ความรู้และพฤติกรรมการจัดการขยะติดเชื้อภายในครัวเรือนของประชาชนหมู่ 4 ในเขตเทศบาลพลายชุมพล อำเภอเมือง จังหวัดพิษณุโลก*

สุวิมล ทาริวงศ์[1] อรรถพล รอดแก้ว, จิตศิริน ก้อนคง[2]
กัญจนาภา ไหวปาน, ศิริลักษณ์ อุดมสุข[3]

(วันที่รับบทความ: 10 ตุลาคม 2566; วันแก้ไขบทความ: 18 ธันวาคม 2566; วันตอบรับบทความ: 20 ธันวาคม 2566)

บทคัดย่อ

การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาความรู้และพฤติกรรมในการจัดการขยะมูลฝอยติดเชื้อของประชาชนที่อาศัยอยู่ในหมู่ที่ 4 เทศบาลตำบลพลายชุมพล จังหวัดพิษณุโลก โดยมีจำนวนอาสาสมัครรวม 150 คน อาสาสมัครส่วนใหญ่ร้อยละ 86.00 ตระหนักถึงความสำคัญของการแยกขยะติดเชื้อก่อนนำไปกำจัด และอาสาสมัครส่วนใหญ่ร้อยละ 87.30 มีความรู้อย่างถูกต้องว่าอุปกรณ์ป้องกันส่วนบุคคล เช่น หน้ากากอนามัยที่ใช้แล้วจัดว่าเป็นขยะติดเชื้อ เป็นต้น อาสาสมัครส่วนใหญ่มากกว่าร้อยละ 80.00 มีความเห็นตรงกันเกี่ยวกับประโยชน์ด้านสิ่งแวดล้อมในการแยกขยะติดเชื้อ การฆ่าเชื้อในอุปกรณ์ทดสอบ และการใช้ถังขยะที่กำหนดเพื่อวัตถุประสงค์ในการกำจัด อาสาสมัครส่วนใหญ่ ร้อยละ 80.70 เชื่อว่าการใช้ชุดทดสอบแอนติเจน (ATK) มีผลกระทบอย่างมากต่อการเพิ่มขึ้นของของเสียจากการติดเชื้อ อย่างไรก็ตาม ปรากฏว่าอาสาสมัครมีความเข้าใจผิด โดยเฉพาะอย่างยิ่งร้อยละ 84.00 เชื่อว่าการแยกขยะติดเชื้อไม่จำเป็นต้องมีการบำบัดเพิ่มเติมใด ๆ นอกจากนี้ ยังมีอาสาสมัครจำนวนมากที่เข้าใจผิดว่าหน้ากากอนามัยแบบผ้ามีการย่อยสลายอย่างปลอดภัย คะแนนความรู้เฉลี่ย 0.83 ± 0.37 แสดงถึงระดับความเข้าใจที่น่าพอใจ อย่างไรก็ตามเป็นที่น่าสังเกตว่ามีความเข้าใจที่คลาดเคลื่อนหลายประการที่พบในการจัดการขยะติดเชื้อ ผลการศึกษานี้สามารถนำไปสู่การดำเนินการวิจัยในอนาคตและใช้เป็นกรอบแนวทางในการพัฒนากลยุทธ์การจัดการขยะติดเชื้อในชุมชนที่คล้ายคลึงกัน

คำสำคัญ: การจัดการขยะติดเชื้อ, พฤติกรรม, ระดับความรู้, การจัดการของเสียในครัวเรือน

---

* บทความวิจัย คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏพิบูลสงคราม

[1] อาจารย์, คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏพิบูลสงคราม, E-Mail: suwimol.t@psru.ac.th

[2] ผู้ช่วยศาสตราจารย์, คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏพิบูลสงคราม, E-Mail: Atthaphol_Rn@psru.ac.th, E-Mail: chitsirin@psru.ac.th

[3] นักศึกษาหลักสูตรสาขาวิชาสาธารณสุขศาสตร์, คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏพิบูลสงคราม

The Knowledge and Behavior Regarding Household Infectious Waste Management in Phlai Chumphon Municipality, Mueang District, Phitsanulok Province*

Suwimol Thariwong[1] Atthaphol Rodkaew, Chitsirin Konkong[2]

Kunchanapa Waipan, Sirilak Audomsuk[3]

(Received: October 10, 2023; Revised: December 18, 2023; Accepted: December 20, 2023)

