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Assessing COVID-19 Preparedness and Perception among Thai Paramedics in Thailand: A Cross-Sectional Study

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ABSTRACT

OBJECTIVE: The coronavirus disease (COVID-19) outbreak has had widespread impacts on global public health systems, including Thailand's. Preparedness for public health emergencies is therefore critical. This study aimed to assess Thai paramedics' operational preparedness and perception in response to the COVID-19 pandemic.

METHODS: A cross-sectional descriptive study was conducted among 225 paramedics in Thailand. Data were collected via an online questionnaire between August and December 2021, covering general information, perceptions of infectious diseases, and COVID-19 response preparedness. The questionnaire on preparedness was a binary response format, with yes scored as 1 and no scored as 0. In contrast, the questionnaire on COVID-19 perception was measured using a 5-point rating scale, with the lowest score being 1 and the highest score being 5. The results were then categorized into three levels: high, moderate, and low. Analyses included frequencies, percentages, means, and standard deviations. Logistic regression was used to assess relationships between basic characteristics, perceptions, and preparedness.

RESULTS: Operational preparedness was moderate, with structural preparedness at 53.3% and operational preparedness at 54.2%. Only 38.7% of the participants were fully prepared across all aspects. Meanwhile, perceived was found to be at a high level for both risk perception and perceived severity (mean scores: 4.50 ± 0.44 and 4.60 ± 0.44 respectively). Logistic regression identified key predictors of preparedness: prior training in COVID-19 patient management (adjusted odds ratio (OR) = 1.79, 95% confidence interval (CI) = 1.01-3.17) and hands-on experience with COVID-19 patients (adjusted OR = 3.33, 95%CI = 1.56-7.12).

CONCLUSION: Integrating knowledge with practical experience enhances emergency preparedness. To improve readiness, capacity development through targeted training, simulation exercises, and real-world practice opportunities is essential for paramedics.

KEYWORDS: COVID-19, cross-sectional studies, emergency medical services, paramedics, preparedness, risk perception

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) outbreak has profoundly impacted healthcare systems worldwide, including Thailand's. The first confirmed case in Thailand was reported in January 2020, making it the first country outside China to detect the virus. As the pandemic evolved, Thailand experienced several waves of infection, with major outbreaks occurring in March 2020, April 2021, and mid-2022. As the pandemic intensified, it strained medical and public health operations, exposing critical challenges such as healthcare workforce shortages, insufficient protective and treatment supplies, difficulties in transporting infected patients, and contamination control issues. In response, the World Health Organization (WHO) declared COVID-19 a public health emergency of international concern[1].

Thailand's Ministry of Public Health classified COVID-19 as the 14th dangerous communicable disease under the Communicable Diseases Act, enforcing stringent surveillance, prevention, and control measures[2,3]. During this crisis, the Emergency Medical Services (EMS) system became pivotal in delivering prehospital care and ensuring safe patient transport. Maintaining high preparedness among EMS personnel is thus essential for effective emergency response.

The National Institute for Emergency Medicine (NIEM) of Thailand reported operational disruptions during the pandemic, including delayed emergency dispatches and suspended services by some organizations due to safety concerns. To address these challenges, NIEM established the Special COVID-19 Operation Team (SCOT) to optimize infected patient transportation and minimize systemic disruptions[4].

Paramedics, as frontline providers in Thailand's EMS system, play a critical role in bridging community care and hospital services. They are core members of the Advanced Life Support-SCOT, trained in infection control for hazardous communicable diseases and emergency patient safety[4]. However, their direct exposure to patients' bodily fluids and contaminated equipment heightens infection risks. Rising disease severity and occupational stressors further compromise their mental well-being and service quality[5,6].

