ministry of Public Health of Thailand; [cited 2023 May 1]. <http://gishealth.moph.go.th/healthmap/index.php>

26. Office of the Council of State of Thailand. Disaster Prevention and Mitigation Act B.E. 2550 (2007) [Internet]. Bangkok: Office of the Council of State of Thailand; 2007 Aug 28 [cited 2023 May 1]. 24 p. <http://web.krisdika.go.th/data/document/ext838/838096_0001.pdf>

27. Tongsamsi K, Tongsamsi I. The role of workmen's compensation fund on labor protection. Hatyai Academic Journal. 2021;19(1):175–91.

28. Chulabhorn Research Institute [Internet]. Bangkok: 28. Chulabhorn Research Institute; [cited 2023 May 1]. <https://research.cri.or.th/>

29. Ramathibodi Poison Center [Internet]. Bangkok: Faculty of Medicine Ramathibodi Hospital, Mahidol University; [cited 2023 May 1]. <https://www.rama.mahidol.ac.th/poisoncenter/>

30. Department of Medical Sciences, Ministry of Public Health. Nonthaburi: Department of Medical Sciences of Thailand; [cited 2023 May 1]. <https://www3.dmsc.moph.go.th/page-view/27>

31. Reference Laboratory and Toxicology Center, Division of Occupational and Environmental Diseases [Internet]. Nonthaburi: Department of Disease Control of Thailand; [cited 2023 May 1]. <https://ddc.moph.go.th/doed/pagecontent.php?page=1007&dept=doed>. Thai.

32. Siriraj Poison Control Center [Internet]. Bangkok: Faculty of Medicine Siriraj Hospital, Mahidol University; [cited 2023 May 1]. <https://www.si.mahidol.ac.th/th/division/shtc/index.asp>. Thai.

33. World Health Organization. Voluntary joint external evaluations (JEE) prompt much-needed multisectoral dialogues for health security: case study. Geneva: World Health Organization; 2021. 4 p.

34. World Health Organization. International health regulations (2005) joint external evaluation tool, first edition [Internet]. Geneva: World Health Organization; 2016 [cited 2023 May 1]. 98 p. <https://extranet.who.int/sph/joint-external-evaluation-tool-1st-edition>

35. World Health Organization. Joint external evaluation of IHR core capacities of Brunei Darussalam: mission report, 28 October-1 November 2019. Geneva: World Health Organization; 2020. 86 p.

36. World Health Organization. Joint external evaluation of IHR core capacities of Malaysia: mission report, 21–25 October 2019. Geneva: World Health Organization; 2020. 82 p.

37. World Health Organization. Joint external evaluation of IHR core capacities of Singapore: mission report: 16–20 April 2018. Geneva: World Health Organization; 2018. 59 p. Contract No.: WHO/WHE/CPI/REP/2018.25.

38. World Health Organization. Joint external evaluation of IHR core capacities of the Republic of the Union Myanmar: mission report, 3–9 May 2017. Geneva: World Health Organization; 2018. 60 p. Contract No.: WHO/WHE/CPI/REP/2018.5.

39. World Health Organization. Joint external evaluation of IHR core capacities Republic of the Philippines: mission report: 10–14 September 2018. Geneva: World Health Organization; 2019. 76 p. Report No.: WHO/WHE/CPI/2019.57.

40. World Health Organization. Joint external evaluation of IHR core capacities of the Democratic republic of Timor-Leste: mission report, 19–23 November 2018. Geneva: World Health Organization; 2019. 64 p. Contract No.: WHO/WHE/CPI/2019.56.

41. World Health Organization. Joint external evaluation of IHR core capacities of the Kingdom of Cambodia: mission report, 26 August–2 September 2016. Geneva: World Health Organization; 2017. 63 p. Contract No.: WHO/WHE/CPI/2017.11.

42. World Health Organization. Joint external evaluation of IHR core capacities of the Lao People's Democratic Republic: mission report, 17-24 February 2017. Geneva: World Health Organization; 2017. 64 p. Contract No.: WHO/WHE/CPI/REP/2017.35.

43. World Health Organization. Joint external evaluation of IHR core capacities of Viet Nam: mission report, 28 October–4 November 2016. Geneva: World Health Organization; 2017. 75 p. Contract No.: WHO/WHE/CPI/2017.21.

44. World Health Organization. Joint external evaluation of IHR core capacities of the Republic of Indonesia: mission report, 20–24 November 2017. Geneva: World Health Organization; 2017. 86 p. Contract No.: WHO/WHE/CPI/REP/2018.9.

45. World Health Organization. Joint external evaluation of IHR core capacities of Australia: mission report, 24 November–1 December 2017. Geneva: World Health Organization; 2018. 83 p. Contract No.: WHO/WHE/CPI/REP/2018.8.

46. World Health Organization. Joint external evaluation of IHR core capacities of the Kingdom of Belgium: mission report, 19–23 June 2017. Geneva: World Health Organization; 2017. 76 p. Contract No.: WHO/WHE/CPI/REP/2017.37.

47. World Health Organization. Joint external evaluation of IHR core capacities of New Zealand: mission report, 26–30 November 2018. Geneva: World Health Organization; 2019. 79 p. Contract No.: WHO/WHE/CPI/2019.63.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Self-awareness of Health Conditions and Service Utilization among People with Diabetes Mellitus, Hypertension, and Chronic Obstructive Pulmonary Disease in Thailand, 2019

Chutima Siripanumas[1]*, Rapeepong Suphanchaimat[2,3], Natthaprang Nittayasoot[2], Weerasak Putthasri[4]

1 Field Epidemiology Training Program, Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

2 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

3 International Health Policy Program, Ministry of Public Health, Thailand

4 National Health Commission Office, Thailand

*Corresponding author email: csiripanumas@gmail.com

Received: 22 Jan 2023; Revised: 29 May 2023; Accepted: 8 Sep 2023
https://doi.org/10.59096/osir.v16i3.265405

Abstract

This study aims to assess the self-reported prevalence of three common non-communicable diseases (NCDs), namely diabetes mellitus (DM), hypertension (HTN) and chronic obstructive pulmonary disease (COPD), determine the proportion of Thai residents with these diseases who utilize health services, and explore factors associated with service utilization. We used data from Thailand's Health and Welfare Survey 2019. We describe the characteristics of those who utilized services and explore factors associated with service utilization using a logistic regression. The prevalence of DM, HTN and COPD among individuals aged at least 15 years was 5.8%, 11.0% and 0.2%, respectively. A high prevalence of these NCDs was observed among older people, those with low education, rural residents, and the unemployed. Those in the richest quintile reported utilizing less services than the poorest. We found associations between having two comorbidities (adjusted odds ratio (AOR) 1.30, 95% confidence interval (CI) 1.12–1.50), living in the northeast (AOR 1.31, 95% CI 1.12–1.53) and being unemployed (AOR 1.22, 95% CI 1.05–1.42) with increased the utilization. The findings highlight the importance of screening services to minimize undiagnosed NCDs, and increase awareness among underserved populations. Provision of awareness campaigns and health education related to NCDs are urgently needed.

Keywords: health service utilization, non-communicable diseases, Thailand

Introduction

Non-communicable diseases (NCDs) are the leading cause of death and disability, contributing to 41 million deaths, which is more than 70% of all deaths worldwide.[1] Approximately one-third of deaths due to NCDs occur among those aged 30–69 years and 85% of these premature deaths occur in low- and middle-income countries. Furthermore, NCDs impose a major and growing burden on health and economic development in the Southeast Asia Region.[2] At the individual level, NCDs cause early death and, among survivors, severe disability. Individuals can be trapped into poverty due to lost productivity and catastrophic health expenditure. For governments, NCDs undermine economic progressiveness and stifle development.[3] Therefore, it is imperative to address this emerging catastrophe for the sake of preventing premature deaths and disability, improve individual well-being, a prosperous economy, and global health security.[4,5] Early detection, screening, and timely treatment are key components to reducing the impacts of NCDs.

To ensure that all individuals and communities receive the health services they need without financial hardship, Universal Health Coverage (UHC) is adopted by many countries, including Thailand. Thailand achieved UHC in 2002 when the entire population was covered by one

of the three public health insurance schemes.[6] The Civil Servant Medical Benefit Scheme (CSMBS) provides health insurance to government officials, their dependents (e.g., parents, spouses, and children) and retirees.[7] The Social Security Scheme (SSS) is a compulsory health insurance program for private-sector employees and government employees. The remaining population are covered by the Universal Coverage Scheme (UCS). The majority of Thai people are covered by UCS (76%), followed by SSS (17%) and the Civil Servant Medical Benefit Scheme (7%).[6]

Mediating factors that affect access to health care are an individual's ability to perceive health care needs, which is shaped by health literacy and education. Health care seeking and utilization capacity have been shown to be associated with age, region, occupation, health insurance, socio-demographic and socio-economic attributes.[8,9]

The 2019 Health and Welfare Survey (HWS) is a nationally representative household survey conducted by the National Statistical Office (NSO). The first survey was undertaken in 1974 and subsequently conducted every other year. The 2019 HWS was the 21st round; data were collected from 27,960 sampled households located in urban and rural areas of every province in March 2019.[10] The survey contained information on health insurance, illness, provisions for health services, and household assets that captures aspects of household health and economic welfare rather than the money metric.[11]

There are limited studies exploring factors (including socio-economic attributes) associated with health services utilization among people with NCDs in Thailand. It is important, in the realm of UHC provisioning in Thailand, to identify the socioeconomic barriers to health service utilization. The aims of this study were: (a) to determine the self-reported prevalence of three common NCDs, namely diabetes mellitus (DM), hypertension (HTN), and chronic obstructive pulmonary disease (COPD), which are the leading causes of premature death in Thailand, (b) to determine the self-report proportion of the population with NCDs who utilize health services, and (c) to determine factors associated with health service utilization, including receiving treatment from a public or private health facility, visiting a local or traditional carer, and self-medication.[12]

Methods

Study Design and Data Source

This study employed a cross-sectional design. We obtained secondary data from the 2019 HWS. The HWS uses a stratified two-stage sampling technique. The primary stage is enumeration area (EA), an area comprising a set of households. From 127,460 EA covering the whole country, 1,990 EA were randomly sampled. The secondary stage is at the household level. From 1,990 EA samples, 16 households per urban EA (defined as being within a municipality) and 12 households per rural EA (outside a municipality) were randomly sampled. All members of the sampled households were interviewed. Finally, the HWS collected data from 27,960 households and 63,594 individuals.[10] In this study, people less than 15 years old were excluded. A total of 52,921 people were obtained.

Data Collection

All participants were asked about the presence of any underlying diseases, which were confirmed by a physician or healthcare worker. The standard question was: "Do you have any underlying diseases?". Those who answered in the affirmative were asked two further questions, the first being: "What is/are the underlying disease(s) that you were diagnosed with by a physician or healthcare worker?". Respondents could indicate up to five diseases. The second question was: "During the last month, did you receive any health services for your underlying disease(s)?". Respondents who answered in the affirmative were also asked to state the number of times they received health services.

Data Analysis

The prevalence of DM, HTN and COPD and prevalence of health service utilization were calculated based on sampling weights to represent the entire Thai population.[10] The NSO provided these weights according to the probability of each individual being randomly selected. We also calculated an asset index using principal component analysis based on questions on the possessions of durable and semi-durable goods and housing characteristics.[10] The asset index was further categorized into five groups based on quintiles. The first quintile was the poorest group, whereas the fifth quintile represented the richest group.

All variables were presented as a weighted proportion and univariate analysis with chi-square statistic was applied. We used logistic regression to identify associations between the dependent and independent variables among those with at least one of the selected NCDs. The independent variables consisted of number of comorbidities in the three selected NCDs, gender, age group, region of residence (central including Bangkok, north, northeast and south), area of residence (urban or rural), education level (up to primary education, secondary education, and bachelor's degree or above), occupation, health insurance and asset index quintile. The dependent variable was self-reported health service utilization within a month before the survey.

All variables were analysed univariately. Independent variables that had a *p*-value of less than 0.1 in the univariable analysis were included in the initial multivariable model. The findings were presented in terms of the prevalence odds ratio with 95% confidence interval (CI). A *p*-value <0.05 was considered significant. All analyses were performed using STATA version 16.

Results

Prevalence of Self-reported DM, HTN and COPD

The prevalence of self-reported DM, HTN and COPD was 5.8%, 11.0% and 0.2%, respectively. Females had a significantly higher prevalence of self-reported DM and HTN (7.3% and 13.0%, respectively), while males had a higher prevalence of COPD (0.2%). The prevalence of HTN and COPD was significantly greater in the northern region (15.3% and 0.3%, respectively) compared to other regions, and for DM, the prevalence was higher in the north-eastern region (6.9%). The prevalence of COPD among urban and rural residents was similar (*p*-value 0.92). However, for DM and HTN, the prevalence was significantly higher for rural residents (6.0% and 11.1%, respectively). Those having up to primary education had nearly a four times higher prevalence of DM, HTN and COPD (10.0%, 18.6% and 0.3%, respectively) than people with a higher education. Members insured with the SSS had the lowest prevalence compared with members of the other two insurance schemes. Those in the richest quintile had the lowest prevalence of DM and COPD than the poorer quintiles, while those in the third quintile had the lowest prevalence of HTN (Table 1).

Table 1. Prevalence of self-reported diabetes mellitus (DM), hypertension (HTN), and chronic obstructive pulmonary diseases (COPD) among the adult (age ≥15 years) in Thailand Health and Welfare Survey, 2019.

Variable	Sample size (n)	Weighted prevalence (%)					
		DM	*P*-value*	HTN	*P*-value*	COPD	*P*-value*
Gender							
Male	24,759	4.2	<0.001	8.9	<0.001	0.2	<0.001
Female	28,162	7.3		13.0		0.1	
Age group (years)							
15–29	9,318	0.2	<0.001	0.2	<0.001	0.0	<0.001
30–39	7,576	0.7		1.0		0.0	
40–49	10,073	2.8		4.2		0.0	
50–59	11,110	7.6		14.0		0.2	
60–69	8,544	15.6		29.5		0.2	
70+	6,300	20.7		43.3		0.9	
Region							
Central	18,480	5.3	<0.001	11.1	<0.001	0.2	<0.001
North	11,368	6.5		15.3		0.3	
Northeast	14,016	6.9		9.1		0.1	
South	9,057	4.4		9.2		0.1	
Area							
Urban	29,700	5.6	<0.001	11.0	<0.001	0.2	0.928
Rural	23,221	6.0		11.1		0.2	
Education							
Up to primary	28,863	10.0	<0.001	18.6	<0.001	0.3	<0.001
Up to secondary	17,641	2.1		4.2		0.1	
Bachelor's degree or above	6,289	2.5		5.1		0.0	
Occupation							
Self-employed	21,683	5.6	<0.001	10.0	<0.001	0.1	<0.001
Employed	14,489	1.9		3.9		0.3	
Unemployed	16,729	10.2		20.0		0.1	
Health insurance							
SSS	5,742	1.6	<0.001	3.7	<0.001	0.1	<0.001
CSMBS	5,058	9.6		19.2		0.2	
UCS	42,121	6.3		11.8		0.2	
Asset index quintile							
Quintile 1	10,429	5.5	<0.001	11.2	<0.001	0.2	<0.001
Quintile 2	10,806	5.8		11.1		0.2	
Quintile 3	11,157	6.0		9.9		0.1	
Quintile 4	11,210	6.7		12.0		0.1	
Quintile 5	9,319	5.1		11.0		0.1	

**Chi-square test. SSS: Social Security Scheme, CSMBS: Civil Servant Medical Benefit Scheme, UCS: Universal Coverage Scheme*

Proportion of Health Service Utilization among People with DM, HTN and COPD

The proportion of health services utilization among those with DM, HTN and COPD was 60.9%, 56.8% and 51.9%, respectively. As shown in Table 2, among those with DM, males had a higher utilization (61.4%) than females (60.8%). For COPD, health services utilization was 48.2% among males and 67.0% among females. Among DM and HTN, those aged 30–39 years had the lowest utilization (53.4% and 27.8%, respectively) whereas for COPD, those aged younger than 30 years had the lowest utilization (0.0%). Residents of the north-eastern region had a higher utilization than the other regions and rural residents had a higher utilization than urban residents. Among DM and COPD, those with a bachelor's degree or above had higher health service utilization. However, for HTN, those with up to primary education had the highest utilization. Those with DM and HTN who were members of the UCS had the highest proportion of utilization (63.2% and 58.3%, respectively). For COPD, members insured by the SSS had the highest utilization (94.8%). Among those with DM, HTN and COPD, the richest quintile had the lowest health service utilization (54.0%, 53.7% and 32.8%, respectively).

Table 2. Proportion of health service utilization within one month among diabetes mellitus (DM), hypertension (HTN), and chronic obstructive pulmonary diseases (COPD) adult (age ≥15 years) in Thailand Health and Welfare Survey, 2019

Variables	Weighted proportion of health service utilization (%)					
	DM	*P*-value	HTN	*P*-value	COPD	*P*-value
Gender						
Male	61.4	<0.001	56.9	0.191	48.2	<0.001
Female	60.8		56.8		67.0	
Age group (years)						
15–29	65.6	<0.001	83.8	<0.001	0.0	<0.001
30–39	53.4		27.8		100.0	
40–49	60.7		54.6		69.3	
50–59	61.0		56.7		50.0	
60–69	60.4		56.7		69.7	
70+	62.1		58.3		47.7	
Region						
Central	59.6	<0.001	55.5	<0.001	53.7	<0.001
North	56.1		55.2		46.6	
Northeast	66.2		63.3		82.3	
South	59.4		52.6		39.8	
Area						
Urban	59.6	<0.001	55.2	<0.001	48.8	<0.001
Rural	62.1		58.2		56.4	
Education						
Up to primary	61.5	<0.001	57.5	<0.001	50.8	<0.001
Up to secondary	57.2		54.5		54.5	
Bachelor's degree or above	63.4		54.4		100.0	
Occupation						
Self-employed	58.6	<0.001	56.2	<0.001	32.4	<0.001
Employed	57.1		51.2		85.8	
Unemployed	63.4		58.3		55.9	
Health insurance						
SSS	46.1	<0.001	53.1	<0.001	94.8	<0.001
CSMBS	50.9		48.1		55.6	
UCS	63.2		58.3		49.6	
Asset index quintile						
Quintile 1	62.8	<0.001	58.1	<0.001	42.9	<0.001
Quintile 2	63.8		59.4		65.9	
Quintile 3	62.8		56.8		69.7	
Quintile 4	60.9		56.2		55.4	
Quintile 5	54.0		53.7		32.8	

SSS: Social Security Scheme, CSMBS: Civil Servant Medical Benefit Scheme, UCS: Universal Coverage Scheme

Factors Associated with Health Service Utilization

On multivariable analysis there was a significant association between having multiple comorbidities and health service utilization. Those with two comorbidities were 1.30 times (95% CI 1.12–1.50) more likely to utilize health services than those with a single underlying disease. There was also a significant association between living in the north-eastern region and utilization. Patients in the north-eastern region were 1.31 times (95% CI 1.12–1.53) more likely to utilize health services than participants in the central region. Being unemployed also had a significant association with utilization. Unemployed residents had 1.22 times (95% CI 1.05–1.42) higher utilization than the self-employed (Table 3).

Table 3. Factors associated with health service utilization within one month among diabetes mellitus (DM), hypertension (HTN), and chronic obstructive pulmonary diseases (COPD) adult (age ≥15 years) in Thailand Health and Welfare Survey, 2019

Characteristics	Crude POR* (95% CI)	*P*-value	Adjusted POR* (95% CI)	*P*-value
Number of underlying diseases (DM, HTN, COPD) (n=8,887)				
Having 1/3 diseases	Reference			
Having 2/3 diseases	1.34 (1.16–1.54)	<0.001	1.30 (1.12–1.50)	<0.001
Having all diseases	2.78 (0.28–27.85)	0.384	2.92 (0.25–33.48)	0.390
Gender (n=13,221)				
Male	0.94 (0.85–1.04)	0.021	1.07 (0.94–1.21)	0.295
Female	Reference			
Age group (years) (n=13,221)				
15–29	Reference			
30–39	1.48 (0.98–2.24)	0.064	0.41 (0.13–1.36)	0.145
40–49	1.95 (1.37–2.79)	<0.001	0.73 (0.24–2.16)	0.565
50–59	2.41 (1.72–3.38)	<0.001	0.78 (0.26–2.29)	0.648
60–69	2.50 (1.79–3.50)	<0.001	0.71 (0.24–2.11)	0.542
70+	2.70 (1.93–3.78)	<0.001	0.74 (0.25–2.18)	0.582
Region (n=13,221)				
Central	Reference			
North	1.04 (0.92–1.18)	0.521	0.94 (0.81–1.10)	0.438
Northeast	1.29 (1.14–1.46)	<0.001	1.31 (1.12–1.53)	0.001
South	0.98 (0.85–1.14)	0.827	0.92 (0.76–1.11)	0.389
Area of residence (n=13,221)				
Urban area	Reference			
Rural area	1.12 (1.02-1.24)	0.023	1.06 (0.94–1.20)	0.339
Education (n=13,211)				
Up to primary	1.25 (1.03–1.53)	0.027	0.89 (0.67–1.19)	0.429
Up to secondary	0.96 (0.77–1.22)	0.761	0.95 (0.70–1.29)	0.748
Bachelor's degree or above	Reference			
Occupation (n=13,217)				
Self-employed	Reference			
Employed	0.77 (0.65–0.91)	0.002	0.97 (0.77–1.23)	0.814
Unemployed	1.15 (1.03–1.27)	0.009	1.22 (1.05–1.42)	0.008
Health insurance (n=13,221)				
SSS	Reference			
CSMBS	1.22 (0.93–1.60)	0.149	0.77 (0.53–1.13)	0.184
UC	1.58 (1.24–2.01)	<0.001	1.18 (0.84–1.68)	0.342
Asset index quintile (n=13,221)				
Quintile 1	1.28 (1.09–1.50)	0.002	1.08 (0.86–1.35)	0.526
Quintile 2	1.30 (1.11–1.52)	0.001	1.13 (0.90–1.40)	0.288
Quintile 3	1.14 (0.97–1.33)	0.103	1.06 (0.86–1.33)	0.536
Quintile 4	1.20 (1.02–1.42)	0.027	1.08 (0.88–1.33)	0.469
Quintile 5	Reference			

**Prevalence odds ratio (POR) was calculated based on sampling weight.*

SSS: Social Security Scheme, CSMBS: Civil Servant Medical Benefit Scheme, UCS: Universal Coverage Scheme

Discussion

The self-reported prevalence of DM, HTN and COPD was 5.8%, 11.0% and 0.2%, respectively, while the prevalence based on the Thai National Health Examination Survey VI (NHES) that was conducted during 2019–20 was 9.5%, 25.4% and 0.4%, respectively.[13] The prevalence of most diseases from the NHES was higher than that of the HWS because the NHES included undiagnosed groups by comprehensive and accurate medical examinations. However, the prevalence of COPD was still low in both surveys. This was likely due to the fact that COPD was self-reported in both surveys. A high prevalence of undiagnosed and untreated NCDs demonstrates the inadequacy of current NCD diagnosis and management strategies.[14] Moreover, the self-reported measures reflect people's awareness and likely lowers the propensity of under-reporting.[15]

The overall prevalence of health service utilization among those with DM, HTN and COPD was 60.9%, 56.8% and 51.9%, respectively. A study in Tanzania reported that the prevalence of service utilization among those with HTN was 34% during the previous 12-month interval.[16] However, the difference might be due to differences in the questionnaire used.