Abstract

The objective of this study was to gain insight into the knowledge and behaviors pertaining to the management of infectious household waste among the residents of Moo 4 villages in Phlai Chumphol Municipality, located in Phitsanulok Province among the total number of 150 participants, a significant majority of 86.00% expressed recognition on the significance of isolating infectious waste prior to its disposal. A significant majority of participants, namely 87.30%, accurately recognized personal protective equipment such as masks utilized by individuals affected with a disease as being classified as infectious waste. A majority of respondents, specifically over 80.00%, expressed consensus regarding the environmental advantages associated with the segregation of infectious waste, disinfection of testing equipment, and utilization of designated bins for disposal purposes. A majority of respondents, specifically 80.70%, expressed the belief that the utilization of Antigen Test Kits (ATKs) had a substantial impact on the escalation of infectious waste. Nevertheless, it was apparent that there were misconceptions among the participants. Specifically, a significant majority of 84.00% held the belief that separated infectious waste did not necessitate any additional treatment. Additionally, a considerable number of individuals were under the mistaken impression that fabric surgical masks degraded in a safe manner. The mean knowledge score was 0.83 ± 0.37, indicating a satisfactory level of comprehension. However, it is important to note that there are various myths within the treatment of infectious waste. The present study provides significant insights that might inform future research and establish a fundamental framework for developing methods for managing infectious waste in comparable areas.

Keywords: Infectious Waste Management, Behavior, Knowledge Level, Household Waste Practices

* Research Article from Faculty of Science and Technology, Pibulsongkram Rajabhat University

[1] Instructor, Faculty of Science and Technology, Pibulsongkram Rajabhat University, E-Mail: suwimol.t@psru.ac.th

[2] Assistant Professor, Faculty of Science and Technology, Pibulsongkram Rajabhat University, E-Mail: Atthaphol_Rn@psru.ac.th, E-Mail: chitsirin@psru.ac.th

[3] Undergraduate student in Public Health Program, Faculty of Science and Technology, Pibulsongkram Rajabhat University

Introduction

The SARS-CoV-2-caused the coronavirus disease 2019 (COVID-19) pandemic was unexpected and first spotted in Wuhan, China in December 2019. It quickly became a global health crisis, impacting over 227 countries and challenging global response efforts (Gurría, 2023; WHO, 2023). The current pandemic has become a major public health issue, posing significant challenges to global societal, infrastructural, and governmental capabilities, according to the organization for economic co-operation and development (OECD) (WHO, 2020). In mid-2021, Thailand rebounded after using community-based contact tracing, isolation, and border control to contain the pandemic by December 2020. The increase in cases, mostly due to the highly contagious Delta strain (B.1.617.2), has underlined the need for comprehensive and adaptive treatments to combat its changing course and serious consequences. Government initiatives, healthcare systems, and demographics have affected these outcomes differently among countries (Oxford Policy Management and United Nations, 2020; Thye, et al., 2021; Kuai and Ser, 2021).

The COVID-19 pandemic has increased the usage of disposable personal protective equipment (PPE) such as masks, gloves, aprons, and others (El-Ramady, et al., 2021). PPE use is increasing to protect frontline medical staff and the public. It has also increased global medical and infectious waste. Trash production has increased throughout the epidemic (Nzediegwu and Chang, 2020). In China, hospital medical waste increased, requiring garbage plants and 46 mobile waste treatment facilities to handle over 240 metric tons of waste everyday. Barcelona generated 1,200 tons of medical waste, up 350% from the average 275 tons (Sarkodie and Owusu, 2020). Thailand's infectious waste has also increased. October 2021 to September 2022 recorded 110,427.65 tons of infectious waste. This was a 22.68% increase from 2021, when infectious waste reached 90,009.23 tons (Bureau of Environmental Health, 2022). Due of COVID-19's persistence on surfaces, household and clinical waste has increased in numerous countries, making waste management difficult (Kampf, et al., 2020). Thermal methods like incineration and microwave treatment are commonly used for hazardous waste management (Klemeš, et al., 2020). However, the pandemic increased waste volume, requiring treatment capacity expansion. In Wuhan, municipal solid waste incinerators and cement kilns were used (Luhar, et al., 2022). Even though PPE waste is increasing, public education about proper disposal and separation of infectious waste is needed. Even in places with excellent waste management systems, improper waste management causes health and environmental problems. Countries must meet the epidemic's immediate demands while simultaneously developing effective, adaptive, and secure medical waste management procedures. This issue affects the ecology and public health (Al-Emam and Al-Yousfi, 2021).