Literature underscores that paramedics' preparedness hinges on COVID-19 awareness and adherence to infection prevention protocols. Accurate knowledge of transmission modes and preventive measures can mitigate infection risks and curb viral spread[7]. Equally vital are adequate personal protective equipment (PPE) and clear operational guidelines to ensure safe and efficient service delivery[8]. Perceived risk severity and occupational exposure awareness also directly influence preventive behaviors[9]. Studies note that healthcare workers with advanced infectious disease training exhibit stronger compliance with prevention protocols[10,11], underscoring the role of knowledge and resource accessibility. Despite these insights, research on Thai paramedics' pandemic response remains limited. As frontline responders, their role in managing health crises demands urgent examination to bolster future outbreak preparedness. This study aimed to assess Thai paramedics' operational preparedness and perception in response to the COVID-19 pandemic. The findings are expected to inform evidence-based recommendations for EMS system enhancement and individual capacity-building initiatives.

METHODS

This cross-sectional descriptive study utilized an online questionnaire to collect data from Thai paramedics actively working under the EMS system between August and December 2021. The inclusion criteria were: (1) being a licensed paramedic registered with the NIEM; (2) currently working in an EMS unit (pre-hospital, hospital-based, or field operations); and (3) voluntarily consenting to participate. The exclusion criterion was having less than one year of EMS work experience.

The sample size was calculated using a population proportion formula (95% confidence interval [CI], margin of error = 0.05) based on 465 licensed paramedics (as of March 1, 2021)[12]. The initial target was 211 participants, with an additional 10% (total n = 230) to account for potential data loss.

A convenience sampling method was employed, as participation in the study was entirely voluntary and not mandatory for all invitees. Email addresses of eligible paramedics were obtained through collaboration with the NIEM. The online questionnaire was distributed to the full list via email. Paramedics with less than one year of work experience were not invited to participate and therefore did not receive the questionnaire. To enhance participation, reminder emails were sent biweekly over a three-month period. The initial response rate was approximately 20%. Ultimately, 230 responses were received. All submitted questionnaires were reviewed manually. A response was excluded only if it contained more than one missing item in any of the key domains (i.e., perception or preparedness). Based on this criterion, 225 complete and valid datasets were retained for final analysis, as shown in Figure 1.

The study adhered to the ethical principles of the Belmont Report and received approval from the Ethics Review Committee of the Faculty of Medicine Vajira Hospital, Navamindradhiraj University (COA 087/2564). Online informed consent was obtained, and all data were anonymized and aggregated to ensure confidentiality.