Those with a lower education had a higher prevalence of DM, HTN and COPD than those with a higher education, a result consistent with other studies. In Japan, lower education level was associated with higher incidence of DM among both men and women, and with HTN only women.[17] In Argentina, adults with higher educational attainment lived healthier and longer lives compared with their less educated peers.[18]

The proportion of respondents utilizing health services was lower among those in the working age. We found the lowest proportion in the 30–39 age group. Formal workers have regular working hours. Moreover, for receiving health services, some workers lost income due to their inability to work. Informal workers may not seek treatment for life-threatening heart conditions.[19] A previous study found that the working age should be considered as a risk-prone group due to their lower access to health services and less use of these services for medical screening.[20]

We found that those in the richest wealth quintile had a lower utilization of health services than those in the poorer quintiles. Studies have shown that poor people tend to have less access to health services than the rich.[21] However, another study in Thailand found that less affluent people had greater health care needs and received more services than the more affluent groups.[7] Possible explanations are that poor people with NCDs tend to have worse outcomes than their richer counterparts.[22] Consequently, they might be more likely to seek health services. We found that the prevalence of DM and COPD was lowest in the richest quintile.

We found a significant association between living in the northeast and health service utilization. Residents in the northeast had a 1.28 times higher utilization than those in the central region. Those living in Bangkok and surrounding areas tend to utilize services less due to time barriers and high medical expenses.[23] A survey by the NSO found that Bangkok had the highest proportion of non-registered population (33.4%).[24] The non-registered population face difficulties in health service utilization as they need to pay upfront when using health facilities to which they were not registered.[25]

Our study showed a significant association between comorbidities and health service utilization. Patients with two comorbidities were 1.31 times more likely to utilize health services than those with single underlying disease. The previous study found that increasing comorbidities was associated with a higher odds of diagnosing HTN, a higher odds of having treatment for HTN, and a higher odds of uncontrolled HTN which led to an increase in health service utilization.[26]

Being unemployed was significantly associated with health service utilization. Unemployed participants had a higher health service utilization than those who were self-employed (adjusted odds ratio 1.22, 95% CI 1.05–1.42). A study from the National Institute for Occupational Safety and Health found that the unemployed were more likely to report adverse health outcomes than the self-employed. The prevalence of chronic health conditions increased from the short-term unemployed to the long-term unemployed.[27]

Limitations

There are some limitations of this study which should be mentioned. First, we classified study participants based on their self-reporting status of a previous diagnosis. Therefore, our finding is prone to recall bias. Second, some of the data were also incomplete. Thus, statistical power might be limited when focusing on certain variables. Third, interviewers from the HWS asked the participants if they had received any health services for their underlying diseases within a month of interview and we classified the outcome variable according to their response. Those who utilize health services less frequently may have been misclassified into the non-utilization group.

Conclusion and Recommendations

The self-reported prevalence of three common non-communicable diseases was lower than the examination-based prevalence. The prevalence of NCDs was higher among those aged 60 years or more, having a low education, living in a rural area and being unemployed. The proportion of health service utilization among those with diabetes mellitus and hypertension was lower in the working-age group. Those in the highest income quintile had a lower proportion of health service utilization compared with the other quintiles. A significant association was seen between multiple comorbidities, living in the northeast region and being unemployed with increased health service utilization.

The findings of the study highlight the importance of screening for NCDs, especially in high risk groups such as the elderly, those with a low education level, living in a rural area and the unemployed. Health education and awareness campaigns related to NCDs should be given to underserved populations. There is need for non-registered populations in Bangkok to increase their health service utilization by improving the primary care unit and facilitating the various registration channels. Based on the study findings, future research may entail assessment of the factors contributing to the regional variations in health service utilization and identifying effective support policies for improving utilization throughout the country. However, for an accurate evaluation of health services utilization, the NSO should add more questions asking participants about health service utilization, adherence to treatment and their underlying health status.

Acknowledgements

Our sincere gratitude goes to Mirza Farrque, Muhammad Jami Husain and Chaoyang Li at the U.S. Centers for Disease Control and Prevention for all their support. The authors extend our sincere gratitude to Vuthiphan Vongmongkol and Anond Kulthanmanusorn at the International Health Policy Program for their help with calculating the asset index.

Suggested Citation

Siripanumas C, Suphanchaimat R, Nittayasoot N, Putthasri W. Self-awareness of health conditions and service utilization among people with diabetes mellitus, hypertension, and chronic obstructive pulmonary disease in Thailand, 2019. OSIR. 2023 Sep;16(3):130–8. doi:10.59096/osir.v16i3.265405.

References

1. World Health Organization. Noncommunicable diseases progress monitor 2020 [Internet]. Geneva: World Health Organization; 2020 Jun 12 [cited 2022 May 16]. <https://www.who.int/publications/i/item/9789240000490>
2. World Health Organization. Noncommunicable diseases [Internet]. Geneva: World Health Organization; [cited 2022 Mar 10]. <https://www.who.int/southeastasia/health-topics/noncommunicable-diseases>
3. World Health Organization. Burden of noncommunicable diseases in the Eastern Mediterranean Region [Internet]. Cairo: WHO Regional Office for Eastern Mediterranean; [cited 2022 Mar 10]. <https://www.emro.who.int/noncommunicable-diseases/publications/burden-of-noncommunicable-diseases-in-the-eastern-mediterranean-region.html>
4. Kostova D, Husain MJ, Sugerman D, Hong Y, Saraiya M, Keltz J, et al. Synergies between communicable and noncommunicable disease programs to enhance global health security. Emerg Infect Dis. 2017 Dec;23(13):S40–6. doi:10.3201/eid2313.170581.
5. World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks [Internet]. Geneva: World Health Organization; 2009 [cited 2022 Mar 10]. 62 p. <https://apps.who.int/iris/handle/10665/44203>
6. Vongmongkol V, Viriyathorn S, Wanwong Y, Wangbanjongkun W, Tangcharoensathien V. Annual prevalence of unmet healthcare need in Thailand: evidence from national household surveys between 2011 and 2019. Int J Equity Health. 2021 Nov 12;20(1):244. doi:10.1186/s12939-021-01578-0.
7. Paek SC, Meemon N, Wan TTH. Thailand's universal coverage scheme and its impact on health-seeking behavior. Springerplus. 2016 Nov 10;5(1):1952. doi:10.1186/s40064-016-3665-4.
8. Xie Y, Ma M, Zhang Y, Tan X. Factors associated with health literacy in rural areas of Central China: structural equation model. BMC Health Serv Res. 2019 May 10;19(1):300. doi:10.1186/s12913-019-4094-1.

9. Van Minh H, Oh J, Giang KB, Bao Ngoc N, Minh Hoang N, Giang Huong TT, et al. Health service utilization among people with noncommunicable diseases in Rural Vietnam. J Public Health Manag Pract. 2018;24 Suppl 2:S60–6. doi:10.1097/PHH.0000000000000696.

10. National Statistical Office of Thailand. Health and welfare survey 2019 [Internet]. Bangkok: National Statistical Office, Ministry of Digital Economy and Society; 2019 [cited 2022 Mar 9]. 130 p. <http://www.nso.go.th/sites/2014en/Pages/Statistical%20Themes/Population-Society/Social%20Security/Health--Welfare.aspx>. Thai.

11. Prakongsai P. An application of the asset index for measuring household living standards in Thailand. SSRN [Preprint]. 2006 Apr 4 [cited 2022 Mar 9]. <http://dx.doi.org/10.2139/ssrn.1080909>

12. Division of Non-Communicable Diseases, Ministry of Public Health. Situation of NCD 2019 [Internet]. Nonthaburi: Division of Non-Communicable Diseases; 2020 May [cited 2022 Apr 3]. 87 p. <http://www.thaincd.com/document/file/download/knowledge/%E0%B8%A3%E0%B8%B2%E0%B8%A2%E0%B8%87%E0%B8%B2%E0%B8%99%E0%B8%AA%E0%B8%96%E0%B8%B2%E0%B8%99%E0%B8%81%E0%B8%B2%E0%B8%A3%E0%B8%93%E0%B9%8C%E0%B9%82%E0%B8%A3%E0%B8%84NCDs63update.pdf>. Thai.

13. Aekplakorn W, editor. Thailand's National Health Examination Survey VI 2019–2020 [Internet]. Bangkok: Faculty of Medicine Ramathibodi Hospital, Mahidol University; 2021 Sep [cited 2022 Mar 25]. 345 p. <https://kb.hsri.or.th/dspace/handle/11228/5425>

14. Arokiasamy P, Uttamacharya, Kowal P, Capistrant BD, Gildner TE, Thiele E, et al. Chronic noncommunicable diseases in 6 low- and middle-income countries: findings from wave 1 of the world health organization's study on global ageing and adult health (SAGE). Am J Epidemiol. 2017 Mar 15;185(6):414–28. doi:10.1093/aje/kww125.

15. Onur I, Velamuri M. The gap between self-reported and objective measures of disease status in India. PLoS One. 2018 Aug 27;13(8): e0202786. doi:10.1371/journal.pone.0202786.

16. Bovet P, Gervasoni JP, Mkamba M, Balampama M, Lengeler C, Paccaud F. Low utilization of health care services following screening for hypertension in Dar es Salaam (Tanzania): a prospective population-based study. BMC Public Health. 2008 Dec 16;8(1):407. doi:10.1186/1471-2458-8-407.

17. Oshio T, Kan M. Educational level as a predictor of the incidences of non-communicable diseases among middle-aged Japanese: a hazards-model analysis. BMC Public Health. 2019 Jul 1;19(1):852. doi:10.1186/s12889-019-7182-6.

18. Zajacova A, Lawrence EM. The relationship between education and health: reducing disparities through a contextual approach. Annu Rev Public Health. 2018 Apr 1;39(1):273–89. doi:10.1146/annurev-publhealth-031816-044628.

19. Alfers L. Informal workers' access to health services [Internet]. Manchester: Women in Informal Employment: Globalizing and Organizing; 2015 Jul 28 [cited 2022 Mar 25]. <https://www.wiego.org/blog/informal-workers%E2%80%99-access-health-services>

20. Policy and Strategy Section, Bureau of Non-Communicable Diseases. 5-year national NCDS prevention and control strategic and action plan (2017–2021). Nonthaburi: Bureau of Non-Communicable Disease, Department of Disease Control, Ministry of Public Health of Thailand; 2017 May. 141 p.

21. Peters DH, Garg A, Bloom G, Walker DG, Brieger WR, Hafizur Rahman M. Poverty and access to health care in developing countries. Ann N Y Acad Sci. 2008 Jul 25;1136:161–71. doi:10.1196/annals.1425.011.

22. World Health Organization, Regional Office for the Western Pacific. Noncommunicable disease and poverty: the need for pro-poor strategies in the Western Pacific Region: a review [Internet]. Geneva: World Health Organization; 2007 [cited 2022 Mar 25]. 83 p. <https://apps.who.int/iris/handle/10665/206941>

23. Thungthong J, Waleekhachonloet O, Chanasopon S, Aewsuwan K, Limwattananon S, Limwattananon C, et al. Utilization and unmet healthcare need for outpatient and inpatient services of population living in Bangkok Metropolitan in 2015. Journal of Health System Research. 2017;11(3):378–90.

24. National Statistical Office of Thailand. Non-registered Population Survey 2020 [Internet]. Bangkok: National Statistical Office, Ministry of Digital Economy and Society; 2021 [cited 2022 Mar 25]. 42 p. <http://www.nso.go.th/sites/2014en/Survey/social/domographic/non_registered/population2020.pdf>. Thai.

25. Hfocus. BMA expand medical services-increase access to health service for non-register population [Internet]. Udonthani: Hfocus.org; 2019 Dec 21 [cited 2022 Mar 21]. <https://www.hfocus.org/content/2019/12/18225>. Thai.

26. Sum G, Koh GCH, Mercer SW, Wei LY, Majeed A, Oldenburg B, et al. Patients with more comorbidities have better detection of chronic conditions, but poorer management and control: findings from six middle-income countries. BMC Public Health. 2020 Jan 6;20(1):9. doi:10.1186/s12889-019-8112-3.

27. National Institute for Occupational Safety and Health. NIOSH study examines relationship between employment status, healthcare access, and health outcomes [Internet]. Atlanta: Centers for Disease Control and Prevention; 2021 Nov 18 [cited 2022 May 17]. <https://www.cdc.gov/niosh/updates/upd-11-18-21.html>

Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Factors Associated with Anthrax Vaccination Coverage in Two Anthrax-prone Districts, Bangladesh, 2019

Subrota Malakar[1]*, Alden Henderson[2], Mallick Masum Billah[1], Md Shohidul Islam Khokon[3], Md Abu Sufian[3]

1 Institute of Epidemiology, Disease Control and Research, Bangladesh

2 U.S. Centers for Disease Control and Prevention, USA

3 Department of Livestock Services, Ministry of Fisheries and Livestock, Bangladesh

*Corresponding author email: malakar07dvm@gmail.com

Received: 10 Jun 2022; Revised: 8 Sep 2023; Accepted: 15 Sep 2023
https://doi.org/10.59096/osir.v16i3.265576

Abstract

Anthrax is a significant public health threat in Bangladesh due to recent outbreaks in humans and animals. To reduce the incidence of anthrax, the Department of Livestock Services implemented the Preventing Anthrax and Rabies Project (PARB) to enhance anthrax surveillance and response in two anthrax-prone districts. We conducted a retrospective review of PARB data on livestock farmers' knowledge and practice towards anthrax, anthrax vaccination and anthrax vaccination coverage in six subdistricts of northern and one subdistrict in southwestern Bangladesh. We calculated prevalence ratios (PR) and 95% confidence intervals (CI) to identify risk factors for low vaccination coverage. We found that farmers from farms with low vaccine coverage (<80%) had poor knowledge on animal anthrax (PR 1.75, 95% CI 1.50–1.93) and human anthrax (PR 1.66, 95% CI 1.45–1.87), were less likely to treat (PR 1.79, 95% CI 1.58–1.99) and more likely to slaughter (PR 1.53, 95% CI 1.10–2.09) sick animals than farms with high vaccine coverage. These findings reveal poor knowledge and practices related to anthrax among farmers in low vaccine coverage subdistricts of Bangladesh. Developing and disseminating behavioral change components to farmers can improve their knowledge and practices about anthrax and increase vaccine coverage.

Keywords: anthrax, knowledge, practice, vaccination, Bangladesh

Introduction

Globally, around 1.8 billion people live in anthrax-risk areas.[1] Human and animal anthrax are endemic in South Asian countries, including Bangladesh, and present a significant public health threat in these countries because most of the population is engaged in agronomic and animal rearing practices.[2] The Institute of Epidemiology, Disease Control and Research in Bangladesh investigated 15 human anthrax outbreaks from May 2016 to November 2018 and recorded 378 cases in 2020.[3]

Low vaccination coverage in animals due to scarcity of vaccine is an important factor in many animal anthrax outbreaks.[4] The Bangladesh Livestock Research Institute produced six million doses of anthrax vaccine in 2019–2020, but the demand was for 41 million doses to cover the cattle population.[5] Risk factors such as behavioral (slaughtering sick animals) and environmental (seasonal flooding) contribute to the repeated outbreaks of anthrax.[6,7]

The Sirajganj and Meherpur Districts are two anthrax hot spots in Bangladesh because of frequent anthrax outbreaks and the high cattle population.[7] The Department of Livestock Services (DLS), Bangladesh conducts the 'Preventing Anthrax and Rabies in Bangladesh' (PARB) surveillance project with goals to reduce the incidence of animal anthrax and establish a protocol for anthrax outbreaks in anthrax-prone districts. Community animal health workers report the suspected occurrence of animal anthrax and rabies. They also collect and send samples to a DLS field disease investigation laboratory for confirmation. This paper describes the livestock farmers' knowledge and practice towards anthrax, anthrax vaccination and anthrax

vaccination coverage in two districts in Bangladesh and identifies risk factors for low vaccination coverage. This information was not previously available in these subdistricts and will be used to develop programs for better management of anthrax disease.

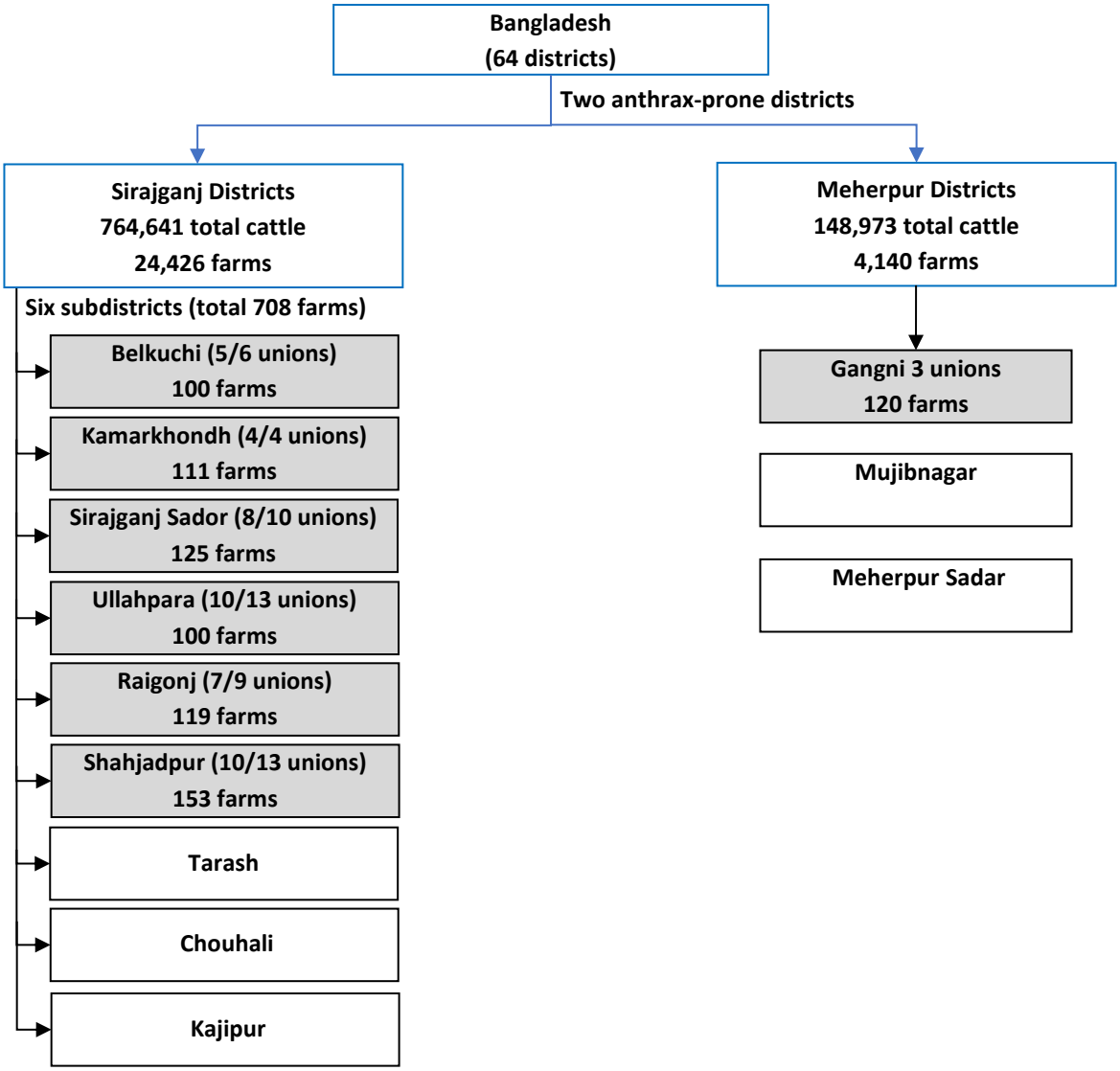
Methods

Study Design and Population

We conducted a retrospective review of the DLS PARB data from June 2018 to June 2019 and interviewed the farmers from 14 to 28 Jul 2019.