Infectious waste increased due to COVID-19 pandemic use of PPE emphasizing the significance of waste management. Technology and treatment methods improve, yet public understanding remains challenging. The unintended combining of waste types, especially infectious waste, can release pollutants and spread viruses like coronavirus. In order to prevent this, waste separation and disposal must be fully understood. Public education on infectious waste handling methods is essential for effective management. This study examines household knowledge and behavior about infectious waste management in Phlai Chumphol Subdistrict, Mueang District, Phitsanulok Province. Develop insights to improve community waste disposal protocols.

Research Objectives

To assess infectious waste management knowledge and behavior in Phlai Chumphol Subdistrict, Mueang District, Phitsanulok Province.

Literature Reviews

Definition and Classification of Infectious Waste

The 2002 Ministerial Regulations on the Disposal of Infectious Waste define "infectious waste" as trash containing germs in quantities or concentrations that cause disease. Medical diagnostics, therapy, immunization, disease testing, post-mortems, and research produce most such waste. This includes (1) human or animal remains from surgical procedures, post-mortem examinations, or experimental animals; (2) sharp objects such as needles, blades, syringes, glass tubes, containers, slides, and slide covers; and (3) materials such as cotton, gauze, or rubber hoses that have or possibly come into contact with blood, blood products, bodily fluids, or live pathogen vaccines. Infectious waste refers to materials that have been exposed to bodily fluids of patients, including but not limited to mucus, saliva, and blood. (Hanpanjakit, et al., 2018). During the outbreak of COVID-19, there was a notable increase in the volume and sources of solid waste. It is of crucial significance for relevant organizations and countries, including Thailand, to conduct a thorough evaluation of their current processes and procedures in order to improve the effectiveness of infectious waste management. Chandanachulaka, et al. (2021) used documentary research and expert consultations from a variety of professions to study infectious waste management during the COVID-19 epidemic in Thailand. The study revealed that the main contributors to the generation of infectious waste are 41,786 hospitals, 3,224 veterinary hospitals, and 816 microbiological laboratories.

The outbreak of COVID-19 has resulted in a significant increase in waste volumes, beyond the normal disposal capacity of Thailand. COVID-19 waste is often categorized as ordinary infectious waste according to global rules. However, a few nations including China and South Korea have implemented distinct methods in managing this waste. The recommendations for Thailand encompass several key areas, mainly the revision of the Public Health Act, the broadening of waste source definitions, the strengthening of personal protective measures, and the promotion of inter-ministerial collaboration. In addition, it is recommended to provide support to provincial authorities and explore novel waste management strategies, such as waste-to-energy technologies.

The Knowledge, Attitudes, Practices (KAP) model

One educational paradigm that is commonly used in health education topics is the rational model. In this framework, educational interventions target both individual and group entities with the main goal of encouraging healthy behaviors and preventing unhealthy ones. The distribution of impartial, objective information is given top priority in these activities. Known by its abbreviation KAP model, its fundamental concept is that increasing a person's knowledge base generally leads one's behavior to change. This paradigm functions under the assumption that a lack of knowledge is the main obstacle to taking responsible and logical action. Therefore, when this deficiency is addressed by well-informed education, a predicted step-by-step sequence emerges increasing knowledge triggers a change in attitudes and beliefs, which in turn leads to an alteration in behavior (Mitic, et al., 2012).

KAP model has become a vital resource in the field of health education and treatments. It provides a means of identifying and comprehending the complex relationships that exist between information, beliefs, and the behaviors that follow within a community. Health practitioners can create procedures that are precisely customized to the complex demands of certain groups by using this theoretical framework. Furthermore, KAP surveys are incredibly useful in highlighting and identifying differences in knowledge, attitudes, and practices. These insights enable the thoughtful distribution of resources, guaranteeing that treatments effectively close noticeable gaps or misconceptions. Moreover, KAP assessments' sequential character, which involves conducting them both before and after an intervention, provides an effective structure for assessing the provable effects of health campaigns or initiatives (Azlan, et al., 2020).