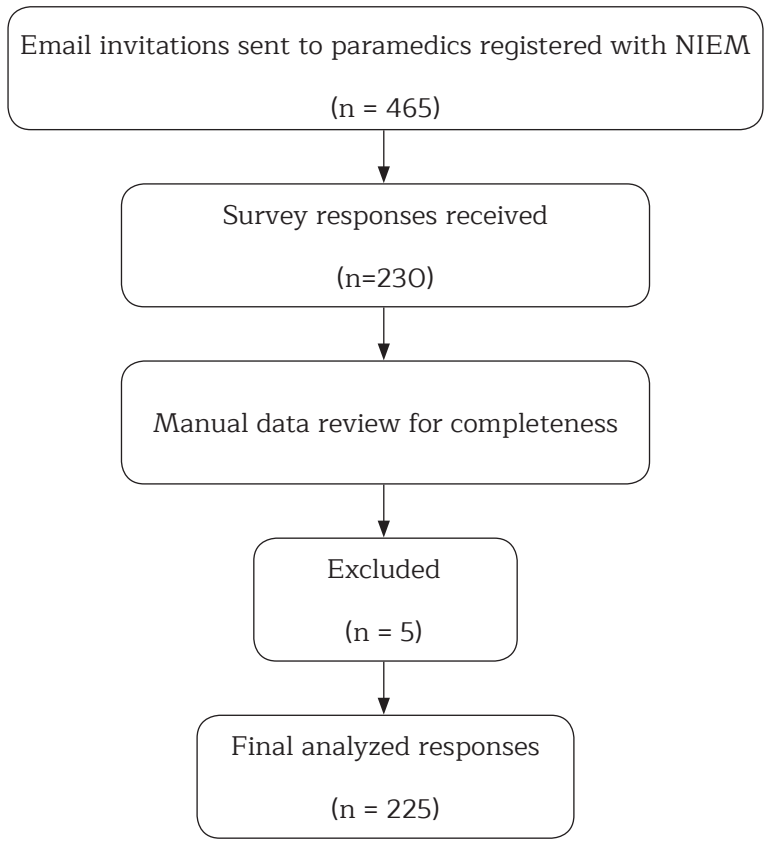

Figure 1 Participant flow diagram

The research instrument used in this study was an online questionnaire consisting of three sections: (1) basic characteristics, (2) perception of COVID-19, and (3) preparedness for emergency operations during the COVID-19 pandemic. The questionnaire on COVID-19 perception was adapted from the study by Singveeratham et al.[13], which focused on risk perception and perceived severity of COVID-19. The questions were modified to align with the work context of paramedics. Responses were measured using a 5-point rating scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire included nine questions on risk perception and six questions on perceived severity, totaling 15 items. The questionnaire on preparedness for emergency operations during the COVID-19 pandemic was adapted from the SCOT preparedness assessment and pre-deployment checklist from the NIEM's operational guidelines[4]. It consisted of two main sections: (1) structural preparedness (9 items) and (2) operational preparedness (24 items), which was further divided into pre-operation preparedness (7 items), preparedness during operation (12 items), and post-operation preparedness (5 items). In total, the questionnaire comprised 33 items. The questions on preparedness were closed-ended, with only two response options: "yes" (1 point) and "no" (0 points). The content validity of the questionnaire was assessed by three experts, including an emergency medicine physician, a specialist in health systems and EMS, and an expert in pre-hospital emergency operations. Each expert independently evaluated the relevance and clarity of the questionnaire items using a structured rating scale. Based on their assessments, the content validity index was found to be 0.80. Reliability testing was subsequently conducted through a pilot study. The reliability score for the perception section was 0.85, while the preparedness section had a reliability score of 0.87.

Data interpretation for perception scores showed that a mean score of 4.0 or higher indicated a high level, a mean score between 3.0 and 3.9 indicated a moderate level, and a mean score below 3.0 indicated a low level of perception. For preparedness scores, a total score of 33 indicated full preparedness, while any score below 33 indicated a lack of full preparedness. Given the highly contagious nature of COVID-19 and its widespread impact, effective prevention measures are crucial. Operational preparedness was assessed based on the highest safety standards, as errors in real-world emergency response situations could have serious consequences.

Data were analyzed using SPSS version 29 (IBM SPSS Statistics for Windows, version 29.0. Armonk, NY: IBM Corp). Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used. Factors influencing operational preparedness were analyzed using logistic regression analysis.

RESULTS

The study included a total of 225 participants, the majority of whom were female (57.8%). The median age of participants was 26.0 years, and 85.3% were single. Most participants had obtained a bachelor's degree (96.9%). Regarding work experience, the majority had been employed as paramedics for 1-3 years, with a median work experience of 3.0 years. The highest proportion of participants (53.3%) worked in general hospitals, university-affiliated hospitals, or the Erawan Emergency Medical Center. Additionally, 53.3% had undergone COVID-19-related training, while 75.6% had experience in handling COVID-19 cases. The data are presented in Table 1.

Table 1 Baseline characteristics (N = 225)

Variables	N = 225 (%)
Gender	
Male	95 (42.2)
Female	130 (57.8)
Age (years)	
21-25	102 (45.3)
> 25	123 (54.7)
Median = 26.0 (Min = 21, Max = 48)	
Status	
Single	192 (85.3)
Couple	33 (14.7)
Education	
Bachelor	218 (96.9)
Postgraduate	7 (3.1)
Experience (years)	
1-3	138 (61.3)
> 3	87 (38.7)
Median = 3.2 (Min = 1, Max = 8)	
Place of work	
Community hospitals/ Private hospitals/ Local administrative Organization	105 (46.7)
General hospitals/ University-affiliated hospitals/ Erawan Emergency Medical Center	120 (53.3)
Training experience on COVID-19	
No	105 (46.7)
Yes	120 (53.3)
Prior hands-on experience in COVID-19 patient retrieval	
No	55 (24.4)
Yes	170 (75.6)

Abbreviation: N, number

The assessment of COVID-19 response preparedness was divided into two main components: infrastructure preparedness and operational capacity. The findings revealed that 53.3% of participants were structurally ready (mean = 7.70/9.00 ± 1.86), while 54.2% were operationally ready (mean = 22.40/24.00 ± 2.61). When both aspects were combined, only 38.7% of participants were fully prepared in all areas, with a total preparedness score of mean = 30.1/33.00 ± 3.97 (Table 2).