Sampling and Sample Size

Farms were selected from subdistricts with previous anthrax outbreaks and availability of a field assistant to assist with the survey (Figure 1). To choose study areas, we reviewed scientific papers, government reports, and electronic and print media on anthrax outbreaks. Of the 64 districts in Bangladesh 6 reported an anthrax outbreak in the last seven years. Of these, two (Meherpur and Sirajganj Districts) had a high frequency of livestock rearing and a previous anthrax outbreak. Within these two districts, we selected subdistricts with previous anthrax outbreaks. Sirajganj District had nine subdistricts with a previous anthrax outbreak but only six had a field assistant available. Meherpur District had three subdistricts with a previous anthrax outbreak but only one had a field assistant available. The Unions in the subdistrict and the farms in the unions were selected by convenience sampling.



Cattle population from Planning Ministry, Bangladesh Bureau of Statistics. [8]
Gray shaded boxes are the subdistricts that were surveyed.

Figure 1. Selection of farms to be sampled for anthrax vaccine coverage, Bangladesh 2019

Data Collection

PARB data collectors used semi-structured questionnaires to interview farmers through door-to-door surveys between 5 AM to 11 AM and 4 PM to 6 PM. If a farmer was not at home, the data collector interviewed another person who was knowledgeable about raising the cattle. The data collector went to each farm with a government or private vaccinator.

Operational Definitions

- Eligible cattle—age more than one year and not pregnant
- Completed anthrax vaccination—one shot (1 mL) of anthrax vaccine each year.
- Adequate knowledge on anthrax—defined as recognizing the word 'anthrax', knowing the symptoms, and disease potentiality (severity and transmission of anthrax).
- "To handle a sick animal" means when an animal gets sick, the farmer will treat the sick animal by treating the symptoms or slaughtering the animal if it does not recover.

Calculation of Anthrax Vaccine Coverage

We calculated vaccine coverage by dividing the number of cattle farmers who completed vaccination of their eligible cattle by the total number of farmers interviewed with the assumption that one farmer equaled one farm and an average number of cattle on a farm being four. We defined high vaccine coverage as 80% or above.[4,9]

Data Cleaning and Analysis

Duplicate entries were identified and removed from the data set. We conducted descriptive and inferential statistical analysis in Epi Info 7 to identify factors of low vaccination coverage. We calculated the prevalence ratios and 95% confidence intervals (CI) to assess associations.

Ethical Approval

All participants were informed of the purpose of the investigation and participation was voluntary. Verbal informed consent was collected from participants and guardians of minors before the interview. There were minimal risks of harm to study respondents. Participants were assured that their personal identity would be kept confidential and that the data would be used only for the purposes of the study. Participants were informed that they could withdraw from the study at any time with no penalty. The study was conducted with the permission of the Principal Investigator of the PARB project, which had administrative approval from the Ministry of Fisheries and Livestock.

Results

Demographic Characteristics of Participants

We identified 907 farms and interviewed 828 farmers (91% response rate). As shown in Table 1, most participants (59%) were aged between 30 and 50 years. Approximately 48% had no formal education and 74% said that farming was their livelihood. Most farmers reared cattle (66%) as their main source of livelihood and to increase their income. Others also reared chickens (58%) and ducks (21%).

Table 1. Sociodemographic characteristics of livestock farmers in Sirajganj and Meherpur Districts, Bangladesh, 2019 (n=828 farms)

Variables	n (%)	Average
Age group (years) (n=812)		**39**
0–10	3 (0.4)	
11–20	44 (5.4)	
21–30	138 (17.0)	
31–40	257 (31.7)	
41–50	234 (28.8)	
51–60	72 (8.9)	
61–70	32 (3.9)	
71–80	32 (3.9)	
Number of family members (n=826)		**6**
2–4	202 (24.4)	
5–7	409 (49.5)	
8–10	181 (21.9)	
11–13	27 (3.3)	
≥14	7 (0.8)	
Occupation (n=823)		
Farmer	607 (74)	
Housewife	68 (8)	
Laborer	60 (7)	
Service holder	29 (4)	
None (student)	28 (3)	
Businessperson	20 (2)	
Others	11 (2)	
Education status (n=821)		
None	390 (48)	
Primary school certificate	291 (35)	
Secondary school certificate or above	140 (17)	
Main type of animal reared (n=826)		
Cow	3,237 (66)	3.9
Goat	1,486 (31)	1.8
Sheep	142 (3)	0.2
Buffalo	4 (0)	0.005
Type of poultry reared (n=826)		
Backyard poultry	10,018 (58)	12.1
Commercial poultry	1,770 (11)	2.1
Ducks	3,699 (21)	4.47
Pigeons	1,753 (10)	2.12

Vaccine Coverage

Table 2 presents the anthrax vaccination status of livestock farms. Vaccination coverage was highest in Sajhadpur Subdistrict (84%) of Sirajganj District and lowest in Gangni Subdistrict (52%) of Meherpur District. The overall vaccine coverage was 70%. Based on the 80% cut-off value, we categorized Sahjadpur (84%), Ullahpara (83%), and Raigonj (82%) Subdistricts as having sufficient vaccination coverage and Belkuchi (70%), Kamarkhandh (55%), Sirajganj Sadar (59%), and Gangni (52%) as subdistricts with low vaccination coverage.[5] Vaccination coverage of study area has been showed in Figure 2.

There were 733 farmers (62%) vaccinated their animals against anthrax, foot and mouth disease, black quarter disease, or hemorrhagic septicemia; of whom 26% vaccinated their cattle only with anthrax vaccine and 68% in combination with another vaccine.

Table 2. Anthrax vaccination status of livestock farms in Sirajganj and Meherpur Districts, Bangladesh, 2019

Characteristics	Livestock farms completed anthrax vaccination		Total (n=733)	Prevalence of vaccination	Prevalence in percent
	Yes	No			
Subdistrict					
Gangni	34	32	66	0.515	52%
Kamarkhondh	61	50	111	0.549	55%
Sirajganj Sadar	74	51	125	0.592	59%
Belkuchi	65	28	93	0.698	70%
Raigonj	97	21	118	0.822	82%
Ullahpara	57	12	69	0.826	83%
Shahjadpur	127	24	151	0.842	84%
Total occupation of livestock owner (n=644)					
Farmer	348	98	446	0.780	78%
Businessperson or service holder	106	17	123	0.861	86%
Housewife or student	73	2	75	0.97	97%

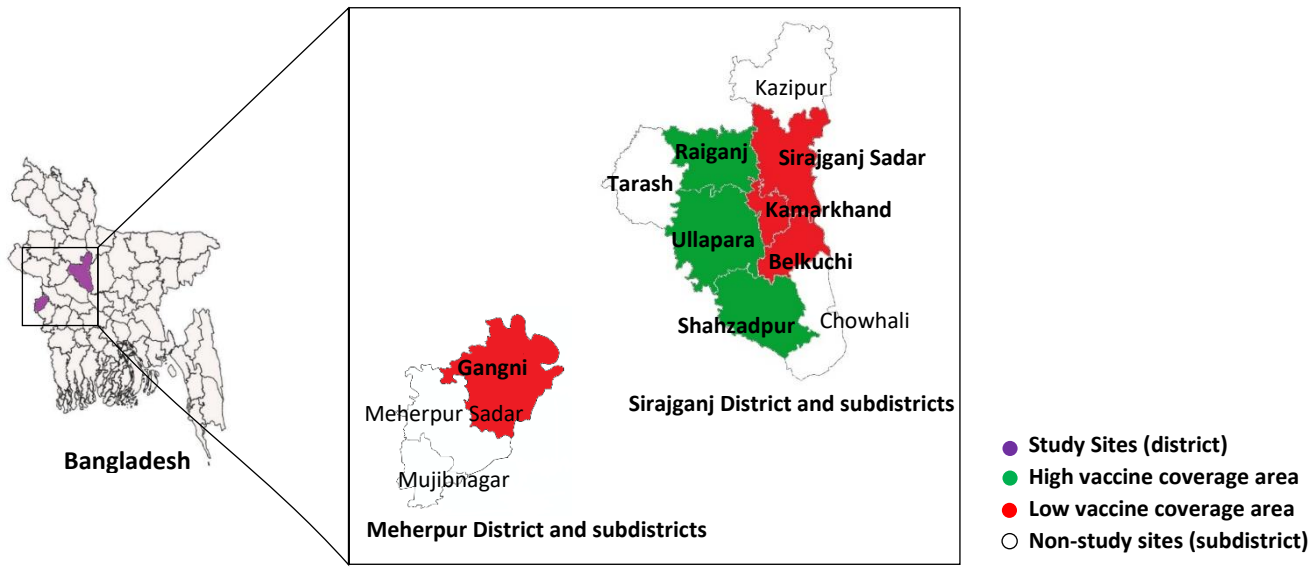


Figure 2. Map showing the livestock vaccination coverage and study sites in Sirajganj and Meherpur Districts, Bangladesh, 2019

Knowledge and Practice

Table 3 compares knowledge and practice between subdistricts with low and high vaccine coverage. Farmers from farms with low coverage had 1.75 times less knowledge about animal anthrax vaccination, and 1.66 times less knowledge on human anthrax vaccination.

In terms of practice, farms with low coverage were 1.8 times more likely to not treat a sick animal, 1.5 times more likely to slaughter, consume or sell the meat of a sick animal, and 1.4 times less likely to handle a sick animal despite being aware of the health hazards of anthrax. There was no difference between farmers from farms with low and high vaccine coverage regarding training on anthrax disease and prevention, source of information, and disposal of carcasses.

During interviews with farmers, it was mentioned that coverage was low because of insufficient number of veterinarians in the subdistricts and limited access to vaccines.

Table 3. Knowledge and practice of livestock farmers in Sirajganj and Meherpur Districts, Bangladesh, 2019 (n=828 farms)

Characteristics	Low coverage subdistrict (n)	High coverage subdistrict (n)	Prevalence	Prevalence ratio	95% CI
Knowledge related factors					
Other sources	208	284	0.42	0.67	0.56–0.82
Government veterinary hospital only	57	35	0.62	Ref	
Basic knowledge on animal anthrax (n=828)					
Not adequate	207	62	0.77	1.75	1.50–1.93
Adequate	249	310	0.44	Ref	
Basic knowledge on human anthrax (n=828)					
Not adequate	258	107	0.70	1.66	1.45–1.87
Adequate	198	265	0.42	Ref	
Practice when a sick animal identified (n=828)					
Slaughter and eat or sell meat in market	14	7	0.66	1.53	1.10–2.09
Do not provide treatment	203	58	0.77	1.79	1.58–1.99
Get treatment	239	307	0.43	Ref	
Handling of sick animals (n=603)					
No	82	58	0.58	1.38	1.15–1.63
Yes	198	265	0.42	Ref	
Training on animal anthrax disease and prevention (n=790)					
No	438	322	0.57	0.95	0.71–1.29
Yes	18	12	0.6	Ref	
Handling of dead animals (n=599)					
Float in water	22	29	0.43	0.91	0.65–1.26
Bury	259	289	0.47	Ref	

Ref: reference group

Discussion

Vaccine coverage for anthrax in seven subdistricts in Sirajganj and Meherpur Districts ranged from 52 to 84 percent, with three subdistricts being above the recommended level of 80%. Factors related to low coverage were farmers' knowledge on animal and human anthrax and their behavior and practice dealing with sick animals. Farmers stated that low vaccine coverage was due to insufficient number of veterinarians in the area and limited access to vaccines. In addition, insufficient production and distribution of vaccines contributed to the low coverage.[5]

Compared to areas with high vaccination coverage, farmers from subdistricts with low vaccination coverage did not have adequate knowledge of human and animal anthrax and vaccination, treated sick animals less often, gave delayed treatment, and slaughtered sick animals more often. There was no difference between farms with low and high vaccine coverage concerning farmers training on anthrax disease and prevention, source of information, and disposal of carcasses.

Farmers with better knowledge on anthrax have better anthrax prevention practices.[10] In our study, subdistricts with low vaccination coverage were more likely to self-treat their sick animals and often handled sick animals without personal protection. When their animals become severely ill, they often slaughtered the

animal and then ate or sold the meat. When the animal died, most farmers buried the dead animal but some discarded the carcass in the river.[10] This behavior puts the farmers at greater risk for anthrax.

Farmers are more likely to spend money for veterinary services if there is a chance to save an animal.[11] In our study, most farmers wanted veterinary services but only 16% had a veterinarian treat their animals. This could have occurred because access is a problem in rural areas and, when a veterinarian is unavailable, farmers seek treatment from a pharmacist or traditional healer.

Knowledge of anthrax transmission and mortality motivated Bangladeshi farmers to vaccinate their animals.[7] Consequently, most farmers vaccinate their animals against many diseases and anthrax vaccination is the most common of all vaccinations. However, farmers in subdistricts with low anthrax vaccination coverage are not aware that animals need to be vaccinated once per year.

Most farmers know about the symptoms of animal and human anthrax and that anthrax is a lethal disease for animals and can cause serious illness in humans.[10,12] In our study, most farmers did not know how to prevent anthrax. They are unfamiliar with anthrax transmission because they may be new farmers and there is limited access to relevant training. While many sources provide information on anthrax, it might be difficult for them to understand. In addition, anthrax has local names and sometimes farmers mix up anthrax with other acute diseases.

Limitations

In our survey, farmers may not have responded to all questions accurately and few of the respondent are not above 18 years of age. In our professional experience, farmers often give socially acceptable responses when they are affected financially or involved in subsequent slaughtering, selling and consumption of meat from a suspected carcass. Multivariable analyses could not be performed due to data unavailability and therefore confounding could exist. However, the associated factors found in this study are consistent with other studies and background knowledge, therefore the findings are acceptably reliable and useful.

Public Health Action and Recommendations

We recommend increasing the farmer's awareness of anthrax through campaigns, media coverage, and training on anthrax prevention and control. Awareness programs may help to increase basic knowledge about anthrax transmission and prevention. For example, development of materials (with pictures) for school children and local people, particularly those in farmers' families, would be helpful. Educational material needs to be developed at a primary school level of education with photos and illustrations to make the information easy to read and understand. Distribution of the materials during a mass vaccination program could increase knowledge among farmers. We also recommend increasing vaccine production by the Livestock Research Institute in Bangladesh to increase vaccine coverage.

Increasing the number of veterinary surgeons and supportive staff in those areas will be helpful to increase the quality of veterinary services. Expansion of the veterinary extension service may help sick animals receive better treatment. Burial or incineration of carcasses can reduce soil contamination with anthrax spores. There are government rules and regulations that promulgate fines for people slaughtering sick animals with improper disposal of the carcasses.[13,14] We encourage government officials to enforce these regulations to discourage this behavior.

Acknowledgements

The authors acknowledge the contribution of the staff of the U.S. Centers for Disease Control and Prevention, Preventing Anthrax and Rabies Project, and the Division of Livestock Services.

Suggested Citation

Malakar S, Henderson A, Billah MM, Khokon MSI, Sufian MA. Factors associated with anthrax vaccination coverage in two anthrax-prone districts, Bangladesh, 2019. OSIR. 2023 Sep;16(3):139–45. doi:10.59096/osir.v16i3.265576.

References

1. Carlson CJ, Kracalik IT, Ross N, Alexander KA, Hugh-Jones ME, Fegan M, et al. The global distribution of Bacillus anthracis and associated anthrax risk to humans, livestock and wildlife. Nat Microbiol. 2019;4(8):1337–43. doi:10.1038/s41564-019-0435-4.

2. Division of Infectious Disease Epidemiology. Anthrax: surveillance and investigation protocol [Internet]. Charleston: West Virginia Office of Epidemiology and Prevention Services; 2020 Jul [cited 2020 Oct 20]. 14 p. <https://oeps.wv.gov/anthrax/documents/lhd/Anthrax_protocol.pdf>

3. Institute of Epidemiology, Disease Control and Research. List of outbreak investigation done by IEDCR in 2016–2018 [Internet]. Dhaka: Institute of Epidemiology, Disease Control and

Research: c2018 [cited 2021 Sep 16]. <https://old.iedcr.gov.bd/index.php/outbreak>

4. Sarker MSA, El Zowalaty ME, Ahosanul Haque Shahid M, Sarker MA, Rahman MB, Jarhult JD, et al. Maximization of livestock anthrax vaccination coverage in Bangladesh: An alternative approach. Vaccines. 2020 Aug 4;8(3):435. doi:10.3390/vaccines8030435.
5. Livestock Research Institute, Vaccine production. Annual reports: tested sample report of October 2020 [Internet]. Dhaka: Livestock Research Institute; 2020 Nov 25 [cited 2020 Dec 5]. <http://lri.gov.bd/site/annual_reports/fac9f38b-d3b3-422f-9a64-52adcd9e56d5/->. Bengali.
6. Rume FI. Epidemiology of anthrax in domestic animals of Bangladesh [dissertation]. Dhaka: Faculty of Biological Sciences, University of Dhaka; 2016. 38 p.
7. Rume FI, Karim MR, Ahsan CR, Yasmin M, Biswas PK. Risk factors for bovine anthrax in Bangladesh, 2010-2014: A case-control study. Epidemiol Infect. 2020 Feb 28;148:e67. doi:10.1017/S0950268820000576.
8. Bangladesh Bureau of Statistics. Preliminary report on agriculture census 2019 [Internet]. Dhaka. Bangladesh Bureau of Statistics; 2019 Oct. 68 p. <https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b343a8b4_956b_45ca_872f_4cf9b2f1a6e0/9beb0d821f582859681d77f76e89e321.pdf>
9. Pantha B, Day J, Lenhart S. Optimal control applied in an anthrax epizootic model. Journal of Biological Systems. 2016;24(4):495–517. doi:10.1142/S021833901650025X.
10. Dutta PK, Biswas H, Ahmed JU, Shakif-Ul-Azam M, Ahammed BMJ, Dey AR. Knowledge, attitude and practices (KAP) towards Anthrax among livestock farmers in selected rural areas of Bangladesh. Vet Med Sci. 2021 Sep;7(5):1648–55. doi: 10.1002/vms3.561.
11. Traxler RM, Napetvaridze T, Asanishvili Z, Geleishvili M, Rukhadze K, Maghlakelidze G, et al. Knowledge, attitudes, and practices related to anthrax and animal care: A case-control study in Georgia. PLoS One. 2019 Oct 18;14(10):e0224176. doi:10.1371/journal.pone.0224176.
12. Inglesby TV, O'Toole T, Henderson DA, Bartlett JG, Ascher MS, Eitzen E, et al. Anthrax as a Biological Weapon, 2002 Updated Recommendations for Management. JAMA. 2002; 287(17):2236–52. doi:10.1001/jama.287.17.2236.
13. Animal slaughter and meat quality control act 2011 [Internet]. Dhaka: Department of Livestock Services; 2011 [cited 2021 Feb 19]. 11 p. <http://www.dls.gov.bd/site/view/law> Bangali.
14. Animal disease act 2005 [Internet]. Dhaka: Department of Livestock Services; 2005 [cited 2023 Sep 20]. 14 p. <https://mofl.gov.bd/site/view/law/Fish-and-Livestock-related-all-laws>. Bangali.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Real-world Effectiveness of a COVID-19 Vaccine (BNT162b2) against SARS-CoV-2 Infection during the Omicron Variant Predominant Period among Thai Adolescents

Watsamon Jantarabenjakul[1,2,3]*, Natthaprang Nittayasoot[4], Thanyawee Puthanakit[1,2], Panithee Thammawijaya[4]

1 Division of Infectious Diseases, Department of Pediatrics, Chulalongkorn University, Thailand

2 Center of Excellence for Pediatric Infectious Diseases and Vaccines, Faculty of Medicine, Chulalongkorn University, Thailand

3 Thai Red Cross Emerging Infectious Disease Clinical Center, King Chulalongkorn Memorial Hospital, Thailand

4 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

*Corresponding author email: watsamon.j@chula.ac.th

Received: 11 May 2023; Revised: 29 Aug 2023; Accepted: 15 Sep 2023
https://doi.org/10.59096/osir.v16i3.262998

Abstract

This study assessed the real-world vaccine effectiveness (RVE) of a 2-dose schedule of BNT162b2 against the Omicron variant among Thai adolescents aged 12 to 18 in the Eastern Region. A test-negative matched 1:1 case-control design was conducted using nationwide records of RT-PCR tests and vaccination history. Cases were matched with controls by the specimen collection date and residential province. Conditional logistic regression was used to determine the RVE. From January to June 2022, when Omicron prevailed, 7,770 adolescents (3,758 detected and 4,012 undetected) were reported to the system. At the time of the RT-PCR test, 684 (14%), 295 (6%), 3,834 (78%), 104 (2%), and three adolescents had received no, one, two, three, and four doses of any COVID-19 vaccines, respectively. A total of 3,304 eligible adolescents with 2-dose of BNT162b2 with a median (interquartile range (IQR)) age of 16 (14–17) years were analyzed. The median (IQR) interval from the last vaccination to RT-PCR test was 91 (55–125) days. The age-adjusted RVE of BNT162b2 against infection was 22% (95% confidence interval (CI) 5–35%). The highest RVE was 71% (95% CI -9–92%), which occurred 15–29 days after vaccination. We therefore recommend that a booster dose be considered.