Beyond merely disseminating knowledge, the KAP approach promotes a more comprehensive understanding of the fundamental facilitators and barriers associated with behavior modification. KAP-

centric methods to community engagement raise health literacy levels and encourage community involvement, which in turn creates a sense of shared ownership and openness to health interventions. Culturally particular habits and beliefs that could otherwise go unrecognized become more apparent, making it possible to create interventions that are more responsive to cultural differences and, consequently, more effective. Policymakers can create health policies that better reflect and tackle the reality of community-based knowledge, attitudes, and practices by using the macro-level insights from KAP studies. The KAP model, particularly promotes an all-encompassing strategy, enhances the impact and cost-effectiveness of health education programs (Truong, et al., 2014).

Methodology

Research Design

This survey research aimed to elucidate the knowledge and practices pertaining to infectious waste management among households in Village No. 4, Phai Chumphol Municipality, Mueang District, Phitsanulok Province.

Participants and Sampling

A representative population of 150 participants was determined using Yamane's formula (Yamane, 1973) at a confidence level of 0.05 within a community consisting of 240 households. The study mandated that participants, primarily individuals who were either household heads or representatives, meet particular requirements. These criteria included being a minimum of 30 years old, possessing fluency in the Thai language, and not having any significant health limitations. Participants who did not provide consent or expressed intentions to withdraw from the study were not included in the analysis. The sampling process consisted of categorizing households into ten distinct groups, followed by the random selection of representatives from each group until the desired sample size was achieved.

Instrumentation

A thorough questionnaire that was carefully designed to record participants' answers using both closed-ended questions—which encourage concise responses—and rating scale questions was utilized as the main tool for collecting data. An important feature of the instrument, the rating scale questions, were thoughtfully included to provide participants a scored scale on which to express their opinions, attitudes, or preferences. This allowed for a more detailed and comprehensive understanding of their perspective.

Validity and Reliability

By analyzing item-total correlations and employing indices like item-objective congruence (IOC) and discrimination indices, three experts evaluated the content validity. Their validity was further confirmed by reliability tests, which showed a Cronbach's alpha of around 0.89 and a range of 0.67–1 and a KR-20 confidence of 0.81.

Data Analysis

Descriptive statistical analyses-frequencies, percentages, means, and standard deviation values-were deployed to interpret demographic data and assess the use and knowledge of infectious waste items like face masks and ATK test kits, as well as analyze knowledge and behavior scores.

Ethical Adherence

The Human Research Ethics Committee of Pibulsongkram Rajabhat University granted approval for this study (Certification COA No: 068/2022 PSRU-EC: B2022/0017). All participants provided written informed consent prior to data collection, with the assurance of autonomy to withdraw or omit questionnaire items without necessitating justification.

Results

The data from the questionnaire was collected and then analyzed in order to evaluate the demographic features, knowledge, attitudes, and habits of the 150 people involved in the study. Following an analysis of the demographic characteristics of the sample population, it is apparent that a substantial majority, precisely 67.30%, comprised persons who self-identified as female. Moreover, a significant percentage of 52.00% was seen to fall under the age bracket of 41-50 years. In relation to marital status, a total of 93.30% of the participants were included in the analysis. The most prevalent degree of education reported by the participants was primary school, with a percentage of 84.70%. The occupation category with the highest representation among the respondents was self-employed, comprising 54.00% of the sample.

Considering the examination of facial mask and ATK test kit utilization within the sample of 150 individuals, it was observed that the prevailing behavior consisted of employing medical masks in combination with reusable cloth masks, constituting 80.00% of the observed practices. The study findings indicate that the reported frequency of daily mask usage was 96.00%. Furthermore, it was observed that 99.30% of the participants reported using an average of 7 masks per week. Notably, 96.00% of these individuals reported not reusing masks. In 67.30% of the sample, the length of mask usage per instance exceeded 6 hours (Table 1).

Table 1 Utilization patterns of face masks and antigen test kits (ATK) among participants. (n = 150)

Description	Number (Persons)	Percent (%)
Type of Face Mask Used		
Medical mask only	18	12.00
Medical & reusable cloth mask	120	80.00
Medical mask & other equipment	3	2.00
Did not use any face mask	9	6.00
Face Mask Usage Frequency		
Daily	144	96.00
1-3 days per week	6	4.00
Average Number of Masks Used Weekly		
7 or more pieces	149	99.30
1-3 pieces	1	0.70
Mask Reuse Frequency		
Never	144	96.00
3-4 times	6	4.00
Average Duration of Mask Usage at a Time		
3-4 hours	1	0.70
5-6 hours	48	32.00
More than 6 hours	101	67.30
ATK Test Kit Type Used		
Saliva test ATK kit only	0	0.00
Nasal cavity ATK test kit only	9	6.00
Did not use any ATK test kit	141	94.00