Table 2 COVID-19 response preparedness assessment (N = 225)

Variables	Preparedness		Mean (SD)
	No N (%)	Yes N (%)	
Infrastructure preparedness (9 items)	105 (46.7)	120 (53.3)	7.7 (1.86)
Operational capacity (24 items)	103 (45.8)	122 (54.2)	22.4 (2.61)
Total Preparedness Score (33 items)	138 (61.3)	87 (38.7)	30.1 (3.97)

Abbreviations: N, number; SD, standard deviation

The overall perceived risk of exposure and perceived severity of COVID-19 infection were at a high level, with mean scores of 4.50 ± 0.44 and 4.60 ± 0.44, respectively. An item-by-item analysis of perceived risk of exposure and perceived severity indicated that all individual items were rated at a high level (Table 3).

An analysis of the association between basic characteristics, COVID-19 perception, and operational preparedness for COVID-19 response found that prior training on COVID-19 and experience in handling COVID-19 cases were significant factors influencing emergency preparedness. Participants with COVID-19 training were significantly more prepared than those without training (adjusted OR = 1.79; 95%CI = 1.01-3.17, p = 0.043). Meanwhile, participants with prior experience handling COVID-19 patients were significantly more prepared than those without such experience (adjusted OR = 3.33; 95%CI = 1.56-7.12, p = 0.002). The data are presented in Table 4.

Table 3 Perceived risk of exposure and perceived severity of COVID-19 infection (N = 225)

Variables	Mean (SD)	Meaning
Perceived risk of exposure		
1. Chest compressions pose a risk of COVID-19 virus transmission	4.6 (0.66)	High
2. Open-system tracheal suctioning increases the risk of COVID-19 infection	4.7 (0.52)	High
3. Endotracheal intubation carries a risk of COVID-19 virus exposure	4.7 (0.60)	High
4. Procedures requiring high-flow oxygen (e.g., nebulizer therapy, bag-valve mask ventilation, high-flow nasal cannula) increase the risk of COVID-19 transmission	4.7 (0.61)	High
5. If patients are not pre-screened for COVID-19 by the dispatch and coordination center, responders are at higher risk of infection	4.6 (0.60)	High
6. Treating patients during transport in an air-conditioned ambulance may lead to COVID-19 virus spread	4.0 (1.01)	High
7. Healthcare workers may contract COVID-19 from patients if they fail to wash hands after procedures	4.5 (0.67)	High
8. Close contact (< 2 meters) between patients and responders increases the risk of COVID-19 transmission	4.2 (0.84)	High
9. Wearing a surgical mask or face shield reduces the risk of COVID-19 infection	4.5 (0.66)	High
Total	4.5 (0.44)	High
Perceived severity		
1. Do you think COVID-19 is a dangerous communicable disease?	4.6 (0.67)	High
2. Do you believe COVID-19 is a life-threatening disease?	4.6 (0.60)	High
3. Do you think COVID-19 causes severe lung infection?	4.7 (0.50)	High
4. If a person has underlying medical conditions and contracts COVID-19, does it increase the risk of severe/fatal outcomes?	4.8 (0.50)	High
5. Do you believe elderly individuals have a higher risk of death if infected with COVID-19?	4.7 (0.53)	High
6. Do you think healthy individuals who contract COVID-19 will only experience mild symptoms (like a common cold)?	4.0 (1.01)	High
Total	4.6 (0.44)	High

Abbreviation: SD, standard deviation

Table 4 Association between basic characteristics, perception of COVID-19, and operational preparedness for COVID-19 response (N = 225)