Keywords: COVID-19 vaccine, adolescent, Omicron, SARS-CoV-2, vaccine effectiveness

Introduction

In 2022, Omicron became the dominant circulating variant, according to the World Health Organization.[1] In Thailand, the Department of Medical Sciences reported that, since January 2022, more than 93% of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) variants were Omicron.[2] Due to the numerous mutations in the spike protein of this variant, concerns have arisen about a significant reduction in vaccine effectiveness and an increased risk for reinfections.[3–5] Immunization is a pharmaceutical intervention that can decrease the severity of diseases and reduce the risk of infection. However, the first generation of COVID-19 vaccines was developed for the ancestral strain, which may affect its real-world vaccine effectiveness (RVE).[6]

Compared to adults, adolescents experience less severe symptoms when infected with SARS-CoV-2. However, they can develop serious illnesses and complications such as respiratory failure, myocarditis, a multisystem inflammatory syndrome in children and adolescents, and long COVID-19.[7,8] The case fatality rate among Thai adolescents was 8.71% in 2021 and decreased to 0.02% in 2022. In addition, the psychosocial and emotional well-being of adolescents has been negatively affected by the COVID-19 pandemic.[9]

In Thailand, as of January 2022, five COVID-19 vaccines were available, including BNT162b2 (Pfizer BioNTech), mRNA-1273 (Moderna), AZD1222 (AstraZeneca), CoronaVac (Sinovac), and BBIBP-CoV (Sinopharm). However, Thailand primarily uses BNT162b2 in a school-based program for adolescents, with the first and second doses of the primary series implemented four weeks apart, and a booster dose offered three months later. Other vaccines were recommended to other groups, with mRNA-1273 and BBIBP-CoV provided by the private sector. As of 10 Mar 2023, 78% of the Thai population completed the primary series, 39% received a third dose, and 9% received a fourth dose, while among adolescents, 81% completed the primary series, and 25% received a booster dose.[10] Thailand has experienced several SARS-CoV-2 waves dominated by different variants, with the Omicron variant first reported at the end of 2021 and has been predominant since January 2022.[11,12] It is unknown whether the RVE of the primary series against Omicron might affect the community's decision to receive a booster dose.

This study aimed to determine the RVE of a 2-dose BNT162b2 vaccine against SARS-CoV-2 infection among Thai adolescents during Omicron predominance.

Methods

A retrospective test-negative, matched case-control study was conducted. Cases were defined as adolescents who presented to a hospital or healthcare center for SARS-CoV-2 Reverse transcriptase polymerase chain reaction (RT-PCR) testing and had a positive result (detected). Controls were defined as adolescents who tested negative (undetected) for SARS-CoV-2. SARS-CoV-2 RT-PCR results were obtained from the co-laboratory database, which is the national laboratory recording system of the Department of Medical Sciences, Ministry of Public Health (MOPH), and collected laboratory results from both public and private health facilities in Thailand.[13] Vaccination status was ascertained through the National Vaccine Registry database from the MOPH-Immunization Center, which documented vaccine product, vaccine batch, and dates of each vaccination dose.[14]

The inclusion criteria were Thai adolescents aged 12–18 years living in the Eastern Region, including Chonburi, Rayong, Chanthaburi, Trat, Chachoengsao, Prachinburi, and Sa Kaeo Provinces, who were tested by RT-PCR for SARS-CoV-2 from 1 Jan to 30 Jun 2022. Subjects were excluded if 1) the SARS-CoV-2 RT-PCR results were reported as indeterminate or inconclusive, 2) the assay type was missing, 3) there was inconsistent vaccination information, such as missing date or vaccine type, and 4) they had a history of previous SARS-CoV-2 infection within three months.[15] One control was matched to each case from a pool of adolescents who were tested within a 14-day interval and lived in the same province. If a participant had more than one positive RT-PCR result, only the first test was included when calculating the interval between the last vaccination and the RT-PCR test. If a participant had more than one negative RT-PCR result, their most recent test result was used in the matching process. Regarding vaccine exposure, the vaccine received within 14 days prior to lab collection was not counted as a vaccination dose as the peak of immune response typically takes place two weeks after vaccination.[16] Participants who had received a COVID-19 vaccine other than the 2-dose schedule of BNT162b2 were excluded because the sample size was insufficient for an evaluation of protection.

The study was approved by the institutional ethics committee of the Department of Disease Control, MOPH (letterhead: No. FWA 00013622, Ref. No. 65005) and was conducted under the tenets of the Declaration of Helsinki. All individual information was encrypted since the beginning of the data retrieval process. As we used secondary datasets from the MOPH, direct informed consent from the participants was not applicable.

The baseline characteristics of study subjects, including age and location by infection status and history of vaccination, were presented descriptively. We employed conditional logistic regression models to measure the relationship between SARS-CoV-2 infection and the vaccinated and unvaccinated groups, using the odds ratio (OR) and 95% confidence interval (CI). The final vaccine effectiveness (VE) was computed as (1 – OR) x 100%. Subgroup analyses were conducted to investigate the VE in two different age groups (12–15 and 16–18 years). If a case and control from the same matched pair were in a different age group, they were excluded from the calculation. We also examined the VE waning over time by the duration between the last vaccination to RT-PCR testing in four time periods: 15–29, 30–89, 90–179, and ≥180 days. According to the World Health Organization's sample size calculation for vaccine effectiveness for a test-negative case-control study, the study utilized an alpha value of 0.05 and a power of 80%.[17] The predicted vaccine effectiveness against SARS-CoV-2 infection was set at 30%, while the control group was expected to have a vaccine coverage of 65%. To achieve this, we needed 1,605 cases and 1,605 controls. All statistical analyses were conducted using Stata version 17 (Stata Corp., College Station, Texas).

Results

Baseline Characteristics

From January to June 2022, 7,770 adolescents were reported to the co-laboratory system (3,758 were detected, and 4,012 were undetected by RT-PCR). Among them, 4,920 eligible adolescents were included in the study, consisting of 2,460 cases and 2,460 controls. Within this group, 684 (13.9%) had not received any COVID-19 vaccine, while 295 (6.0%), 3,834 (77.9%), 104 (2.1%), and three (0.06%) had received one, two, three, and four doses, respectively. The most common regimen for primary vaccination was two doses of BNT162b2 (90.2%). In order to analyze the RVE of the 2-dose BNT162b2, a subset of 3,304 adolescents was selected, comprising 1,652 cases and 1,652 controls (Figure 1).

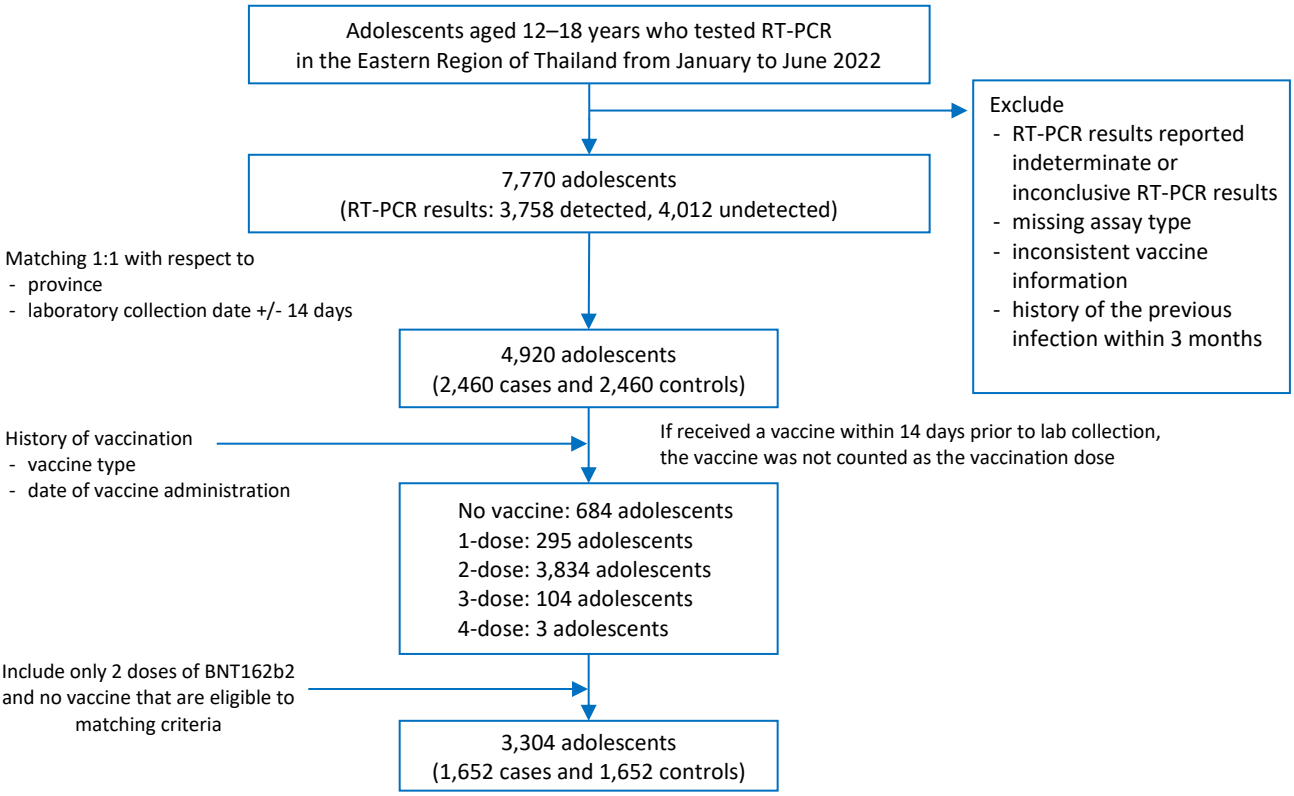


Figure 1. Flow diagram of a test-negative case-control study to determine the real-world effectiveness of 2-dose BNT162b2 against SARS-CoV-2 infection among Thai adolescents during Omicron predominance

The median (interquartile range, IQR) age was 15.8 (13.9–17.3) years, and 53.4% were aged 12–15 years. The median (IQR) interval between the last vaccination and first RT-PCR test was 91 (55–125) days (Table 1).

Table 1. Comparison of baseline characteristics of cases (RT-PCR SARS-CoV-2 detected) and controls (RT-PCR SARS-CoV-2 undetected) in the test-negative case-control study

Characteristic	Overall (n=3,304)	Cases (n=1,652)	Controls (n=1,652)	*P*-value
Age (years), median (IQR)	15.8 (13.9–17.3)	15.7 (13.9–17.3)	15.8 (13.9–17.4)	0.40
Age (years), n (%)				0.14
12–15	1,764 (53.4)	903 (54.7)	861 (52.1)	
16–18	1,540 (46.6)	749 (45.3)	791 (47.9)	
History of vaccination, n (%)				0.01
No	538 (16.3)	243 (14.7)	295 (17.9)	
Yes	2,766 (83.7)	1,409 (85.3)	1,357 (82.1)	
Interval between the last vaccination and RT-PCR test (days), n (%)				0.16
15–29	595 (18)	317 (19.2)	278 (16.8)	
30–89	1,011 (30.6)	516 (31.2)	495 (30)	
90–179	1,541 (46.6)	744 (45.1)	797 (48.2)	
≥180	157 (4.8)	75 (4.5)	82 (5)	

The geographic distribution of participants was as follows: Chonburi (40.2%), Rayong (23.5%), Prachinburi (15.3%), Chachoengsao (14.0%), Trat (4.7%), Sa Kaeo (1.4%), and Chanthaburi (0.9%). The timeline of primary vaccination with BNT162b2 and RT-PCR testing is shown in Figure 2. The first dose of BNT162b2 was administered from October to November 2021, and the second dose was delivered from October to December 2021. The peak of SARS-CoV-2 infection was in January–March 2022. No death was reported during the study period.

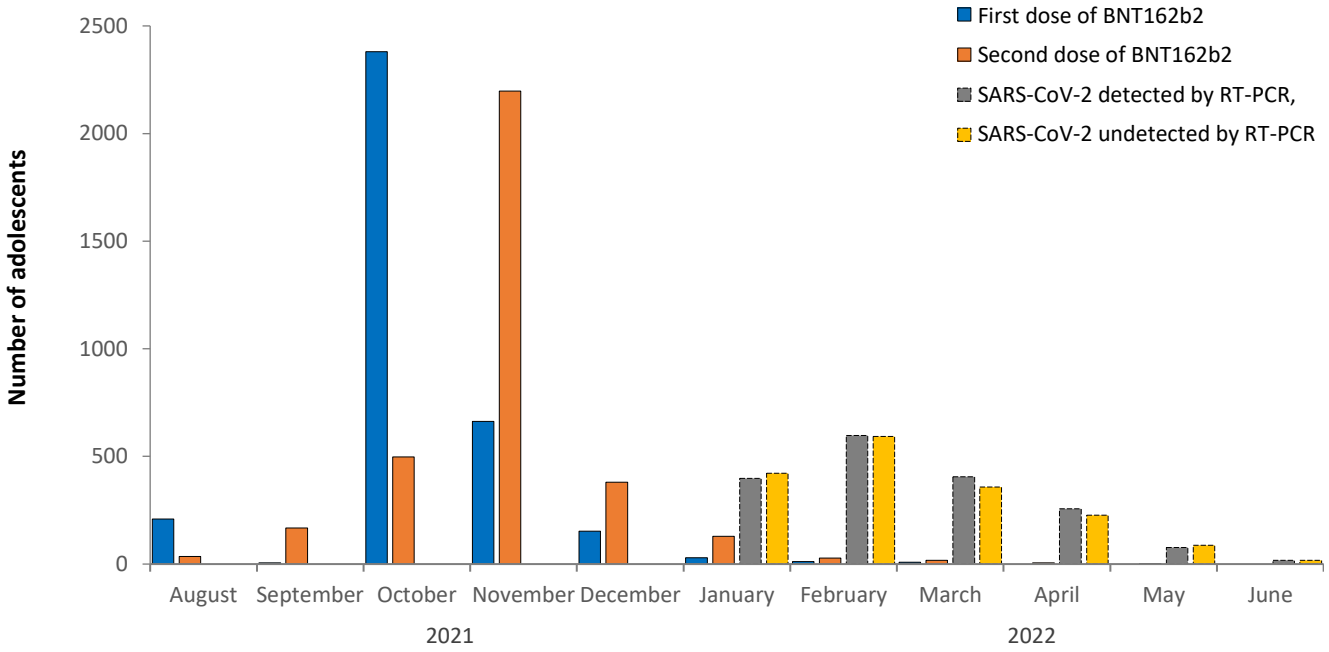


Figure 2. Timeline of the first and second BNT162b2 administration and reported RT-PCR of SARS-CoV-2 results among Thai adolescents in the Eastern Region by month

Real-world Vaccine Effectiveness of 2-dose BNT162b2 against SARS-CoV-2 Infection

The RVE (95% CI) of BNT162b2 against the Omicron infection was 22% (7–34%). Among those aged 12–15 and 16–18 years, the RVE was 19% (-16–48%) and 31% (10–46%), respectively (Table 2). After adjusting for age, the RVE (95% CI) of BNT162b was 22% (5–35%). The RVE (95% CI) against infection over time is shown in Table 3 and reached its highest point (71%) 15–29 days after vaccination.

Table 2. Vaccine effectiveness of 2-dose BNT162b2 against SARS-CoV-2 infection among Thai adolescents stratified by age group

Age group (years)	Odds ratio (95% CI)	Vaccine effectiveness (95% CI)	Vaccine effectiveness (95% CI)†
12–18	0.78 (0.66–0.93)	22% (7–34%)	22% (5–35%)
12–15	0.81 (0.52–1.26)	19% (-26–48%)	NA
16–18	0.69 (0.54–0.90)	31% (10–46%)	NA

†Age adjusted
CI: confidence interval, NA: not applicable

Table 3. Vaccine effectiveness of 2-dose BNT162b2 against SARS-CoV-2 infection among Thai adolescents stratified by the duration of last vaccination and RT-PCR test

Interval between the last vaccination and RT-PCR test (days)	Odds ratio (95% CI)	Vaccine effectiveness (95% CI)
15–29	0.29 (0.08–1.09)	71% (-9–92%)
30–89	0.94 (0.43–2.02)	6% (-100–57%)
90–179	0.66 (0.32–1.35)	37% (-35–65%)
≥180	NA	NA

NA: not applicable (no event to calculate)

Discussion

This study evaluated the RVE of a 2-dose BNT162b2 vaccine against SARS-CoV-2 infection among Thai adolescents aged 12 to 18 years in a period of Omicron predominance. The RVE was 22% and was slightly higher in older adolescents (16–18 years) than in younger ones (12–15 years). These findings are consistent with those of similar studies conducted in the United States and Singapore, which reported VE against infection ranging from 20 to 25% and VE against hospitalization ranging from 40 to 75%.[5,18] Younger adolescents had lower VE than older adolescents, which might be attributed to their less mature immune system or a different immune response to the vaccine.[19] Our findings indicate that the RVE against the Omicron variant was lower compared to the vaccine efficacy against the Alpha variant in a randomized control trial and the RVE against the Delta variant.[19,20] This difference can be attributed to several factors, including the difference in study timelines, the presence of multiple mutations in the spike protein, the increased transmissibility, and its ability to evade the immune response of the Omicron variants.[21–23]

Assessing the performance of COVID-19 vaccines post-licensure is crucial to inform decision-making on their use in national or regional vaccination strategies, including booster dose regimens and effectiveness against new emerging virus variants. This study reported a rapid decline in RVE from 71% within 30 days to values ranging from 6% to 37% after 30 days from the last vaccination. The decline in protection over time has been observed in other studies and is more accelerated with the Omicron variant compared to the Delta variant.[20] Therefore, it is important to consider administering a booster dose. A booster dose of monovalent BNT162b2 among adolescents in a national cohort from Singapore was found to have an increased RVE against Omicron infection (RVE 56%, 95% CI 53–58) and against hospitalization (RVE 94%, 95% CI 86–97%).[15] Another study from the United States reported a higher RVE against symptomatic SARS-CoV2 infection (71%, 95% CI 67–76%) among adolescents during a period of Omicron predominance after receiving a booster dose of BNT162b2.[24]

The strength of this study is the use of a national data registry that links RT-PCR testing and vaccination history; however, there are also some limitations to consider. Firstly, the lack of clinical data limited our ability to distinguish between the RVE for symptomatic or asymptomatic SARS-CoV-2 infection. Secondly, we did not have data on the immune status of participants, which may have affected the RVE in immunocompromised individuals. However, this proportion is relatively small among adolescents. Thirdly, we did not exclude adolescents with previous infection more than three months which may have affected RVE estimates. Prior SARS-CoV-2 infection can affect the estimated VE; people who haven't been vaccinated but have had a previous infection may have immunity resulting from the infection, which could lead to lower VE estimates. On the other hand, individuals who have been vaccinated and had a prior infection may have stronger protection than those who were only vaccinated, resulting in higher VE estimates. However, the Thai guideline recommended to give COVID-19 vaccines after three months of infection. Our results should therefore reflect the RVE in Thailand. Fourthly, there may be a bias between vaccinated and unvaccinated individuals for health care seeking due to the lack of randomization of vaccination, although the test-negative study is designed to minimize this potential bias. Fifthly, there is a risk of misclassification in individuals with COVID-19 who tested negative due to the timing of testing. However, the laboratory results in the study were from RT-PCR, which has high sensitivity and specificity. Lastly, our study solely evaluated the RVE of the 2-dose BNT162b2 regimen against infection, and it might have limited capability to detect the RVE of alternative regimens as well as against severe infection and mortality. Overall, while our study provides important insights into the real-world effectiveness of the BNT162b2 against the Omicron variant, further research is needed to address these limitations and provide a more comprehensive understanding of the RVE against emerging variants of SARS-CoV-2.

Public Health Action and Recommendations

This study highlights the importance of continued monitoring of real-world VE, and it is crucial to communicate the findings to the public. While the RVE of 2-dose BNT162b2 against Omicron infection is relatively low, the marginal effectiveness could provide a non-negligible impact in alleviating the risk of wide-spreading infection, given the fact that adolescents are socially active. Furthermore, it still provides protection against hospitalization and death. Additionally, several meta-analyses have shown that vaccination reduced the risk of long COVID syndrome and multisystem inflammatory syndrome in children and adolescents.[25–26] Based on the results that the rapid decline of RVE of the primary series of BNT162b2 and findings from other studies, it is recommended that a booster dose of the mRNA vaccine be administered to adolescents.[15,24] This booster dose aims to increase the

VE against emerging variants, as they may exhibit immune escape and immunity waning. The public should also be encouraged to continue practicing other preventive measures, such as wearing masks and practicing physical distancing when infectious to reduce the spread of the virus.

Conclusion

Among Thai adolescents aged 12 to 18 years, the age-adjusted RVE against confirmed COVID-19 infection (Omicron variant) after they received two doses of BNT162b2, with a median follow-up time of approximately three months, was 22% (95% CI 5–35%), which was comparable to reports from other countries. A rapid decline in protection was observed; therefore, administering a booster dose of mRNA vaccine may be necessary to enhance the vaccine's effectiveness against the Omicron variant.

Acknowledgments

We would like to thank the provincial health office of Chonburi, Rayong, Chanthaburi, Trat, Chachoengsao, Prachinburi, and Sa Kaeo Provinces, the Department of Medical Sciences, the Department of Disease Control, and the Office of the Permanent Secretary Ministry of Public Health for their invaluable support and collaboration in providing access to the data used in this study.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Funding

The authors declare that no external funding was received for the execution of this study.