The findings taken from Table 2, which examines at 150 participants' understandings and perspectives on infectious waste management, show a markedly higher level of awareness in a variety of crucial areas. The vast majority of participants (95.33%to 98.67%) showed adequate knowledge of the significance of classifying items used by infected individuals as infectious waste, the minimal environmental impact of

cloth surgical masks, the requirement to disinfect testing equipment before disposal, and the significance of segregating hazardous waste. Despite these encouraging points, it is worth noting that only 60.00% of the participants know the difference between infectious and hazardous waste, and only 33.33% know that isolated infectious waste needs to be treated further before being disposed of. With a mean knowledge score of 0.87 ± 0.33, participants generally demonstrated a significant level of awareness regarding infectious waste management. However, there were clear gaps in their knowledge of some of the aspects involving this issue.

Table 2 Knowledge and perceptions of respondents on infectious waste management.

	Total respondents (n = 150)	Number of Respondents	Percentage (%)
1	All harmful trash, including masks and ATKs, must be separated before it can be disposed of.	143	95.33
2	Cloth surgical masks decompose rapidly and don't present a significant environmental risk.	148	98.67
3	Infectious waste is the same as dangerous garbage since it can spread infections.	90	60.00
4	Infectious waste that is disposed of separately benefits the environment immediately.	145	96.67
5	Testing equipment must be cleaned with an alcohol or chlorine solution to remove any bacteria before it can be disposed of.	148	98.67
6	Testing equipment-related infectious waste needs to be disposed of in containers with clear markings, like red bags.	145	96.67
7	Segregated infectious waste requires no further treatment before disposal.	50	33.33
8	The utilization of ATKs for COVID-19 has led to a significant surge in infectious waste generation.	144	96.00
9	The segregation of waste from infected individuals is not mandatory for each disposal instance.	147	98.00
10	Items utilized by infected individuals, such as masks and ATKs, are deemed infectious waste.	148	98.67
	Knowledge score (mean ± SD) = 0.87 ± 0.33		

Table 3 classifies the respondents based on their knowledge of infectious waste. The results show that most of the respondents showed very good knowledge (63.00%), while a small percentage had medium knowledge (34.00%). Even a few percent (2.70%) were categorized as having little knowledge, suggesting that most respondents were generally aware of the handling and categorization of infectious waste.

Table 3 Distribution of respondents according to their level of knowledge on infectious waste.

Knowledge Level	Amount (n = 150)	Percentage (%)
Low (0-6 points)	4	2.70
Medium (7-8 points)	51	34.00
Very Good (9-10 points)	95	63.30

Most of the 150 respondents to the infectious waste management survey adhere to waste disposal and segregation regulations. Specifically, 97.30% and 98.67% of respondents said they routinely separated ATK test kits and masks before discarding them. The majority (65.30%) burnt infectious waste on occasion on their own. Although 55.30% of respondents adopted it occasionally, encasing old ATK test kits in Ziploc bags before disposal to reduce the spread of germs was only minimally implemented. While "Post-Disposal Hygiene" and "Waste Segregation and Disposal" were generally followed, "Preventive Measures for Germ Spread" differed, offering suggestions for how to increase public adherence to comprehensive waste management techniques (Table 4).

Table 4 Examination of infectious waste management behavior among respondents. (n = 150)

No.	Behavioral Aspect in Infectious Waste Management	Never Practiced (%)	Practiced Occasionally (%)	Practiced Regularly (%)
Waste Segregation and Disposal				
1	Differentiation of masks from other waste before disposal	0 (0.00)	2 (1.33)	148 (98.67)
2	Segregation of utilized ATK test kits from other waste prior to disposal.	0 (0.00)	4 (2.70)	146 (97.30)
3	Sorting of utilized items (e.g., lunch boxes, water bottles) if infected, from other waste pre-disposal.	0 (0.00)	4 (2.70)	146 (97.30)

Table 4 (Continued)