Variables	Categories	Preparedness		Crude OR (95%CI)	P-value	Adjusted OR (95%CI)	P-value
		No N (%)	Yes N (%)				
Sex	Male	60 (63.2)	35 (36.8)	Ref.			
	Female	78 (60.0)	52 (40.0)	1.33 (0.73-2.42)	0.347		
Age (years)	21-25	65 (63.7)	37 (36.3)	Ref.			
	> 25	73 (59.3)	50 (40.7)	1.14 (0.50-2.59)	0.743		
Status	Single	119 (62.0)	73 (38.0)	Ref.			
	Couple	19 (57.6)	14 (42.4)	1.04 (0.44-2.44)	0.918		
Education	Bachelor	137 (62.8)	81 (37.2)	Ref.			
	Postgraduate	1 (14.3)	6 (85.7)	8.39 (0.94-74.91)	0.057		
Experience (years)	1-3	87 (63.0)	51 (37.0)	Ref.			
	> 3	51 (58.6)	36 (41.4)	1.00 (0.43-2.32)	0.990		
Place of work	Community hospitals/ Private hospitals/ Local administrative organization	69 (65.7)	36 (34.3)	Ref.			
	General hospitals/ University-affiliated hospitals/ Erawan Emergency Medical Center	69 (57.5)	51 (42.5)	1.34 (0.74-2.42)	0.321		
Training experience on COVID-19	No	74 (70.5)	31 (29.5)	Ref.			
	Yes	64 (53.3)	56 (46.7)	1.83 (1.01-3.31)	0.045	1.79 (1.01-3.17)	0.043*
Prior hands-on experience in COVID-19 patient retrieval	No	45 (81.8)	10 (18.2)	Ref.			
	Yes	93 (54.7)	77 (45.3)	2.86 (1.32-6.21)	0.008	3.33 (1.56-7.12)	0.002*
Perceived risk of exposure	Low to moderate	15 (75.0)	5 (25.0)	Ref.			
	High	123 (60.0)	82 (40.0)	1.57 (0.48-5.14)	0.455		
Perceived severity	Low to moderate	10 (66.7)	5 (33.3)	Ref.			
	High	128 (61.0)	82 (39.0)	0.87 (0.24-3.11)	0.834		

Abbreviations: CI, confidence interval; n, number; OR, odds ratio; Ref, reference

DISCUSSION

This study revealed that paramedic preparedness for handling COVID-19 cases remained moderate, with only 38.7% of participants demonstrating full preparedness. While structural and operational readiness scores averaged approximately 50%, this figure falls significantly short of the standards required for effective emergency response during high-risk outbreaks. The findings point to systemic limitations, such as inadequate infrastructure, insufficient access to PPE, and resource constraints, which undermined paramedics' readiness and confidence. During Thailand's third wave, resource shortages, excessive workloads, equipment deficits, and public communication challenges further strained EMS capacity. Effective outbreak response demands near-perfect safety standards, as even minor errors can compromise patient outcomes. Prior research emphasizes that EMS readiness hinges on supportive policies such as compensation and access to high-quality protective gear[14]. Systematic reviews cite personal risk, PPE shortages, and evolving guidelines as key barriers[15]. As a critical public health sector, EMS requires robust medical resources, PPE, specialized equipment, transport vehicles, institutional collaboration, and community engagement to mitigate infection risks[16].

Importantly, this study found that training and previous experience in managing COVID-19 cases were statistically significant predictors of individual preparedness. Paramedics who had received training were 1.79 times more likely to be prepared (95% CI = 1.01-3.17), while those with prior hands-on experience were 3.33 times more likely to be prepared (95% CI = 1.56-7.12) (Table 4).