Disclosure

Authors declare no conflict of interest.

Suggested Citation

Jantarabenjakul W, Nittayasoot N, Puthanakit T, Thammawijaya P. Real-world effectiveness of a COVID-19 vaccine (BNT162b2) against SARS-CoV-2 infection during the Omicron variant predominant period among Thai adolescents. OSIR. 2023 Sep;16(3):146–52. doi:10.59096/osir.v16i3.262998.

References

1. World Health Organization. Tracking SARS-CoV-2 variants [Internet]. Geneva: World Health Organization: [cited 2023 May 5]. <https://www.who.int/activities/tracking-SARS-CoV-2-variants>
2. Department of Medical Science, Ministry of Public Health. SARS-CoV-2 variants in Thailand [Internet]. Nonthaburi: Department of Medical Science: [cited 2023 Jun 20]. <https://www3.dmsc.moph.go.th/page-view/110>
3. Flores-Vega VR, Monroy-Molina JV, Jimenez-Hernandez LE, Torres AG, Santos-Preciado JI, Rosales-Reyes R. SARS-CoV-2: Evolution and emergence of new viral variants. Viruses. 2022 Mar 22;14(4):653. doi:10.3390/v14040653.
4. Andrews N, Stowe J, Kirsebom F, Toffa S, Rickeard T, Gallagher E, et al. Covid-19 vaccine effectiveness against the Omicron (B.1.1.529) variant. N Engl J Med. 2022 Apr 21;386(16): 1532–46. doi:10.1056/NEJMoa2119451.
5. Price AM, Olson SM, Newhams MM, Halasa NB, Boom JA, Sahni LC, et al. BNT162b2 protection against the Omicron variant in children and adolescents. N Engl J Med. 2022 May 19;386 (20):1899–909. doi:10.1056/NEJMoa2202826.
6. Chi WY, Li YD, Huang HC, Chan TEH, Chow SY, Su JH, et al. COVID-19 vaccine update: vaccine effectiveness, SARS-CoV-2 variants, boosters, adverse effects, and immune correlates of protection. J Biomed Sci. 2022 Oct 15;29(1):82. doi:10.1186/s12929-022-00853-8.
7. She J, Liu L, Liu W. COVID-19 epidemic: Disease characteristics in children. J Med Virol. 2020 Jul;92(7):747–54. doi:10.1002/jmv.25807.
8. Bahl A, Mielke N, Johnson S, Desai A, Qu L. Severe COVID-19 outcomes in pediatrics: An observational cohort analysis comparing Alpha, Delta, and Omicron variants. Lancet Reg Health Am. 2023 Feb;18:100405. doi:10.1016/j.lana. 2022.100405.
9. Anderson KN, Swedo EA, Trinh E, Ray C, Krause K, Verenden J, et al. Adverse childhood experiences during the COVID-19 pandemic and associations with poor mental health and suicidal behaviors among high school students-adolescent behaviors and experiences survey, United States, January-June 2021. MMWR Morb Mortal Wkly Rep 2022 Oct 14;71(41):1301–5. doi:10.15585/mmwr.mm7141a2.
10. Department of Disease Control, Ministry of Public Health. Thailand COVID-19 vaccines tracker [Internet]. Nonthaburi: Department of Disease Control; [cited 2023 Jun 20]. <https://ddc.moph.go.th/vaccine-covid19/pages/%E0%B8%A3%E0%B8%B2%E0%B8%A2%E0%B8%87%E0%B8%B2%E0%B8%99%E0%B8%84%E0%B8%A7%E0%B8%B2%E0%B8%A1%E0%B8%81%E0%B9%89%E0%B8%B2%E0%B8%A7%E

0%B8%AB%E0%B8%99%E0%B9%89%E0%B8%B2%E0%B8%81%E0%B8%B2%E0%B8%A3%E0%B9%83%E0%B8%AB%E0%B9%89%E0%B8%9A%E0%B8%A3%E0%B8%B4%E0%B8%81%E0%B8%B2%E0%B8%A3%E0%B8%89%E0%B8%B5%E0%B8%94%E0%B8%A7%E0%B8%B1%E0%B8%84%E0%B8%8B%E0%B8%B5%E0%B8%99%E0%B9%82%E0%B8%84%E0%B8%A7%E0%B8%B4%E0%B8%94-19>. Thai.

11. Puenpa J, Rattanakomol P, Saengdao N, Chansaenroj J, Yorsaeng R, Suwannakarn K, et al. Molecular characterization and tracking of severe acute respiratory syndrome coronavirus 2 in Thailand, 2020-2022. Arch Virol. 2023 Jan 3;168(1):26. doi:10.1007/s00705-022-05666-6.

12. Department of Medical Sciences. SARS-CoV-2 variants in Thailand surveillance data by Department of Medical Sciences [dataset on the Internet]. Nonthaburi: Department of Medical Sciences: 2022 Oct 18 [cited 2023 May 5]. <https://dmsc.gdcatalog.go.th/dataset/sars-cov-2-variants/resource/>.

13. Department of Medical Sciences. National laboratory recording system [Internet]. Nonthaburi: Department of Medical Sciences: [cited 2023 Jul 1]. <https://service.dmsc.moph.go.th/reportcovid19/labsend/login/>

14. Ministry of Public Health. MOPH immunization center dashboard [Internet]. Nonthaburi: Ministry of Public Health: [cited 2023 Jul 1]. <https://cvp1.moph.go.th/dashboard>

15. National Center for Immunization and Respiratory Diseases, Division of Viral Diseases. Overview of Testing for SARS-CoV-2, the virus that causes COVID-19 [Internet]. Atlanta: U.S. Center for Disease Control and Prevention: [cited 2023 May 5] <https://www.cdc.gov/coronavirus/2019-ncov/hcp/testing-overview.html>

16. Poland GA, Ovsyannikova IG, Kennedy RB. SARS-CoV-2 immunity: review and applications to phase 3 vaccine candidates. Lancet. 2020 Nov 14;396(10262):1595–606. doi:10.1016/S0140-6736(20)32137-1.

17. World Health Organization. Sample size calculator for evaluation of COVID-19 vaccine effectiveness (excel) [Internet]. Geneva: World Health Organization: 2021 Mar 17 [cited 2022 Jul 10]. <https://apps.who.int/iris/rest/bitstreams/1337428/retrieve>

18. Chiew CJ, Premikha M, Chong CY, Wei WE, Ong B, Lye DC, et al. Effectiveness of primary series and booster vaccination against SARS-CoV-2 infection and hospitalisation among adolescents aged 12-17 years in Singapore: a national cohort study. Lancet Infect Dis. 2023 Feb;23(2):177–82. doi:10.1016/S1473-3099(22)00573-4.

19. Frenck RW Jr, Klein NP, Kitchin N, Gurtman A, Absalon J, Lockhart S, et al. Safety, immunogenicity, and efficacy of the BNT162b2 Covid-19 vaccine in adolescents. N Engl J Med. 2021 Jul;385(3):239–50. doi:10.1056/NEJMoa2107456.

20. Oliveira CR, Niccolai LM, Sheikha H, Elmansy L, Kalinich CC, Grubaugh ND, et al. Assessment of clinical effectiveness of BNT162b2 COVID-19 vaccine in US adolescents. JAMA Netw Open. 2022 Mar 1;5(3):e220935. doi:10.1001/jamanetworkopen.2022.0935.

21. Andrews N, Stowe J, Kirsebom F, Toffa S, Rickeard T, Gallagher E, et al. Covid-19 vaccine effectiveness against the Omicron (B.1.1.529) variant. N Engl J Med. 2022 Apr 21; 386(16):1532–46. doi:10.1056/NEJMoa2119451.

22. Iketani S, Liu L, Guo Y, Liu L, Chan JF, Huang Y, et al. Antibody evasion properties of SARS-CoV-2 Omicron sublineages. Nature. 2022 Apr; 604(7906):553–6. doi:10.1038/s41586-022-04594-4.

23. Liu L, Iketani S, Guo Y, Chan JF, Wang M, Liu L, et al. Striking antibody evasion manifested by the Omicron variant of SARS-CoV-2. Nature. 2022 Feb;602(7898):676–81. doi:10.1038/s41586-021-04388-0.

24. Fleming-Dutra KE, Britton A, Shang N, Derado G, Link-Gelles R, Accorsi EK, et al. Association of prior BNT162b2 COVID-19 vaccination with symptomatic SARS-CoV-2 infection in children and adolescents during Omicron predominance. JAMA. 2022 Jun 14;327(22):2210–9. doi:10.1001/jama.2022.7493.

25. Watanabe A, Iwagami M, Yasuhara J, Takagi H, Kuno T. Protective effect of COVID-19 vaccination against long COVID syndrome: A systematic review and meta-analysis. Vaccine. 2023;41(11): 1783–90. doi:10.1016/j.vaccine.2023.02.008.

26. Zambrano LD, Newhams MM, Olson SM, Halasa NB, Price AM, Boom JA, et al. Effectiveness of BNT162b2 (Pfizer-BioNTech) mRNA vaccination against multisystem inflammatory syndrome in children among persons aged 12-18 years - United States, July-December 2021. MMWR Morb Mortal Wkly Rep. 2022 Jan 14;71(2):52–8. doi:10.15585/mmwr.mm7102e1.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Evaluation of a Hospital-based Hypertension Screening Program in Seven Hospitals in Thailand

Rawinan Soma[1]*, Hirunwat Praekunatham[2], Phanthanee Thitichai[1]

1 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

2 Division of Occupational and Environmental Disease, Department of Disease Control, Ministry of Public Health, Thailand

*Corresponding author email: rawinan.soma@gmail.com

Received: 3 Aug 2021; Revised: 11 Sep 2023; Accepted: 22 Sep 2023
https://doi.org/10.59096/osir.v16i3.263774

Abstract

The Department of Disease Control in Thailand piloted an intervention program at seven hospitals around the country for screening hypertension during May–September 2019. The intervention focused on implementing a guideline for managing patients with raised blood pressure. The guideline included provision of a blood pressure notification and follow-up book and conducting meetings to communicate them to the hospital representative, aim for enhancing patient coverage and reducing the risks from persistent hypertension. An evaluation was conducted to assess the effectiveness of the program and identify weaknesses. The evaluation consisted of quantitative and qualitative methods. A comparison of the proportion of newly diagnosed hypertensive patients among patients who had raised blood pressure before and after implementation of the intervention was performed. Healthcare workers in each hospital were interviewed about the work process of the program. The overall proportion of newly diagnosed hypertensive patients increased by 1.1% after the intervention (range: -11.7 to 2.9%). The practice compared between pre- and post-intervention did not have difference as expected. From the qualitative interviews, healthcare workers believed that the decision to make a follow-up appointment rested solely with the physician. Physicians tended to make appointments at one month because of their high workload. Adequate orientation of the guideline and providing robust and feasible processes were essential for the program's success. Monitoring and evaluation should be done periodically to ensure protocol adherence.

Keywords: hospital-based screening, hypertension screening, hypertension diagnosis, program evaluation

Introduction

Hypertension is a condition in which blood vessels have persistently raised pressure. Raised blood pressure (RBP) is defined as a systolic blood pressure (SBP) ≥140 millimetres of mercury (mmHg) or a diastolic blood pressure (DBP) ≥90 mmHg.[1,2] Globally, 1.4 billion adults have raised blood pressure; however, less than 21% of them have blood pressure controlled within normal range after the treatment.[3] From a couple of survey globally, undiagnosed hypertension patients were account for 5.3–50% and left untreated.[4–8] Persistent RBP or hypertension can increase the risk of cardiovascular diseases (CVDs), which are a leading cause of death. It is estimated that 17.9 million people died from CVDs in 2016, representing 31% of all global deaths, mainly due to heart attack and stroke.[3]

In 2016, the fifth Thai National Health Examination Survey revealed that the number of RBP patients (aged above 15 years) was around 13.3 million, which is a prevalence of 24.7%.[9] Among this group, 5.9 million (44.7%) had undiagnosed hypertension. According to the Thai Ministry of Public Health in the 2018 fiscal year, approximately 44 million people in Thailand visited hospitals and had their blood pressure measured, of which about 11 million had RBP and 65% had not yet been diagnosed as hypertension.[10] This vulnerable group tends to experience inappropriate management (including diagnosis), follow up, and treatment.

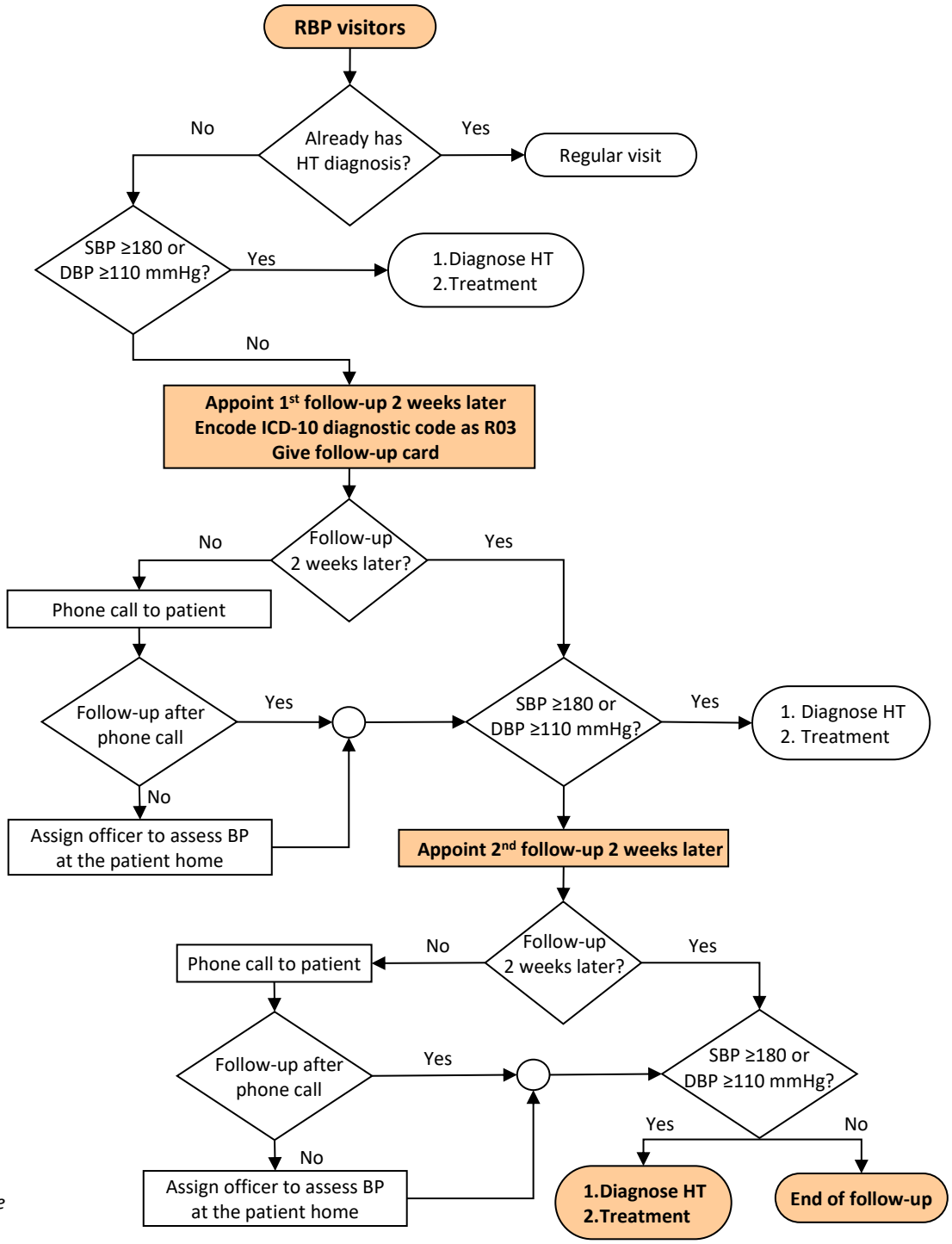
A previous study from Thailand was able to increase hypertension diagnoses during hospital visits using interventions such as notification of RBP through

healthcare personnel's interface to reduce unrecognised RBP visitors, and the introduction of a "follow up book" to reduce the loss to follow-up rate.[11] The rate of newly diagnosis hypertension increased by 15.4% after the intervention.

Subsequently, a hospital-based hypertension screening program was established by the Department of Disease Control for enhancing RBP patient coverage and reducing the risks from persistent hypertension.[12]

The major intervention of this program is the developing of management guideline for RBP visitors. The management flowchart is shown in Figure 1.

The program was started since May 2019 in many hospitals in the central region of Thailand.[12] Along with the program implementation, to assess the effectiveness of this guideline and find opportunities for improvement, the program required a post-implementation evaluation.



HT: hypertension
RBP: raised blood pressure
SBP: systolic blood pressure
DBP: diastolic blood pressure
BP: blood pressure
ICD-10: International Classification of Diseases, tenth revision
R03: ICD-10 code R03 for abnormal blood-pressure reading, without diagnosis

Figure 1. RBP management flowchart (adapted from guideline for raised blood pressure visitor management for healthcare personnel, Division of Non-communicable Diseases, Department of Disease Control, 2019)

Methods

Study Design

This evaluation was a cross-sectional study consisting of two parts: a quantitative analysis and qualitative interviews. In the quantitative part, we compared the proportions of newly diagnosed hypertension patients among all raised blood pressure patients between pre- and post-program implementation. The period of data collection was from the start of the program in May 2019 until the program evaluation. We also collected data in the same period in 2018 (before the program started), for comparative purposes. The data collection period for each hospital differed depending on the starting of program implementation and we evaluated the program one month after the implementation.

In the qualitative part, healthcare personnel including physicians, screening nurses, non-communicable disease (NCD)-care team leaders, public health officers or NCD-related job titles were interviewed with open-ended questionnaires. Topics discussed consisted of orientation and distribution of the guideline in the workplace, recognition of RBP patients during hospital visits, follow-up practices and management, and diagnosis practices.

Program evaluation purposely selected in seven hospitals and across four provinces in the central region of Thailand. The selected hospitals included small-sized hospitals (fewer than 50 beds), medium-sized hospitals (60–100 beds) and large-sized hospitals (greater than 100 beds). In this study, only one large hospital, hospital "A" (328 beds), and one medium hospital, hospital "B1" (65 beds), were selected. The rest of the selected hospitals, namely hospital "S" (48 beds), hospital "BS" (30 beds), hospital "B2" (27 beds), hospital "BB" (26 beds), and hospital "P" (18 beds) were classified as small-sized. The study population for the quantitative study included all hospital visitors who had a blood pressure equal to or greater than 140/90 mmHg at their visit. We excluded visitors who had already been diagnosed with hypertension before the study period. Pregnant women and those aged less than 15 years were also excluded.

Operational Definitions

A hypertensive patient in this study included any patient with one of the following: the international classification of diseases, tenth revision (ICD-10) diagnostic codes recorded in the hospital database: I10 (Essential hypertension), I11 (Hypertensive heart disease), I12 (Hypertensive chronic kidney disease), I13 (Hypertensive heart and chronic kidney disease), and I15 (Secondary hypertension).[13]

Blood pressure status in this study was divided into four levels based on the 2019 Thai guideline on the treatment and diagnosis of hypertension: (1) isolated systolic hypertension; SBP ≥140 mmHg and DBP <90 mmHg, (2) stage 1 hypertension; SBP 140–159 or DBP 90–99 mmHg, (3) stage 2 hypertension; SBP 160–179 or DBP 100–109 mmHg, and (4) stage 3 hypertension; SBP ≥180 or DBP ≥110 mmHg.[14]

A newly diagnosed hypertensive patient was defined as a hypertensive patient who was first diagnosed with an ICD-10 code I10 to I15 (Hypertension and related condition) in the hospital database during the study period.

Data Collection and Variables

All data were extracted from electronic medical records in each hospital database. Selected variables included hospital number, gender, date of birth, weight, height, visit date, underlying disease, and residential address. Data were collected once in the evaluation period and separated into a pre-implementation and post-implementation dataset. The data of patients with multiple visits should be treated by selecting the latest date of patient visit. In the process of data cleaning, weight, height and blood pressure were verified for validity. A weight in the range of 30–130 kilograms, height in the range of 100–200 centimetres, systolic blood pressure level in the range of 60–220 mmHg and diastolic blood pressure in the range of 40–120 mmHg were defined as valid. A patient with any level outside these valid ranges were excluded from the analysis.

Data Analysis

Continuous variables were presented descriptively using medians with interquartile ranges. Categorical variables were presented using proportions. The main outcome of the program was calculated as the proportion of newly diagnosed hypertensive patients among all RBP patients. We compared the proportions between pre- and post-implementation using a chi-square test. The statistically significant level (α) was set as 0.05. Python version 3.8.5 was used for data analysis.

Results

Characteristics of Study Population

The medical records of 123,552 patients with RBP were identified and extracted from the seven study hospitals. After data were cleaned and duplications were deleted, 36,324 patients were identified as RBP, of which 17,650 (48.6%) and 18,674 (51.4%) were reported in 2018 (pre-implementation) and 2019 (post-implementation), respectively.

The demographic characteristics of the pre- and post-implementation study population is shown on Table 1. Males accounted for 48.0–48.2% of the RBP patients. The median age was 56 years (Q1–Q3: 34–78) and 57 years (Q1–Q3: 35–79) in 2018 and 2019, respectively. Most were aged 60 years and older. At the hospital visit, 69% of the patients were diagnosed with isolated systolic hypertension, followed by stage 1 hypertension (27.6–27.7%) and stage 2 hypertension (2.6–2.7%) whereas stage 3 hypertension was detected in 0.5–0.6%. Approximately 5% had diabetes and dyslipidemia. When comparing between 2018 and 2019, there were no differences in the distribution of RBP patients by age, gender, body mass index, blood pressure level, and comorbidities.