No.	Behavioral Aspect in Infectious Waste Management	Never Practiced (%)	Practiced Occasionally (%)	Practiced Regularly (%)
4	Folding/bundling masks before disposal to minimize germ spread.	0 (0.00)	8 (5.30)	142 (94.70)
5	Depositing masks in a specified bin or container before disposal.	0 (0.00)	14 (9.30)	136 (90.70)
6	If infected, storing used items (e.g., lunch boxes) in dedicated bins before disposal.	0 (0.00)	17 (11.30)	133 (88.70)
7	Differentiation of masks from other waste before disposal.	0 (0.00)	2 (1.33)	148 (98.67)
8	Segregation of utilized ATK test kits from other waste prior to disposal.	0 (0.00)	4 (2.70)	146 (97.30)
9	Sorting of utilized items (e.g., lunch boxes, water bottles) if infected, from other waste pre-disposal.	0 (0.00)	4 (2.70)	146 (97.30)
10	Self-incineration of utilized facial masks as a disposal technique.	0 (0.00)	27 (18.00)	123 (82.00)
11	Autonomously conducting the incineration of infectious waste materials.	0 (0.00)	98 (65.30)	52 (34.70)
12	Employing self-facilitated burial as a disposal method for used masks.	0 (0.00)	7 (4.70)	143 (95.30)
13	Allocating utilized masks to municipal waste receptacles for disposal.	0 (0.00)	5 (3.30)	145 (96.70)
14	Coordinating the disposal of masks, ATKs, and infected person waste at waste management sites like hospitals.	0 (0.00)	2 (1.30)	143 (95.30)
Preventive Measures for Germ Spread				
15	Encasing utilized ATK test kits in Ziploc bags pre-disposal to mitigate germ spread.	0 (0.00)	83 (55.30)	67 (44.70)
16	Consolidating masks, ATK test kits, and infected waste at dedicated infectious waste disposal points.	0 (0.00)	10 (6.70)	140 (93.30)

Table 4 (Continued)

No.	Behavioral Aspect in Infectious Waste Management	Never Practiced (%)	Practiced Occasionally (%)	Practiced Regularly (%)
17	Folding/bundling masks before disposal to minimize germ spread.	0 (0.00)	8 (5.30)	142 (94.70)
Post-Disposal Hygiene				
18	Handwashing post mask sorting.	0 (0.00)	13 (8.70)	137 (91.30)
19	Handwashing post ATK test kit sorting.	0 (0.00)	8 (5.30)	142 (94.70)
20	After collecting infected waste, wash hands.	0 (0.00)	11 (7.30)	139 (92.70)

Discussions

The COVID-19 pandemic, triggered by the SARS-CoV-2 virus, quickly became a global health emergency affecting over 227 countries and territories, with international response mechanisms tested (Gurría, 2023; WHO, 2020; WHO, 2023). The COVID-19 pandemic has caused waste and environmental management issues because to a spike in medical waste and PPE use. Several areas have seen a substantial increase in daily litter production, emphasizing the need to enhance garbage management. Raising public awareness of careful garbage disposal and proper waste separation is essential. Addressing pandemic-related health issues and implementing safe and effective waste management strategies are crucial for overcoming future challenges (Kampf, et al., 2020; Klemeš, et al., 2020).

The differences in infectious waste management knowledge and expertise among participants are noteworthy. While some people realize hazardous waste segregation and disposal, knowledge gaps, especially about different types of waste, are concerning. It showed the positive and negative consequences of waste processing and disposal, highlighting the gap between theory and practice. This contradiction requires improved education programs and practical recommendations to adopt consistent and efficient waste management procedures and protect public and environmental health. Numerous researchs have shown infectious waste management knowledge, policy, and implementation discrepancies. A Philippine research found an abundance of guidelines for managing domestic healthcare waste, especially during the pandemic, despite appropriate legislation for normal household and healthcare waste disposal. Waste segregation policy gaps cause downstream inefficiencies and environmental health risks, requiring an adaptive

policy strategy to meet public health needs (Apostol, et al., 2022). Recent Bhutanese research found that technological, fiscal, social, and staff training barriers hindered Medical Waste (MW) management practices (Letho, et al., 2021). A cross-sectional research in Phuket, Thailand, found that clinic workers had higher medical waste management knowledge, attitudes, and behaviors. Akkajit, et al. (2020) highlighted the importance of practical knowledge, duration of employment, and proper waste collection and transportation in waste management. These studies underline the necessity for coordinated policy creation, successful implementation, and ongoing infectious waste management training. These actions are crucial for global health and environmental security.