Although the original conceptual framework did not explicitly incorporate the relationship between training, experience and practice, these results necessitate a clearer theoretical distinction between these constructs. In this context, training refers to formal, structured educational interventions including didactic instruction and simulation-based learning. Experience encompasses direct exposure to COVID-19 patient care and real-world clinical encounters. Practice represents the ongoing application and refinement of both trained skills and experiential knowledge in clinical settings. The substantially higher odds ratio for experience (OR = 3.33) compared to training (OR = 1.79) suggests that hands-on exposure provides more robust preparedness than formal instruction alone. This differential impact aligns with experiential learning theory, which posits that learning through direct experience yields deeper understanding and better skill retention than passive knowledge acquisition. The nearly two-fold difference in effect sizes indicates that contextual and adaptive learning occurring during real patient encounters may be more effective in developing emergency preparedness competencies than standardized training protocols alone. These results suggest that training and experiential learning play a pivotal role in shaping the actual practice behaviors of paramedics in the field. This is consistent with well-established theories of adult learning and emergency preparedness, which emphasize that structured training improves not only knowledge acquisition but also behavioral response capacity during real-world emergencies. However, our findings indicate that the combination of both modalities may be optimal, as training provides foundational knowledge frameworks while experience develops practical expertise and adaptive problem-solving skills necessary for complex emergency situations.

Given the moderate preparedness levels found, this evidence supports the potential for simulation-based and virtual training to address identified gaps in emergency preparedness among paramedics[17,18]. Importantly, training programs should be designed to bridge the gap between theoretical knowledge and practical application, potentially through progressive exposure models that combine classroom instruction with supervised clinical experience. The results of this study can be applied in public health, particularly in training, to help healthcare personnel gain confidence in dealing with epidemic situations, reduce stress, and be better prepared to manage more complex situations[19]. It also ensures that they receive continuous updates and real-time information necessary for effective practice. Additionally, real-world experience further boosts healthcare professionals' confidence, enhances their adaptability to diverse situations, facilitates rapid clinical decision-making, strengthens team communication, and improves coordination efficiency. Experience fosters the development of strategic response plans, aligning with the WHO's preparedness guidelines, which emphasize that experience helps healthcare systems refine their approaches to respiratory infectious disease outbreaks[20].

The results consistently demonstrated that paramedics, as frontline healthcare workers, exhibited a high level of risk perception and awareness regarding the severity of COVID-19 infection, reflecting their professional understanding of the disease's dangers and the critical need for preventive measures. Given their frequent exposure during patient care, commuting, and work in high-risk environments, such awareness is essential. These findings align with previous studies[21,22], which have established that healthcare professionals perceive COVID-19 as a significant threat and recognize their elevated infection risk compared to the general population. Paramedics' heightened awareness, which likely exceeded that of the general public[23], may have been influenced by the widespread outbreaks occurring in Thailand during the study period[24]. However, while this heightened risk perception and awareness reflect paramedics' professional vigilance and commitment to safety, the findings indicate that perception alone was insufficient to ensure full operational preparedness. This gap between awareness and action underscores the need for comprehensive

structural support and targeted skill-based training to bridge the divide between knowledge and its practical application in emergency response settings.

Several limitations must be noted. First, online surveys may have introduced response biases due to potential misinterpretations. Second, the findings are specific to frontline paramedics and may not extend to other healthcare roles. Third, generalizability of findings to the broader paramedic population may be limited due to potential selection bias, as survey respondents may represent a subset of particularly engaged or motivated individuals with specific perspectives on emergency preparedness. Fourth, the study did not assess participants' physical and mental health status, which could potentially influence their preparedness levels. Finally, preparedness was evaluated at the individual level, excluding systemic factors (e.g., policies, management, and technology) that shape overall preparedness.

CONCLUSION

Paramedics play a crucial frontline role in patient care, ranging from community-based responses to advanced emergency medical systems. The study found that paramedics had a high level of COVID-19 perception, but only 38.7% were fully prepared for operations during the pandemic. The findings emphasize that training and hands-on experience in handling COVID-19 cases significantly enhance paramedics' operational preparedness. To improve individual-level preparedness, it is essential to develop comprehensive training programs to build protocol proficiency and provide practical experience opportunities to enhance confidence and efficiency in public health emergencies.

CONFLICT OF INTEREST

The authors declare no conflicts of interest regarding the research, authorship, or publication.

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DATA AVAILABILITY STATEMENT

The datasets utilized and/or analyzed throughout the present study may be obtained from the corresponding author upon reasonable request.

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