Table 1. A comparison of characteristics of RBP patients between pre- and post-implementation of a hospital-based intervention program

Characteristics	Pre-implementation (n=17,650)		Post-implementation (n=18,674)	
	Number of patients	Percent	Number of patients	Percent
Age				
Median	56		57	
Interquartile range (Q1–Q3)	22 (34–78)		22 (35–79)	
Age group (years)				
15–44	4,810	27.3	4,863	26.0
45–60	5,705	32.3	5,924	31.7
>60	7,135	40.4	7,887	42.2
Gender				
Male (%)	8,479	48.0	8,995	48.2
BMI				
Median	25		25	
Interquartile range (Q1–Q3)	6.2 (22.2–28.4)		6.2 (22.1–28.3)	
BMI categories				
Underweight	1,002	5.7	1,022	5.5
Normal	4,568	25.9	4,932	26.4
Pre-obese	3,213	18.2	3,407	18.2
Obesity level 1	5,826	33.0	6,127	32.8
Obesity level 2	3,041	17.2	3,186	17.1
Blood pressure status at visit				
Isolated systolic hypertension	12,231	69.3	12,895	69.1
Stage 1	4,881	27.7	5,156	27.6
Stage 2	453	2.6	510	2.7
Stage 3	85	0.5	113	0.6
Comorbidities				
Diabetes	943	5.3	988	5.3
Dyslipidemia	1,031	5.8	1,088	5.8

BMI: body mass index

Main Outcome: Newly Diagnosed Hypertension among RBP Patients

Overall, the proportion of newly diagnosed hypertensive patients across all seven hospitals increased significantly from 8.5% (1,389/16,261) in 2018 to 9.6% (1,637/17,037) in 2019 (p <0.01). As shown in Table 2, four of the seven selected hospitals demonstrated an increase, of which one was statistically significant. In contrast, three hospitals demonstrated a decrease, of which one was statistically significant.

Table 2. Comparison of the proportion of newly diagnosed hypertension patients among RBP patients by selected hospitals

Hospitals	No. of beds	Period of data collection	Pre-implementation (2018)			Post-implementation (2019)			Difference (%)	*P*-value
			No. of RBP patients	No. of diagnosis	Percent (%)	No. of RBP patients	No. of diagnosis	Percent (%)		
B1	65	June–September	4,591	561	12.2	5,467	826	15.1	2.9	<0.001
BS	30	June–September	2,242	184	8.2	2,335	216	9.3	1.0	0.125
S	48	June–September	1,005	79	7.9	1,166	100	8.6	0.7	0.578
A	328	July–September	2,305	104	4.5	2,009	95	4.7	0.2	0.747
P	18	June–September	4,434	208	4.7	4,283	190	4.4	-0.3	0.586
B2	27	August–September	1,310	150	11.5	1,430	155	10.8	-0.6	0.650
BB	26	August–September	374	103	27.5	347	55	15.9	-11.7	<0.001
Totals			**16,261**	**1,389**	**8.5**	**17,037**	**1,637**	**9.6**	**1.1**	**0.002**

Stage 3 Hypertension

Based on the 2019 Thai guideline on the treatment and diagnosis of hypertension, undiagnosed stage 3 hypertension patients needed to get hypertension diagnosis and treatment at visit. As shown in Table 3, 36–37% of patients who were classified as stage 3 hypertension received a diagnosis as hypertension and received treatment to control their blood pressure (31/85 in 2018 versus 42/113 in 2019). However, the proportions among patients with stage 3 hypertension and received diagnosis ranged from 14.3–60.0% versus 21.4–50.0% in 2018 and 2019, respectively.

Table 3. Comparison of the proportion of newly diagnosed hypertension patients among RBP patients with stage 3 hypertension by selected hospitals

Hospitals	Pre-implementation			Post-implementation		
	No. of RBP patients with stage 3 hypertension	No. of diagnosis	Percent (%)	No. of RBP patients with stage 3 hypertension	No. of diagnosis	Percent (%)
A	14	2	14.3	14	5	35.7
BB	4	1	25.0	2	1	50.0
B1	20	12	60.0	51	24	47.1
B2	9	4	44.4	14	3	21.4
BS	21	6	28.6	12	3	25.0
P	5	3	60.0	8	3	37.5
S	12	3	25.0	12	3	25.0
Total	**85**	**31**	**36.5**	**113**	**42**	**37.2**

Assessment of RBP Practices among Healthcare Personnel

Orientation of the guideline

The RBP management guideline was distributed to all seven selected hospitals. However, only three could participate in the orientation meeting held by the Division of Non-communicable Diseases, Department of Disease Control in May 2019. During implementation, influenced by NCD-care team leaders of each hospital, the management of RBP patients varied among the selected hospitals. This issue also affected the time at the commencement of program implementation. Thus, "B1" gained the highest increase in diagnosis, the staff from hospital "B1" said they had communicated with the program manager about the guideline and management protocol.

Recognition of RBP during visits

Patients' blood pressure levels were measured by the screening officers. Four of the seven hospitals had some notification methods when RBP patients were

detected. For example, a small sticky note was used as a notification by being written down and attached with the patients' medical records. "Blood pressure" box was highlighted on the computer screen for the screening staff when blood pressure values were above 160/90 mmHg. However, no notification pop up was shown on the screen for physicians in all the selected hospitals. When the blood pressure of RBP visitors reached 180/110 mmHg, all hospitals had a special "fast track" to send them to the emergency room immediately after detection.

Follow-up practices

Physicians played a key role to determine whether patients needed to be followed up. Because of their high daily workload, most physicians tended to follow up RBP patients with a blood pressure ≥160/90 mmHg and set a follow-up period as around one month. Officers from hospital "B1" stated that they had separate records for the enrolled RBP patients who needed to be followed up and gave them special appointment cards. The special card includes the patient's information so that the RBP patients were able to follow up their blood pressure at other health facilities. Furthermore, the card provided useful advice for the patients in case their blood pressure became elevated or if they developed other suspicious symptoms. When patients with RBP were detected, the responsible staff from all seven hospitals did not use the ICD-10 code R03: "Abnormal blood-pressure reading, without diagnosis", to track down the patients. However, all seven hospitals worked in collaboration with village health volunteers to follow up patients, assess blood pressure and report the results to the hospital.

Diagnosis practices

Physicians from all the hospitals have a crucial role for making the definite hypertension diagnosis for the incoming visitors. All interviewed physicians also stated that they followed the 2019 Thai guideline on the treatment and diagnosis of hypertension, announced by Thai Hypertension Society.[14]

Discussion

It was found that the proportion of newly diagnosed hypertension significantly increased after implementation of a hospital-based intervention program, although the increase was small (1.1%). This indicates that this intervention involving only guideline distribution and one meeting could not yield impressive results. Therefore, the success of intervention required good communication and coordination as well as support from the policy level.[8,15] However, in one hospital ("B1"), the increase was 2.9%, which was statistically significant, and suggests that the implementation of the guideline into RBP management practices was partially successful. This particular hospital has good internal communication and collaboration and has meticulous RBP case recognition and detection methods.[15] Moreover, systems developed for RBP registration using separate records and case follow-up were effectively conducted. A special appointment card would be one of the practical ways to help adherence to the follow-up process.

According to the result, RBP patients were recognized manually by responsible staff using sticky notes. Meanwhile, hospital information software only provided minimal highlights in exceeding blood pressure value but did not have recognition aid like automatic label or notification pop up box. So, a computer-based recognition support system could be beneficial in this situation. From the result, almost all the selected hospitals did not have effective ways to detect and register high number of RBP patients which visited the hospital. Integration of clinical decision support system (CDSS) in hospital information systems might improve recognition and detection of raised blood pressure patients on visits by establishing visual-aid pop-up when RBP patient was found, or automatically label 1st visit of RBP patient as R03 for further follow-up and assessment. From the systematic review, CDSS provides diagnostic support based on patient data, and automating output from history taking and physical examination.[13,16] Moreover, CDSS lead to automated workflow improvement; they could deliver solutions for detection, recognition, and diagnosis.

Due to their high workload, physicians usually make an appointment with the patients with stage 2 and 3 hypertension (blood pressure ≥160/90 mmHg) to follow up the blood pressure level. Therefore, stage 1 or isolated systolic hypertension patients tended to be ignored by the healthcare staff to reassess the blood pressure. Since these patients account for about 90% of all RBP patients, this could affect the actual number of newly diagnosed hypertension patients. From a couple of studies, isolated systolic hypertension and stage 1 hypertension accounted for morbidity and mortality from cardiovascular disease or cerebrovascular disease latterly.[17–20]

This study has some limitations. We relied on the diagnosis based on electronic hospital medical records. We could have missed some of the RBP patients who follow up their blood pressure at health facilities outside the hospital. Secondly, all hospitals did not start the intervention in the same period, which means we could not compare the results from each hospital directly. Moreover, this could result in a slightly lower number of newly diagnosed hypertension patients.

Recommendations

We recommend hospitals develop a "Raised Blood Pressure" recognition system, e.g., a pop-up notification on the physician's computer screen, or highlight blood pressure notification, to increase RBP recognition and detection in the hospital setting. RBP patients who need follow up should be systematically labelled in hospital databases, such as ICD-10 encoding as R03 or registered in separate records. At the policy level, feasible tools or specific interventions should be provided along with the guideline. The monitoring and evaluation should be periodically conducted to ensure all implemented hospital practices adhere to the guideline and remove barriers or obstacles of program success.

Acknowledgements

We would like to thank the Division of Non-Communicable Diseases, Regional Office of Disease Prevention and Control, Provincial Health Office and hospital staff for providing data and for their collaboration.

Suggested Citation

Soma R, Praekunatham H, Thitichai P. Evaluation of a hospital-based hypertension screening program in seven hospitals in Thailand. OSIR. 2023 Sep;16(3):153–60. doi:10.59096/osir.v16i3.263774.

References

1. World Health Organization. Hypertension: overview [Internet]. Geneva: World Health Organization; [cited 2022 May 16]. <https://www.who.int/health-topics/hypertension#tab=tab_1>
2. World Health Organization. High blood pressure-measure accurately, control it and live longer [Internet]. Geneva: World Health Organization; 2022 May 16 [cited 2022 Sep 15]. <https://www.who.int/srilanka/news/detail/16-05-2022-high-blood-pressure---measure-accurately--control-it-and-live-longer>
3. World Health Organization. Cardiovascular diseases (CVDs) [Internet]. Geneva: World Health Organization; 2021 Jun 11 [cited 2022 Sep 15]. <https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)>
4. Chow CK. Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. JAMA. 2013;310(9):959. doi:10.1001/jama.2013.184182.
5. Nwankwo T, Yoon SS, Burt V, Gu Q. Hypertension among adults in the United States: national health and nutrition examination survey, 2011–2012. NCHS data brief. 2013 Oct;133:1–8.
6. Islam FMA, Bhuiyan A, Chakrabarti R, Rahman MA, Kanagasingam Y, Hiller JE. Undiagnosed hypertension in a rural district in Bangladesh: The Bangladesh population-based diabetes and Eye Study (BPDES). J Hum Hypertens. 2016 Apr;30(4):252–9. doi:10.1038/jhh.2015.65.
7. Najafipour H, Nasri HR, Rostamzadeh F, Amirzadeh R, Shadkam M, Mirzazadeh A. Prevalence and incidence of pre-hypertension and hypertension (awareness/control) in Iran: Findings from Kerman Coronary Artery Diseases Risk Factors Study 2 (KERCADRS). J Hum Hypertens. 2020 May;36(5):461–72. doi:10.1038/s41371-020-00392-5.
8. Huguet N, Larson A, Angier H, Marino M, Green BB, Moreno L, et al. Rates of undiagnosed hypertension and diagnosed hypertension without anti-hypertensive medication following the Affordable Care Act. Am J Hypertens. 2021 Sep 22;34(9):989–98. doi:10.1093/ajh/hpab069.
9. Aekplakorn W, editor. 5th Thai national health examination survey. Nonthaburi: Health System Research Institute; 2016 Nov 1. 283 p. Thai.
10. Health data center database [Internet]. Nonthaburi: Ministry of Public Health; 2018 [cited 2022 May 16]. <https://hdcservice.moph.go.th/hdc/main/index.php>. Thai.
11. Yueayai, K, Moran, AE, Pratipanwat, P, Chaisongkram, S, Anosri, L, Thitichai, P. Hospital-based intervention to enhance hypertension diagnosis in hospital K, Thailand, 2017-2019: A pre-post pilot intervention study. J Clin Hypertens. 2020 Aug;22(8):1310–20. doi:10.1111/jch.13953.
12. Guideline for raised blood pressure visitor management for healthcare personnel. Nonthaburi: Division of Non-communicable diseases, Department of Disease Control; 2019. 12 p. Thai.
13. World Health Organization. (2004). ICD-10: international statistical classification of diseases and related health problems: tenth revision, 2nd ed. Geneva: World Health Organization; 2004.

14. Thai Hypertension Society. 2019 Thai guidelines on the treatment of hypertension [Internet]. Bangkok: Thai Hypertension Society; 2022 Apr [cited 2022 May 16]. 78 p. <http://www.thaihypertension.org/files/HT%20guideline%202019.with%20watermark.pdf>. Thai.

15. Meador M, Osheroff JA, Reisler B. Improving identification and diagnosis of hypertensive patients hiding in plain sight (HIPS) in health centers. Jt Comm J Qual Patient Saf. 2018 Mar;44(3):117–29. doi:10.1016/j.jcjq.2017.09.003.

16. Sutton RT, Pincock D, Baumgart DC, Sadowski DC, Fedorak RN, Kroeker KI. An overview of clinical decision support systems: Benefits, risks, and strategies for success. NPJ Dig Med. 2020;3(1):17. doi:10.1038/s41746-020-0221-y.

17. Atasoy S, Middeke M, Johar H, Peters A, Heier M, Ladwig KH. Cardiovascular mortality risk in young adults with isolated systolic hypertension: findings from population-based Monica/Kora cohort study. J Hum Hypertens. 2021 Dec;36(12):1059–65. doi:10.1038/s41371-021-00619-z.

18. Yano Y, Stamler J, Garside DB, Daviglus ML, Franklin SS, Carnethon MR, et al. Isolated systolic hypertension in young and middle-aged adults and 31-year risk for cardiovascular mortality. J Am Coll Cardiol. 2015;65(4):327–35. doi:10.1016/j.jacc.2014.10.060.

19. Peng X, Jin C, Song Q, Wu S, Cai J. Stage 1 hypertension and the 10-year and lifetime risk of cardiovascular disease: A prospective real-world study. J Am Heart Assoc. 2023 Apr 4;12(7):e028762. doi:10.1161/jaha.122.028762.

20. Antikainen R, Jousilahti P, Tuomilehto J. Systolic blood pressure, isolated systolic hypertension and risk of coronary heart disease, strokes, cardiovascular disease and all-cause mortality in the middle-aged population. J Hypertens. 1998 May;16(5):577–83. doi:10.1097/00004872-199816050-00004.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Association between Needlestick and Sharps Injury with Long Working Hours among Nurses in Thailand

Paninee Panyakarn[1]*, Pantila Taweewigyakarn[1], Rapeepong Suphanchaimat[2], Krisada Sawaengdee[3]

1 Field Epidemiology Training Program, Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

2 International Health Policy Program, Ministry of Public Health, Thailand

3 Thailand Nursing and Midwifery Council, Thailand

*Corresponding author email: panineepanyakarn@gmail.com

Received: 27 Jul 2023; Revised: 11 Sep 2023; Accepted: 22 Sep 2023
https://doi.org/10.59096/osir.v16i3.264393

Abstract

Needlestick and sharps injury (NSSI) is a significant public health problem. The objective of this study was to describe NSSI among Thai nurses from 2012–2021 and explore the association between long working hours and NSSI. We used data from the Health Data Center of the Ministry of Public Health and the 2012 Thai Nurse Cohort Study. Multiple logistic regression was used to assess the association between long working hours (more than 12 hours/day or more than 40 hours/week) and NSSI. The prevalence of NSSI among nurses increased between 2012 and 2021. Long working hours was significantly associated with NSSI (adjusted odds ratio 1.5, 95% confidence interval 1.3–1.8). Policies to regulate long working hours and excessive work shifts should be implemented.

Keywords: needlestick and sharps injury, registered nurses, long working hours, Thai nurses

Introduction

Occupational hazard is a health condition that occurs from work activities.[1] It leads to health risks, and also causes losses in global gross domestic product of approximately 4–6% annually.[2,3] According to the World Health Organization, nursing and midwifery have the largest volume of health care workers (HCW) worldwide.[4–8] In the past decade, needlestick and sharps injury (NSSI) has been one of the major occupational hazards and the number of nurses affected by NSSI has been increasing.[9–13] Infections resulting from needlestick injuries include hepatitis B and C and HIV.[14,15]

According to previous studies, nurses are at greater risk of NSSI than other types of HCW.[16,17] The Institute of Occupational Safety and Health found that more than 12 hours on duty could affect a worker's performance and alertness and can also affect patient safety.[18–22] Evidence suggested that long working hours (more than 12 hours/day or more than 40 hours/week) were an important risk factor for accidents.[22] NSSI among HCW in newly industrialized countries mostly occurred in hospital wards, especially medicine wards.[23–25]

In Thailand, there is limited evidence on the prevalence of NSSI and its risk factors. Therefore, the objective of this study was to describe NSSI among Thai nurses and to explore the association between NSSI and long working hours.

Methods

Study Design

Data from two data sources were used in this study, namely, the Health Data Center (HDC) database and the 2012 Thai Nurse Cohort Study (TNCS).

The HDC of the Ministry of Public Health contains a large amount of health service data of the Thai population, mostly from public health facilities, with a

small portion of data from private health facilities. We extracted the data from the HDC on 30 Dec 2021, to describe the current situation and trend of NSSI during 2012–2021. A cross-sectional study design was used to describe the types of injuries that occurred. We focused on the following ICD-10 codes: W46 (contact with a hypodermic needle), W27 (contact with a nonpowered hand tool) and T14 (injury unspecified). Other variables included age, gender, marital status, job title (physician, nurse, dentist, pharmacist), and workplace. Figure 1 shows the data extraction flow and data management process.

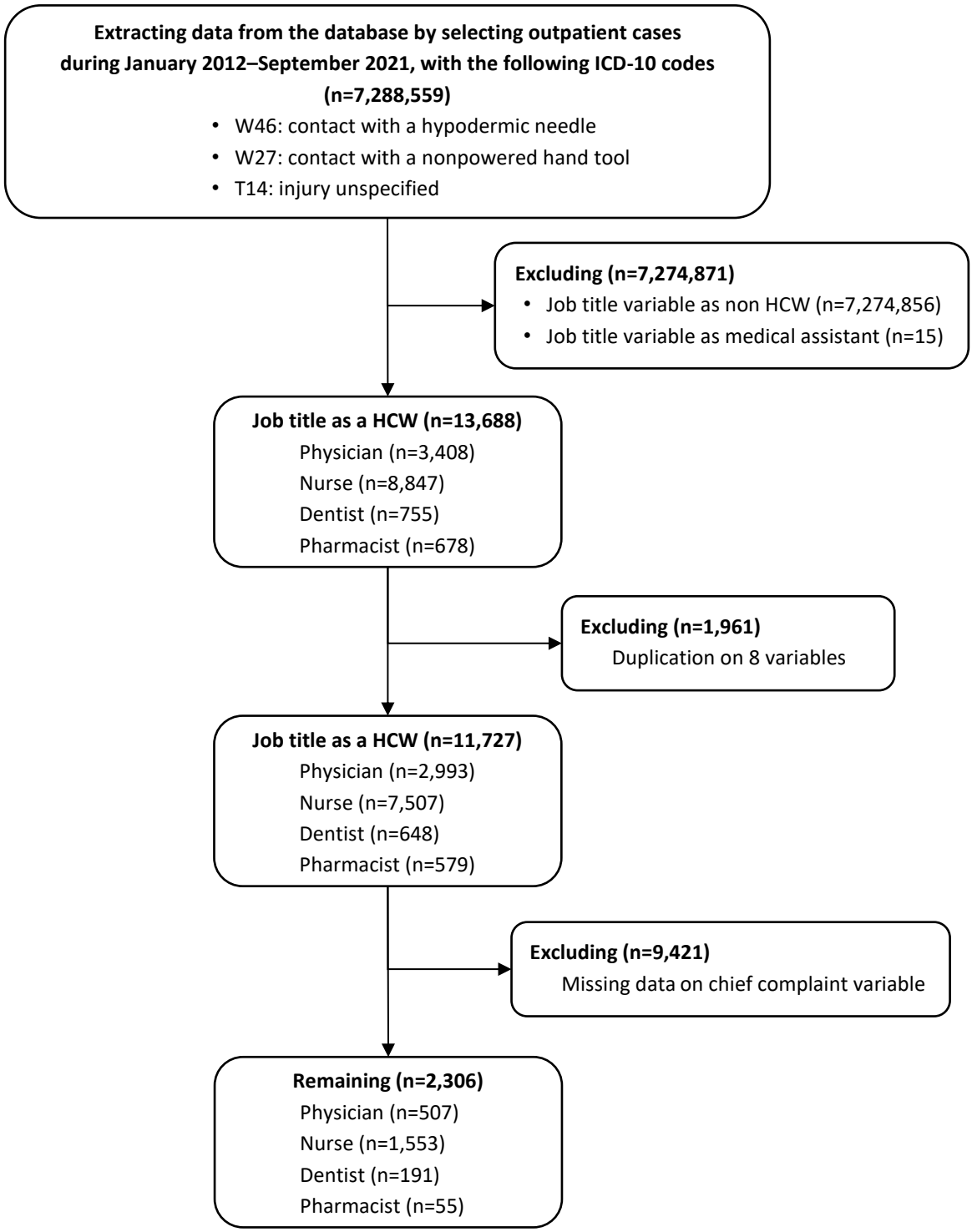


Figure 1. Flow diagram of data extraction from Thailand's Health Data Center database

The Thai Nurse Cohort Study (TNCS) was initiated by the Thailand Nursing and Midwifery Council in 2012. All health care facilities through government sectors, private sectors, and administrative sectors were included. Mailed questionnaires were used to collect the data. We extracted the data on 3 Feb 2020.