The study found that while respondents had some understanding of infectious waste management and some compliance with guidelines, policy implementation and enforcement need improvement. According to the responses of 63% of participants, system performance depends on high awareness. This shows that in-depth knowledge is not adequate to assure waste management effectiveness and safety, especially in a pandemic. Potential risks in material management, the requirement for decontamination, resource unpredictability, and the lack of uniform evaluations emphasize the necessity of individual and community behaviors and good policies. These issues underscore the necessity of implementing actions that prioritize public health and assure the long-term sustainability of the environment. Individual knowledge and structural, policy-driven action must work together to address infectious waste management public health challenges (Bunjongsiri, et al., 2023). Most people are competent at treating infectious waste, although there are variances in particular methods, indicating that community participation might enhance performance. Regular and correct separation of waste and information efforts about the health risks of waste disposal that is incorrect can improve protocol compliance. Educational initiatives, workshops, and joint clean-up campaigns may increase environmental awareness and responsibility. This can help create a healthy, self-sufficient community (Kioupi and Voulvoulis, 2019).

Conclusion

In conclusion, our study determined that the levels of knowledge and practice scores were considered satisfactory. The findings indicate that while individuals possess information regarding waste management practices, there exists variation in the implementation of this knowledge across different geographical locations. It is evident that there is a pressing need for more assistance from governmental bodies and environmental organizations in order to facilitate the persistent adherence of individuals to

sound waste management methods. By prioritizing solutions that demonstrate comprehension and resolution of localized obstacles and assets, we may enhance our waste management practices, thereby safeguarding our well-being and the environment during present and future health crises.

Suggestion

The findings of this study can serve as a basis for formulating comprehensive guidelines for the effective management of infectious waste in community settings. The implementation of the next phase of the study will adhere to the prescribed norms of participation. It will be carried out in certain regions that have been appropriately conditioned to establish a model for managing infectious waste pathogens. This model will be applicable and suitable for various areas.

References

Akkajit, P., Romin, H., Assawadithalerd, M., and Al-Khatib, I. A. (2020). Assessment of Knowledge, Attitude, and Practice in Respect of Medical Waste Management Among Healthcare Workers in Clinics. *Journal of Environmental and Public Health,* 2020, 1-12. https://doi.org/10.1155/2020/8745472

Al-Emam, R., and Al-Yousfi, B. (2021). Waste Management of Used Personal Protective Equipment During the COVID-19 Pandemic in the Eastern Mediterranean Region. *Eastern Mediterranean Health Journal,* 27(11), 1034-1035.

Apostol, G. L., Acolola, A. G., Edillon, M. A., and Valenzuela, S. (2022). How comprehensive and effective are waste management policies during the COVID-19 pandemic? perspectives from the Philippines. *Frontiers in Public Health,* 10. https://doi.org/10.3389/fpubh.2022.958241

Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H., and Mohamad, E. (2020). Public Knowledge, Attitudes and Practices Towards Covid-19: A Cross-Sectional Study in Malaysia. *PLOS ONE,* 15(5). https://doi.org/10.1371/journal.pone.0233668

Bunjongsiri, K., Sangaroon, P., Prasertchai, A., Pradisthaprecha, A., Nakpan, W., Jiratkulthana, S., and Laoraksawong, P. (2023). The Knowledge, Attitude, And Practice for Managing Infectious Waste Management During COVID-19 Pandemic: A Survey in Thailand. *Naresuan University Journal: Science and Technology,* 31(2), 56-68.

Bureau of Environmental Health, M. of P. H. (2022). *Report of Analysis Operations for the First Five Months Report Indicator and Knowledge Situation Analysis Outcomes.* Retrieved October 1, 2023, from https://env.anamai.moph.go.th/web- upload/11xc410600758f76a9b83604e779b2d1de5/ filecenter /kpi/66/3.31/total_kpi3.31.pdf

Chandanachulaka, S., Tookaew, S., Krabkran, P., Hirunrueng, T., and Sridaromont, P. (2021). Study for Improving Infectious Waste Management Efficiency in Thailand. *Thailand Journal of Health Promotion and Environmental Health,* 44(3), 115-128.