To assess the strength of association between NSSI and potential risks, we performed an analytic cross-sectional study among nurses participating in the TNCS. We included only Thai registered nurses who responded to the TNCS questionnaire on NSSI as shown in Figure 2. We focused on the following exposure variables: gender, age, education level, marital status, body mass index (BMI), job position, workplace, department, and work pattern (shift-hours). The outcome variable was the occurrence of NSSI.

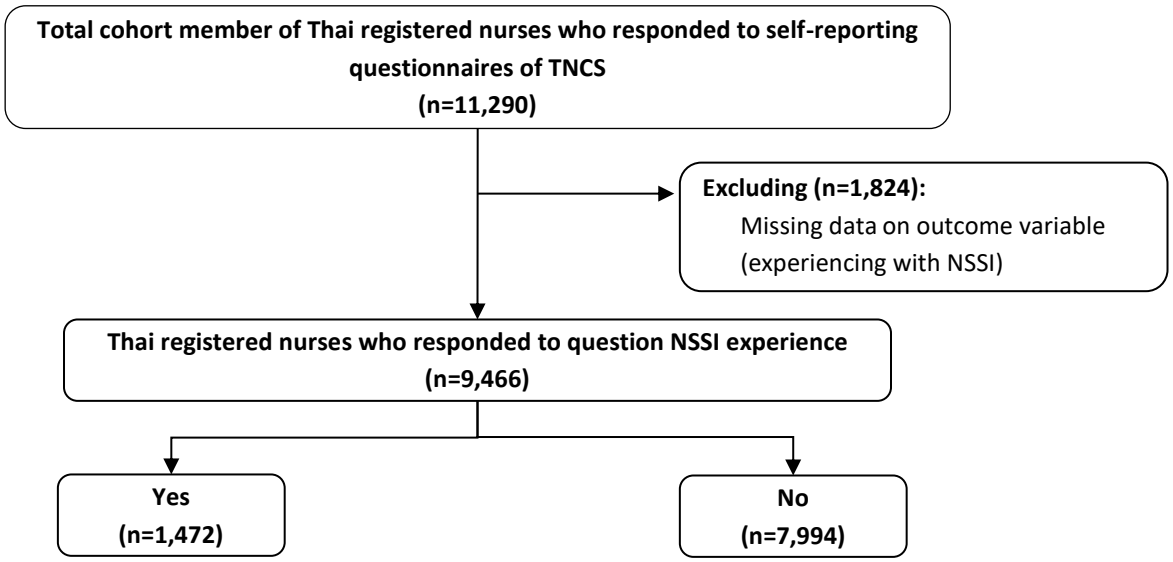


Figure 2. Flow diagram of data extraction from the Thai Nurse Cohort Study database

Operational Definitions

A health care worker (HCW) is a health professional working in well-founded health facilities. NSSI in this case included both a needlestick injury (medical instrument accidentally puncturing the skin) and a sharps injury (medical instrument accidentally cutting the skin). Thai registered nurses were nurses who received a nursing license from the Thailand Nursing and Midwifery Council. Long working hours was defined as a history of working for more than 12 hours/day or more than 40 hours/week. We classified a workplace department within a health facility as emergency or non-emergency. An emergency department included any sub-units in a hospital that are involved with medical procedures done under emergency conditions, such as operating room, labour room, and intensive care unit. General outpatient and inpatient wards were categorized as non-emergency departments. Shift-work was categorized as either fixed or rotating (on duty for two continuous shifts).

Sample Size and Sampling Method

The sample size was calculated using the proportion for infinite population formula.[26] For the HDC database, we used the incidence of NSSI among professional Korean nurses, which was reported as 80% in a study by Smith, et al.[27] Thereupon, at least 246 medical records were needed to estimate the incidence of NSSI. For associated factors of NSSI, we used an odds ratio (OR) of long working hours as 1.90 in the calculation according to a previous study by Nsubuga FM, et al.[28] Based on this, at least 496 medical records (248 medical records for each case and control) were needed. However, in both databases, we included all records in the analysis.

Data Analysis and Outcome Identification

Descriptive statistics were used to depict all variables that we selected to be studied. We used the TNCS to identify an association between NSSI and potential risks using a univariable logistic regression model. Variables with a p-value less than 0.1 were included in the multiple logistic regression modelling process. Crude and adjusted odds ratios and 95% confidence intervals (CI) were presented. Both data sources were encrypted, therefore anonymity of all cases was guaranteed. Data management was done using Microsoft Excel® and data analysis using Stata® v14.

Results

As shown in Table 1, among all HCW with NSSI, the majority (83.7%) were female, most (63.8%) were aged below 30 years with a median (interquartile range) age of 27 (24–33) years. Most were single (overall 72.9%, physicians 84.6%, nurses 67.6%, dentists 85.9%, and pharmacists 72.7%). Unspecified injuries (ICD-10: W46) were the most common NSSI. More than half of all HCW experiencing NSSI worked in a community hospital. Approximately 86% of all NSSI were needle stick injuries, and this proportion was consistent across all job titles.

Table 1. Demographic characteristics of health care workers with needlestick and sharps injuries, Thailand, January 2012 to September 2021

Characteristics	Type of health care worker				
	Total n (%) (N=2,306)	Physician n (%) (n=507)	Nurse n (%) (n=1,553)	Dentist n (%) (n=191)	Pharmacist n (%) (n=55)
Gender					
Male	376 (16.31)	225 (44.38)	84 (5.41)	57 (29.84)	10 (18.18)
Female	1,930 (83.69)	282 (55.62)	1,469 (94.59)	134 (70.16)	45 (81.82)
Age group (years)					
<30	1,472 (63.83)	355 (70.02)	969 (62.40)	116 (60.73)	32 (58.18)
≥30	834 (36.17)	152 (29.98)	584 (37.60)	75 (39.27)	23 (41.82)
Range	20–75	21–75	20–70	22–53	23–47
Mean ± SD	29.95 ± 8.19	29.06 ± 7.22	30.26 ± 8.77	29.62 ± 5.89	30.49 ± 5.72
Median (IQR)	27 (24–33)	26 (25–31)	27 (24–34)	28 (25–33)	29 (26–33)
Marital status					
Single	1,682 (72.94)	429 (84.62)	1,049 (67.55)	164 (85.86)	40 (72.73)
Married/divorce/separated	624 (27.06)	78 (15.38)	504 (32.45)	27 (14.14)	15 (27.27)
ICD-10 code					
W46: contact with a hypodermic needle	1,083 (46.96)	276 (54.44)	701 (45.14)	89 (46.60)	17 (30.91)
W27: contact with a nonpowered hand tool	516 (22.38)	93 (18.34)	365 (23.50)	42 (21.99)	16 (29.09)
T14: injury unspecified	707 (30.66)	138 (27.22)	487 (31.36)	60 (31.41)	22 (40.00)
Workplace					
Community hospital	1,306 (56.63)	182 (35.90)	955 (61.49)	131 (68.59)	38 (69.09)
General hospital	518 (22.46)	138 (27.22)	329 (21.19)	38 (19.90)	13 (23.64)
Regional hospital	382 (16.57)	148 (29.19)	214 (13.78)	17 (8.90)	3 (5.45)
University hospital	62 (2.69)	24 (4.73)	33 (2.12)	5 (2.61)	0 (0.00)
Health promoting hospital	38 (1.65)	15 (2.96)	22 (1.42)	0 (0.00)	1 (1.82)
Type of NSSI					
Needle stick injury	1979 (85.82)	440 (86.79)	1,346 (86.67)	156 (81.68)	37 (67.27)
Sharps injury	327 (14.18)	67 (13.21)	207 (13.33)	35 (18.32)	18 (32.73)

SD: standard deviation, IQR: interquartile range, ICD-10: International classification of diseases, 10th edition, NSSI: needlestick and sharps injury

Figure 3 shows the trend of NSSI events among all health care workers and specifically for Thai nurses from January 2012 to September 2021. There was an increasing trend in NSSI events among Thai nurses with the number of cases increasing from two in 2012 to 347 in nine months of 2021.

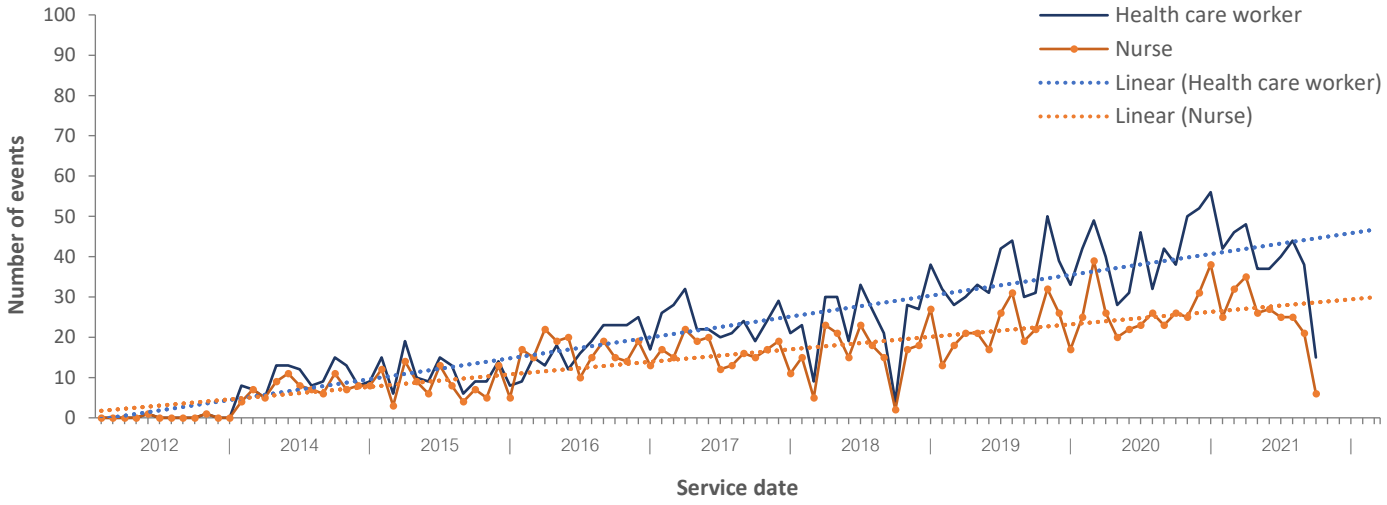


Figure 3. Trend of monthly events of needlestick and sharps injury among all health care workers and Thai nurses, January 2012 to September 2021

Table 2 shows results of the univariable and multivariable analyses based on the TNCS database. Being aged below 30 years, holding a degree not higher than bachelor's degree, being single, obese, being a staff nurse, working in an emergency department, having a fixed work pattern, and working long hours were significantly associated with NSSI on the univariable analysis. After controlling for age, education level, marital status, BMI, job position, work department, and work pattern, long working hours were significantly associated with NSSI with an adjusted OR of 1.5 (95% CI 1.3–1.8). Being single (OR 1.2, 95% CI 1.1–1.4), a staff nurse (OR 2.0, 95% CI 1.6–2.4), working in an emergency department (OR 1.3, 95% CI 1.1–1.5), and having a rotating shift (OR: 1.7, 95% CI 1.4–2.0) were also significant risk factors.

Table 2. Univariable and multivariable analyses on needlestick and sharps injury

Variables	n	Ever experienced NSSI		Crude OR (95% CI)	Adjusted OR (95% CI)
		Yes (%)	No (%)		
Gender					
Male	269	47 (3.23)	222 (2.81)	Reference	–
Female	9,082	1,406 (96.77)	7,676 (97.19)	0.87 (0.63–1.22)	
Age group (years)					
≥30	7,981	1,118 (76.94)	6,863 (86.80)	Reference	
<30	1,379	335 (23.06)	1,044 (13.20)	1.97 (1.71–2.27)*	1.12 (0.94–1.33)
Education level					
>Bachelor's degree	1,867	215 (14.68)	1,652 (20.72)	Reference	
≤Bachelor's degree	7,572	1,250 (85.32)	6,322 (79.28)	1.52 (1.30–1.78)*	0.99 (0.82–1.20)
Marital status					
Married/divorced/separated	6,867	974 (66.53)	5,893 (73.91)	Reference	
Single	2,570	490 (33.47)	2,080 (26.09)	1.43 (1.26–1.61)*	1.22 (1.06–1.40)
Body mass index					
Not exceeding normal range	5,206	865 (59.61)	4,341 (55.18)	Reference	
Exceeding normal range	4,112	586 (40.39)	3,526 (44.82)	0.83 (0.74–0.94)*	0.91 (0.80–1.04)
Job position					
Other†	3,024	234 (16.34)	2,790 (35.61)	Reference	
Staff nurse	6,243	1,198 (83.66)	5,045 (64.39)	2.83 (2.44–3.29)*	1.97 (1.63–2.39)
Workplace					
Private hospital	673	98 (7.83)	575 (8.38)	Reference	
University hospital	979	138 (11.02)	841 (12.26)	0.96 (0.73–1.27)	–
Government hospital	6,460	1,016 (81.15)	5,444 (79.36)	1.10 (0.87–1.37)	
Department					
Non-emergency	5,509	742 (61.99)	4,767 (72.98)	Reference	
Emergency	2,220	455 (38.01)	1,765 (27.02)	1.66 (1.45–1.89)*	1.31 (1.14–1.50)
Work shift					
Fixed	6,538	736 (51.11)	5,802 (73.97)	Reference	
Rotating	2,746	704 (48.89)	2,042 (26.03)	2.72 (2.42–3.05)*	1.69 (1.43–2.00)
Work duration (hours/day)					
≤12	7,709	1,013 (70.20)	6,696 (85.56)	Reference	
>12	1,560	430 (29.80)	1,130 (14.44)	2.52 (2.21–2.87)*	1.51 (1.28–1.78)

**P-value <0.1, †Administrative/nurse educator/academic/researcher*

OR: odds ratio, CI: confidence interval, NSSI: needlestick and sharps injury

Discussion

Our study revealed that the majority of health care workers experiencing NSSI were middle-aged, and the proportion of nurses experiencing NSSI were mostly aged below 30 years. A previous study by Lo et al. in Taiwan in 2014 found that the mean age of HCW experiencing NSSI was 31.4 years.[20] Previous studies have shown that factors associated with an increase in NSSI events include a lack of work experience, rotating shift, and long working hours.[29–31] A likely explanation is that as age and working years increase, nurses become more experienced in preventing NSSI.

NSSI among HCW has been continually increasing during 2012–2021 and several associated factors were identified. The growing number of NSSI might be due to either an increase in the coverage of health facilities under the reporting system or an increase in the true NSSI incidence. However, this needs to be verified by other approaches, such as surveillance evaluation using health facilities' data.

We found that being single, a staff nurse, working in an emergency department, having a rotating shift and long working hours were significantly associated with NSSI. In terms of workplace risk, nurses working in an emergency department faced a greater risk of NSSI than their colleagues in non-emergency departments. Previous studies by Kasatpibal et al. and Wicker et al. also found a high prevalence of NSSI in the operating room, a place where emergency conditions frequently occurred.[32,33]

Our study found that working continuously for more than 12 hours a day increased the risk of NSSI. Long working hours caused a negative effect on the performance of HCW and patient safety as supported by numerous previous studies.[34–41] Fatigue was the most common symptom after long working hours and this may lead to inattention, lack of energy, resulting in workplace accidents, including NSSI.[39,41]

In a review by McDonald, the author emphasized that legislation sets clear expectations about working hours and enables accountability for both the regulated individuals' performance and the regulators' monitoring and enforcement. Therefore, by implementing working hour regulations among HCW, we can enhance patient safety and improve the quality of treatment in health care services.[42]

Limitations

This study contained both strengths and limitations. For strengths, we used two large databases to investigate NSSI among Thai nurses. Thus, power of the analysis was not the main concern. However, some limitations and challenges exist. First, although the TNCS occurred 10 years ago (2012), it was the latest cohort data of Thai nurses that was available. Second, participants who responded to the TNCS questionnaire were those with a valid address to receive the mailed questionnaire. Third, as the questionnaires asked about their experience in the past, recall bias was inevitable. Additionally, participants experiencing NSSI might be more likely to report the event and recall their experience of long working hours than others. Also, most of the reported cases in the HDC were found in community hospitals and higher levels hospitals. This might be because the reporting system at the hospital level might be more systematic compared with health facilities at lower level of care, such as health promoting hospitals. Thus, the NSSI events in lower level of care might be subject to missing. Finally, private health facilities are not obliged to submit service data to the HDC.

Conclusion and Policy Recommendations

In summary, we demonstrated that needlestick and sharps injury among HCW, especially nurses, showed a growing trend over the past decade. Long working hours increased the risk of NSSI. Long working hours should be restricted by implementing the white coat labour law. Adequate supervision on occupational safety for nurses, especially those working in an emergency department and those of young age, should be implemented. Regular monitoring of work-related health status and occupational safety should be introduced in order to help generate evidence to support policy decisions for better working conditions.

Acknowledgements

The authors would like to thank Dr. Supharerk Thawillarp, the chief of Epidemiology Informatics Unit, Division of Epidemiology, Department of Disease Control, Ministry of Public Health, for kind supervision and guidance. We also thank Mr. Somchai Wiengphithak for assistance in data extraction.

Conflicts of Interest

The authors declare no conflict of interest.

Suggested Citation

Panyakarn P, Taweewigyakarn P, Suphanchaimat R, Sawaengdee K. Association between needlestick and sharps injury with long working hours among nurses in Thailand. OSIR. 2023 Sep;16(3):161–9. doi:10.59096/osir.v16i3.264393.

References

1. Canadian Centre for Occupational Health and Safety. Hazard and Risk [Internet]. Hamilton (ON): Canadian Centre for Occupational Health and Safety; [updated 2020 Jul 10; cited 2022 Mar 1]. <https://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html>
2. World Health Organization. Occupational health [Internet]. Geneva: World Health Organization; [cited 2021 Oct 28]. <https://www.who.int/health-topics/occupational-health>
3. World Health Organization. Protecting workers' health [Internet]. Geneva: World Health Organization; [updated 2017 Nov 30; cited 2022 Jun 16]. <https://www.who.int/en/news-room/fact-sheets/detail/protecting-workers'-health>

4. Occupational Safety and Health Administration. Recommended Practices for Safety and Health Programs [Internet]. Washington: U.S. Department of Labor; [cited 2021 Oct 27]. <https://www.osha.gov/safety-management/hazard-Identification#ai3>

5. Huei LC, Ya-Wen L, Ming YC, Chen HL, Yi WJ, Hung LM. Occupational health and safety hazards faced by healthcare professionals in Taiwan: a systematic review of risk factors and control strategies. SAGE open Med. 2020;8: 2050312120918999. doi:10.1177/2050312120918999.

6. Bouya S, Balouchi A, Rafiemanesh H, Amirshahi M, Dastres M, Moghadam MP, et al. Global prevalence and device related causes of needle stick injuries among health care workers: a systematic review and meta-analysis. Ann Glob Heal. 2020;86(1): 35. doi:10.5334/aogh.2698.

7. World Health Organization. Nursing and midwifery [Internet]. Geneva: World Health Organization; 2022 [updated 2022 Mar 18; cited 2022 Jun 17]. <https://www.who.int/news-room/fact-sheets/detail/nursing-and-midwifery>

8. World Health Organization. Occupational infections [Internet]. Geneva: World Health Organization; [cited 2022 Mar 2]. <https://www.who.int/tools/occupational-hazards-in-health-sector/occupational-infections>

9. Wang D, Yang R, Ma H. Needle stick injuries among nurses in China: meta-analysis. J Health Sci Altern Med. 2019;1(3):24–9.

10. Alimohamadi Y, Taghdir M, Sepandi M, Kalhor L, Abedini F. Prevalence of needlestick injuries among health-care workers in iranian hospitals: an updated systematic review and meta-analysis. Arch Trauma Res. 2020;9(2):47–55. doi:10.4103/atr.atr_91_19.

11. Yunihastuti E, Ratih DM, Aisyah MR, Hidayah AJ, Widhani A, Sulaiman AS, et al. Needlestick and sharps injuries in an Indonesian tertiary teaching hospital from 2014 to 2017: a cohort study. BMJ Open. 2020;10(12):e041494. doi:10.1136/bmjopen-2020-041494.

12. Leong XYA, Yee FZY, Leong YY, Tan SG, Amin IBM, Ling ML, et al. Incidence and analysis of sharps injuries and splash exposures in a tertiary hospital in Southeast Asia: a ten-year review. Singapore Med J. 2019;60(12):631–6. doi:10.11622/smedj.2019082.