El-Ramady, H., Brevik, E. C., Elbasiouny, H., Elbehiry, F., Amer, M., Elsakhawy, T., Omara, A. E.-D., Mosa, A. A., El-Ghamry, A. M., Abdalla, N., Rezes, S., Elboraey, M., Ezzat, A., and Eid, Y. (2021). Planning for Disposal of Covid-19 Pandemic Wastes in Developing Countries: A Review of Current Challenges. *Environmental Monitoring and Assessment,* 193(9). https://doi.org /10.1007/s10661-021-09350-1

Gurría, A. (2023). *Covid-19: Joint Actions to Win the War. COVID-19: Joint Actions to Win the War.* Retrieved October 1, 2023, https://www.oecd.org/washington/news-events/list/covid-19jointactionstowinthewar.htm

Hanpanjakit, C., Supaphet, I., Sriromanot, P., Lothaisong, J., Chanta, W., and Hemwipat, T. (2018). *Infectious Waste Management Academic Papers for Health Department Officials.* Retrieved October 1, 2023, http://www.oic.go.th/FILEWEB/CABINFOCENTER17/DRAWER002/ GENERAL/DATA0001/00001430.PDF

Kampf, G., Todt, D., Pfaender, S., and Steinmann, E. (2020). Persistence of Coronaviruses on Inanimate Surfaces and Their Inactivation with Biocidal Agents. *Journal of Hospital Infection,* 104(3), 246-251.

Kioupi, V., and Voulvoulis, N. (2019). Education for Sustainable Development: A Systemic Framework for Connecting the SDGS to Educational Outcomes. *Sustainability,* 11(21), 6104. https://doi.org/10.3390/su11216104

Klemeš, J. J., Van Fan, Y., Tan, R. R., and Jiang, P. (2020). Minimising The Present and Future Plastic Waste, Energy and Environmental Footprints Related To COVID-19. *Renewable and Sustainable Energy Reviews,* 127, 109-883.

Kuai, Y.-H., and Ser, H.-L. (2021). Covid-19 Situation in Thailand. *Progress in Microbes & Molecular Biology,* 4(1). https://doi.org/10.36877/pmmb.a0000260

Letho, Z., Yangdon, T., Lhamo, C., Limbu, C. B., Yoezer, S., Jamtsho, T., Chhetri, P., and Tshering, D. (2021). Awareness and Practice of Medical Waste Management Among Healthcare Providers in National Referral Hospital. *PLOS ONE,* 16(1). https://doi.org/10.1371/journal.pone.0243817

Luhar, I., Luhar, S., and Abdullah, M. M. A. B. (2022). Challenges and Impacts Of COVID-19 Pandemic on Global Waste Management Systems: A Review. *Journal of Composites Science,* 6(9), 271.

Mitic, W., Abdelaziz, B. F., and Madi, H. (2012). *Health Education: Theoretical Concepts, Effective Strategies and Core Competencies.* World Health Organization, Regional Office for the Eastern Mediterranean.

Nzediegwu, C., and Chang, S. X. (2020). Improper Solid Waste Management Increases Potential for COVID-19 Spread in Developing Countries. Resources, *Conservation and Recycling,* 161, 104947. https://doi.org/10.1016/j.resconrec.2020.104947

Oxford Policy Management and United Nations. (2020). *Social Impact Assessment of COVID-19 in Thailand. UNICEF Thailand.* Retrieved October 1, 2023, https://www.unicef.org/thailand/reports/social-impact-assessment-covid-19-thailand

Sarkodie, S. A., and Owusu, P. A. (2020). Impact of Covid-19 Pandemic on Waste Management. *Environment, Development and Sustainability,* 23(5), 7951–7960. https://doi.org/10.1007/s10668-020-00956-y

Thye, A. Y.-K., Law, J. W.-F., Pusparajah, P., Letchumanan, V., Chan, K.-G., and Lee, L.-H. (2021). Emerging SARS-COV-2 Variants of Concern (VOCS): An Impending Global Crisis. *Biomedicines,* 9(10), 1303. https://doi.org/10.3390/biomedicines9101303

Truong, M., Paradies, Y., and Priest, N. (2014). Interventions to Improve Cultural Competency in Healthcare: A Systematic Review of Reviews. *BMC Health Services Research,* 14(1). https://doi.org/10.1186/1472-6963-14-99

World Health Organization (WHO). (2020). *Who Director-General's Opening Remarks at the Media Briefing on COVID-19 - 11 March 2020. World Health Organization.* Retrieved October 1, 2023, https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020

World Health Organization (WHO). (2023). *WHO Coronavirus Disease (COVID-19) Dashboard.* Retrieved October 1, 2023, https://covid19.who.int/table

Yamane, T. (1973). *Statistics, An Introductory Analysis*. Harper and Row.

****