13. Saadeh R, Khairallah K, Abozeid H, Al Rashdan L, Alfaqih M, Alkhatatbeh O. Needle stick and sharp injuries among healthcare workers: A retrospective six-year study. Sultan Qaboos Univ Med J. 2020 Feb;20(1):e54–62. doi:10.18295/squmj.2020.20.01.008.

14. Westermann C, Peters C, Lisiak B, Lamberti M, Nienhaus A. The prevalence of hepatitis C among healthcare workers: a systematic review and meta-analysis. Occup Environ Med 2015; 72(12):880–8. doi:10.1136/oemed-2015-102879.

15. Elshamy K, El-Hadidi M, El-Roby M, Fouda M. Health hazards among oncology nurses exposed to chemotherapy drugs. Afr J Haematol Oncol [Internet]. 2010[cited 2021 Oct 28];1(3):70–8. <http://www.theafjho.com/index.php/AJOHAO/article/view/20/32>

16. National Institute for Occupational Safety and Health. Healthcare Workers [Internet]. Atlanta: U.S. Centers for Disease Control and Prevention; 2017 [cited 2022 Mar 2]. <https://www.cdc.gov/niosh/topics/healthcare/default.html>

17. Institution of Occupational Safety and Health. The effects of shift work on health [Internet]. Wigston: Institution of Occupational Safety and Health; 2015 [cited 2021 Oct 28]. <https://iosh.com/shiftworkhealth>

18. World Health Organization. Long working hours increasing deaths from heart disease and stroke: WHO, ILO [Internet]. Geneva: World Health Organization; 2021 May 17 [cited 2022 Mar 1]. <https://www.who.int/news/item/17-05-2021-long-working-hours-increasing-deaths-from-heart-disease-and-stroke-who-ilo>

19. Rogers AE, Hwang W-T, Scott LD, Aiken LH, Dinges DF. The working hours of hospital staff nurses and patient safety. Health Affairs. 2004; 23(4):202–12. doi: 10.1377/hlthaff.23.4.202.

20. Lo WY, Chiou ST, Huang N, Chien LY. Long work hours and chronic insomnia are associated with needlestick and sharps injuries among hospital nurses in Taiwan: A national survey. Int J Nurs Stud. 2016 Dec;64:130–6. doi:10.1016/j.ijnurstu.2016.10.007.

21. Auta A, Adewuyi EO, Tor-Anyiin A, Edor JP, Kureh GT, Khanal V, et al. Global prevalence of percutaneous injuries among healthcare workers: a systematic review and meta-analysis. Int J Epidemiol. 2018;47(6):1972–80. doi:10.1093/ije/dyy208.

22. Shah SF, Bener A, Al-Kaabi S, Al Khal AL, Samson S. The epidemiology of needle stick injuries among health care workers in a newly developed country. Safety Science. 2006;44(5): 387–94. doi:10.1016/j.ssci.2005.11.002.

23. Setthamas M, Sawaengdee K, Theerawit T, Tangcharoensathien V, Pitaksanurat S, Thinkamrop B, et al. Incidence and risk factors of needle stick and sharp injuries among registered nurses in Thailand. J Public Hlth Dev. 2018;16(1):17–28.

24. Sawaengdee K, Tangcharoensathien V, Theerawit T, Thungjaroenkul P, Thinkhamrop W, Prathumkam P, et al. Thai nurse cohort study: cohort profiles and key findings. BMC Nurs. 2016;15:10. doi 10.1186/s12912-016-0131-0.

25. Thailand Nursing and Midwifery Council. Thailand nursing workforce policy [Internet]. Nonthaburi: Thailand Nursing and Midwifery Council; 2018 Feb 23 [cited 2021 Oct 28]. 12 p. <https://www.tnmc.or.th/images/userfiles/files/003(1).pdf>. Thai.

26. Wayne WD, Chad LC. Biostatistics: a foundation for analysis in the health sciences. 10th ed. Danvers: WILEY; 2013. 777 p.

27. Smith DR, Choe MA, Jeong JS, Jeon MY, Chae YR, An GJ. Epidemiology of needlestick and sharps injuries among professional Korean nurses. J Prof Nurs. 2006;22(6):359–66. doi:10.1016/j.profnurs.2006.10.003.

28. Nsubuga FM, Jaakkola MS. Needle stick injuries among nurses in sub-Saharan Africa. Trop Med Int Health. 2005;10(8):773–81. doi:10.1111/j.1365-3156.2005.01453.x.

29. Parsa-Pili J, Izadi N, Golbabaei F. Factors associated with needle stick and sharp injuries among health care workers. Int J Occup Hyg. 2013;5(4):191-7.

30. Cannaby AM, Carter V, Rolland P, Finn A, Owen J. The scope and variance of clinical nurse specialist job description. Br J Nurs. 2020;29 (11):606–11. doi:10.12968/bjon.2020.29.11.606.

31. Alfulayw KH, Al-Otaibi ST, Alqahtani HA. Factors associated with needlestick injuries among healthcare workers: implications for prevention. BMC Health Serv Res. 2021;21(1):1074. doi:10.1186/s12913-021-07110-y.

32. Kasatpibal N, Whitney JD, Katechanok S, Ngamsakulrat S, Malairungsakul B, Sirikulsathean P, et al. Prevalence and risk factors of needlestick injuries, sharps injuries, and blood and body fluid exposures among operating room nurses in Thailand. Am J Infect Control. 2016;44(1):85–90. doi:10.1016/j.ajic.2015.07.028.

33. Wicker S, Jung J, Allwinn R, Gottschalk R, Rabenau HF. Prevalence and prevention of needlestick injuries among health care workers in a German university hospital. Int Arch Occup Environ Health. 2008;81(3):347–54. doi:10.1007/s00420-007-0219-7.

34. Schulte PA, Wagner GR, Ostry A, Blanciforti LA, Cutlip RG, Krajnak KM, et al. Work, obesity, and occupational safety and health. Am J Public Health. 2007;97(3):428–36. doi:10.2105/AJPH.2006.086900.

35. Bernstrom VH, Alves DE, Ellingsen D, Ingelsrud MH. Healthy working time arrangements for healthcare personnel and patients: a systematic literature review. BMC Health Serv Res. 2019;19(1):193. doi:10.1186/s12913-019-3993-5.

36. Olds DM, Clarke SP. The effect of work hours on adverse events and errors in health care. J Safety Res. 2010;41(2):153–62. doi:10.1016/j.jsr.2010.02.002.

37. Bolster L, Rourke L. The effect of restricting residents' duty hours on patient safety, resident well-being, and resident education: an updated systematic review. J Grad Med Educ. 2015; 7(3):349–63. doi:10.4300/JGME-D-14-00612.1.

38. Jena AB, Farid M, Blumenthal D, Bhattacharya J. Association of residency work hour reform with long term quality and costs of care of US physicians: observational study. BMJ. 2019;366:l4134. doi:10.1136/bmj.l4134.

39. de Cordova PB, Bradford MA, Stone PW. Increased errors and decreased performance at night: a systematic review of the evidence concerning shift work and quality. Work. 2016;53(4):825–34. doi:10.3233/WOR-162250.

40. Witthayapipopsakul W, Cetthakrikul N, Suphanchaimat R, Noree T, Sawaengdee K. Equity of health workforce distribution in Thailand: an implication of concentration index. Risk Manag Healthc Policy. 2019;12:13–22. doi:10.2147/RMHP.S181174.

41. Lin RT, Lin YT, Hsia YF, Kuo CC. Long working hours and burnout in health care workers: non-linear dose-response relationship and the effect mediated by sleeping hours—a cross-sectional study. J Occup Health. 2021;63(1):e12228. doi:https://doi.org/10.1002/1348-9585.12228.

42. McDonald F. Working to death: the regulation of working hours in health care. Law & Policy 2008 Jan;30(1):108–40. doi:10.1111/j.1467-9930.2008.00271.x.

Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Results and Policy Implications of a COVID-19 Vaccine Post-introduction Evaluation in Thailand, May 2022

Chawetsan Namwat[1], Prabda Praphasiri[2,3]*, Chakrarat Pittayawonganon[4], Kriengkrai Prasert[3,5], Sutthichai Nakphook[3,4], Thanawadee Thantithaveewat[6], Aree Moungsookjareoun[7], Monica Fleming[8], Margaret Hercules[8], Ann C. Moen[8], Anthony Mounts[9], Patranuch Sapchookul[2], Darunee Ditsungnoen[2], James D. Heffelfinger[2,8], William W. Davis,[2,8] Sopon Iamsirithaworn[6]

1 Division of Disease Control in Emergency Situations, Department of Disease Control, Ministry of Public Health, Thailand

2 Thailand MOPH-US CDC Collaboration, Thailand

3 Faculty of Public Health, Kasetsart University, Chalermprakiat Sakon Nakhon Province Campus, Thailand

4 Division of Epidemiology, Department of Disease Control, Ministry of Public Health, Thailand

5 Nakhon Phanom Provincial Hospital, Thailand

6 Department of Disease Control, Ministry of Public Health, Thailand

7 WHO Country Office, Thailand

8 U.S. Centers for Disease Control and Prevention, USA

9 Task Force for Global Health, USA

*Corresponding author email: hpu3@cdc.gov

Received: 19 Jul 2023; Revised: 3 Aug 2023; Accepted: 4 Sep 2023
https://doi.org/10.59096/osir.v16i3.264236

Abstract

Thailand initiated a COVID-19 vaccine campaign in February 2021, and by March 2022, approximately 72% of residents over 5 years of age had received two doses of vaccine. We evaluated Thailand's COVID-19 vaccine campaign in Bangkok and in four additional provinces using the World Health Organization COVID-19 post-immunization evaluation (cPIE) protocol. Strengths of the vaccine program included close coordination between different levels and sectors of the Royal Thai Government, close community engagement, and use of national data systems. Areas of the campaign that needed interventions included reviewing cold chain practices, standardizing data forms and addressing bottlenecks in data systems.

Keywords: SARS CoV-2, vaccination, campaign, cPIE, evaluation, Thailand

Thailand initiated a COVID-19 vaccine campaign in February 2021, and administered over 129 million doses in 14 months. Initially, the target population was adults over age 18. In August 2021, children ages 12–18 years were added, while children 5–12 were added in February 2022 and children 2 months to 5 years were added in August 2022. High-priority populations targeted for vaccination included healthcare providers, older adults (over 60 years), people in areas with high COVID-19 incidence, pregnant women, people with comorbidities and children. An estimated 50,256,348 people, or 72% of the total population in the country, received at least two doses by March 2022.[1] To plan for transitioning to an endemic phase of COVID-19 response, the Ministry of Public Health (MOPH) required more

data on booster dose delivery, vaccine hesitancy and vaccine rollout logistics and decided that an evaluation of the vaccine program was needed. The MOPH's Department of Disease Control, together with the Thailand MOPH-US CDC Collaboration (TUC) and the World Health Organization (WHO) Country Office for Thailand implemented a COVID-19 vaccine post-introduction evaluation (cPIE). The cPIE is a tool developed by WHO to identify challenges, recommend corrective actions, and understand best practices in COVID-19 vaccine program implementation.[2]

The WHO cPIE protocol and questionnaires were implemented over a ten-day period.[2] Briefly, five provinces from different regions of the country where TUC had strong partnerships with provincial health staff (Nakhon Phanom, Chiang Rai, Chanthaburi, Surat Thani and Bangkok) were selected to participate. In Bangkok, provincial health officers selected one government health facility in each of six health zones; in the remaining provinces, health officers selected two sub-district health facilities in each of two districts. So that, best practices and also gaps might be identified, two of the health facilities in each province with low vaccine coverage and two with high vaccine coverage in their catchment populations were selected. Key informants who had knowledge of the vaccination program implementation process, as well as vaccine recipients (including members of high-priority groups that were targeted for vaccination), were interviewed using semi-structured questionnaires. The interviews focused on 10 domains: regulatory preparedness, planning and coordination, service delivery, costing/funding, supply chain and waste management, human resources, vaccine demand, vaccine safety, monitoring and evaluation and COVID-19 surveillance. Quantitative data were entered into a Microsoft Access database and descriptive analyses were performed using Microsoft Excel. Content analysis of quantitative data was used to identify themes around best practices and to identify areas that needed improvement.

Between 18–27 Apr 2022, five teams comprising MOPH, TUC and WHO staff visited 22 health facilities, observed 32 vaccine storage facilities, visited 19 vaccination sites and interviewed 44 health care workers and 62 persons in targeted groups who received COVID-19 vaccines.

Key findings included the importance of close coordination at the national, provincial, district and sub-district levels, including close engagement in planning and implementation of vaccine deployment by provincial governors and extensive use of public-private partnerships. Communication between provincial MOPH offices and district and sub-district clinics, as well as between provinces, facilitated sharing resources. For example, sending staff from one province to another to help with the initial vaccine campaigns helped staff to quickly gain experience; 82% of health workers interviewed reported feeling confident in their ability to communicate with patients and address their questions and concerns about COVID-19 vaccines. Coordination extended to sharing vaccines between districts and provinces. Enabling supplies to be positioned in areas where demand was greatest likely promoted higher coverage and lower wastage. Staff at sub-district health facilities were able to share resources without needing provincial approval, which likely reduced the time needed to acquire vaccine doses. The private sector gave extensive support for vaccination programs, including donations of equipment, food and water for staff and volunteers, nonmedical staff at vaccination sites, and venues for vaccination sites.

Approximately 96% of health facilities reported having a sufficient number of trained vaccinators, and 73% reported no vaccine stock outs in the prior six months. All health facilities visited had procedures in place to detect and report adverse events following immunization (AEFIs), as well as appropriate strategies and guidelines for managing AEFIs. Clinics used mobile units that deployed to places people frequented (e.g., temples, markets, long-term care facilities). Province-level experts were available to respond to questions about AEFIs, and regularly monitored AEFI trends. A national committee of experts reviewed each reported AEFI case, and patients were reimbursed through the national insurance scheme for medical care required for AEFIs.

Health facilities had strong community engagement. Ninety percent of facilities reported having activities in place to generate acceptance and demand of COVID-19 vaccines. They worked through community networks (e.g., community and religious leaders) to deliver messages addressing misinformation and vaccine hesitancy. District and sub-district level staff were empowered to adapt approaches to best fit the needs of their populations. Influenza programs that targeted the same high-risk adults that COVID-19 affected were successfully leveraged to improve COVID-19 vaccine distribution.

There was extensive use of centralized electronic databases, including a standalone application and database for COVID-19 called "Mor Prom" that linked testing and vaccination data with national IDs (or

assigned IDs for foreigners); this enabled timely program monitoring. MOPH used existing public health reporting mechanisms to report on COVID-19 vaccination coverage, including using data on registered persons (e.g., Thai citizens and registered migrant workers) and unregistered persons. Data from all populations were used to inform coverage estimates and vaccine deployment. Since February 2021, vaccine coverage data were updated daily and available for subdistrict-level catchment populations, allowing tracking in real-time. Data were reviewed by teams at district and sub-district levels to assess coverage. Approximately 91% of facilities reported using electronic recording and reporting systems, 87% of facilities reported they could track more than one vaccine product for a given individual, 83% reported tracking defaulters (if 2-dose regimens were used), and 69% of healthcare facilities could track uptake of vaccines by gender, 44% by geographic area, 81% by pregnancy status, and 22% by socioeconomic status.

Thai national policies that created new legal frameworks to support implementation of COVID-19 vaccine enabled faster rollout of vaccines. An agreement (the Confidentiality Undertaking by National Regulatory Authorities) between WHO and the Thai National Regulatory Authority facilitated expedited approval of COVID-19 vaccine. Thailand was one of the first countries to implement a mix-and-match strategy for giving vaccines and booster doses (i.e., using different vaccines for first, second and booster doses).[3] National COVID-19 response policy, endorsed by a decision of the National Communicable Disease Committee, enabled the bypass of standard Thai Food and Drug Administration processes and emergency orders permitting import of available vaccines and mix-and-match dosing. Mix-and-match dosing enabled flexibility in vaccine supply logistics and administration, and may have contributed to higher vaccine uptake.

Several areas in Thailand's COVID-19 vaccine rollout were identified for improvement need. First, although shifting vaccines between health facilities could reduce wastage, it was not clear if a system was in place for keeping records on the total length of time vaccines were stored at 2–8°C. Second, early in the pandemic, national and sub-district databases were not connected, making it difficult to determine vaccine coverage at the sub-district level. As a result, some districts developed their own separate databases. There were also difficulties merging Ministry of Labor databases of registered migrant workers with the MOPH vaccine database. Third, though vaccine coverage was high, some people remained hard to reach. Fourth, vaccine hesitancy for booster doses was a frequently reported problem among all populations, especially among older adults. And lastly, some provinces noted that they did not have access to national data on AEFIs and could not share risks with the public. Some provinces noted that AEFI investigations took a long time to complete.

Achieving 2-dose COVID-19 vaccine coverage of 72% of the Thai population in 14 months was made possible by a number of facilitators, including a high degree of organization, strong cooperation between different levels of the health system, widespread use of public-private partnerships, and close engagement with communities. This achievement and these facilitators were the result of decades of investments in the Thai public health system, including seasonal influenza vaccine programs.[4,5] Cold chain and data management processes would benefit from specific recommendations from a more in-depth assessment, and community outreach and communication efforts should be continued to increase coverage of booster doses.

Recommendations from the evaluation of the mass vaccination campaign include:

- Review cold chain requirements and practices for all vaccines, and evaluate the time vaccines are stored at 2–8 °C and ensure the time at 2–8 °C does not exceed 30 days, or temperature exceed 8 °C, especially when vaccines are transported and shared between facilities.
- Standardize data entry forms for immunization monitoring systems and ensure all levels of the health system have access to immunization coverage data in real time.
- Increase vaccine coverage (including for booster doses) for target groups, especially older adults.
- Have a data management expert assess data flow including for vaccination, infection, and AEFI databases and devise solutions as appropriate.

This evaluation has several limitations. It was intended to be a rapid evaluation of a vaccination campaign and, as such, we were not able to fully explore all areas of inquiry in order to make comprehensive recommendations. In addition, the participating provinces were a convenience sample and not necessarily representative of all provinces in the country. Also, it is possible that some key data specific to provinces were not collected, thus could not inform the evaluation.

As Thailand shifts from a pandemic to an endemic phase of COVID-19 response, it will be important to ensure that vaccines are accessible to everyone, especially target populations. Thailand's cPIE

identified best practices that should be continued and areas that need improvement to achieve these goals.

Acknowledgements

The author would like to thank the health workers and administrators who participated in this project.

Author Contributions

Concept and design (CN, PP, CP, JH, WD, SI), Acquisition of data (PP, KP, SN, TT, AM, MF, MH, ACM, AM, PS, DD, JH, WD), Analysis and interpretation of data (PP, KP, SN, TT, AM, MF, MH, ACM, AM, PS, DD, JH, WD), Drafting of the manuscript (WD), Critical revision of paper for important intellectual content (CN, PP, CP, KP, SN, TT, AM, MF, MH, ACM, AM, PS, DD, JH, WD, SI), Obtaining funding (CN, PP, WD), Administrative, technical, or logistic support (PP, PS, DD), Supervision (CN, PP, CP, JH, WD, SI)

Disclosure Statement

The authors have nothing to disclose.

Ethics and Consent

The Thai MOPH considered this a program evaluation and waived IRB requirements. This activity was reviewed by the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy.

Funding Information

This project was funded through a cooperative agreement from CDC to the Task Force for Global Health.

Paper Context

Thailand administered over 129 million doses of COVID-19 vaccine in 14 months. Previous studies have documented facilitators of pandemic influenza vaccine programs over a decade ago, but few have focused on recent COVID-19 campaigns. We identified several facilitators of COVID-19 vaccination programs including strong existing health infrastructure, coordination and management between government entities, and adoption of new technologies to improve data collection. Countries should consider these for COVID-19 vaccine campaigns and in pandemic preparedness planning.

Disclaimer

The opinions expressed by authors contributing to this journal do not necessarily reflect the opinions of the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO) or the institutions with which the authors are affiliated.

Suggested Citation

Namwat C, Praphasiri P, Pittayawonganon C, Prasert K, Nakphook S, Thantithaveewat T, et al. Results and policy implications of a COVID-19 vaccine post-introduction evaluation in Thailand, May 2022. OSIR. 2023 Sep;16(3):170–3. doi:10.59096/osir.v16i3.264236.

References

1. Mathieu E, Ritchie H, Ortiz-Ospina E, Roser M, Hasell J, Appel C, et al. A global database of COVID-19 vaccinations. Nat Hum Behav. 2021 Jul;5(7):947–53. doi:10.1038/s41562-021-01122-8.
2. World Health Organization. COVID-19 vaccine post introduction evaluation (cPIE): interim guidance. Geneva: World Health Organization; 2021 Aug 25 [cited 2023 Jul 15]. 17 p. <https://www.who.int/publications/i/item/WHO-2019-nCoV-cPIE-2021.1>
3. Siddiqui A, Adnan A, Abbas M, Taseen S, Ochani S, Essar MY. Revival of the heterologous prime-boost technique in COVID-19: An outlook from the history of outbreaks. Health Sci Rep. 2022 Feb 23;5(2):e531. doi:10.1002/hsr2.531.
4. Tangcharoensathien V, Witthayapipopsakul W, Panichkriangkrai W, Patcharanarumol W, Mills A. Health systems development in Thailand: a solid platform for successful implementation of universal health coverage. Lancet. 2018 Mar 24;391(10126):1205–23. doi:10.1016/S0140-6736(18)30198-3.
5. 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. 2021 Jul;6(7):e006178. doi:10.1136/bmjgh-2021-006178.

OSIR

Outbreak, Surveillance,
Investigation and Response