# RESEARCH

Prevention and control practices of hand, foot, and mouth disease and related factors among teachers and child caregivers in childcare centres in Phitsanulok Province: a crosssectional study

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# Abstract

**Background** Hand, foot, and mouth disease (HFMD) is a contagious disease associated with several outbreaks in Thailand, especially among children under five years old, particularly those in childcare centers. This cross-sectional study aimed to investigate the knowledge, attitudes, and practices related to the prevention and control of HFMD and to identify the factors associated with the practices among teachers and child caregivers in childcare centres in Phitsanulok Province.

**Methods** The sample included 270 teachers and child caregivers in childcare centres under the local governments in the 9 districts of Phitsanulok Province, Thailand, through stratified random sampling. A validated and reliable self-administered questionnaire was used to collect data. The data were analysed using descriptive statistics and multiple logistic regression to identify associated variables at the  $\alpha = 0.05$  significance level.

**Results** In total, 156 participants (57.78%) had inadequate knowledge (score < 10), 192 participants (71.11%) had a negative attitude (score < 60), 202 participants (74.81%) reported insufficient support for information and equipment (score < 54), and 196 participants (72.59%) displayed low levels of preventive practice (score < 95). Multivariate analysis revealed that participants who had experience caring for children with HFMD (AOR = 2.57, 95% CI = 1.29–5.13, p = 0.007), those with positive attitudes towards HFMD (AOR = 2.69, 95% CI = 1.41–5.15, p = 0.003), and those who received adequate information and equipment support from the local government and healthcare sector (AOR = 6.26, 95% CI = 3.26–12.02, p < 0.001) were more likely to engage in the prevention and control of HFMD practices.

**Conclusions** These findings emphasize the need for training programs designed using experiential-based learning (EBL) to increase positive attitudes and practices. Furthermore, local governments and healthcare sector should increase support for providing information and equipment consistent with the Ministry of Public Health guidelines in Thailand.

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**Open Access** 

**Keywords** Hand, foot, and mouth disease (HFMD), Knowledge, Attitude, Prevention and control practices, Childcare centre

## Introduction

Hand, foot, and, mouth disease (HFMD) is a viral illness that affects young children under 5 years of age and is characterized by mouth sores and rashes on the hands and feet that typically resolve without complications [1]. HFMD is caused by various enteroviruses and spread through oral ingestion of the shed virus from the gastrointestinal or upper respiratory tract of infected hosts or via vesicle fluid or oral secretions. Patients tend to be most infectious during the first week of the disease, with an incubation period ranging between 3 and 6 days. Following ingestion, the virus replicates in the lymphoid tissue of the lower intestine and the pharynx and spreads to the regional lymph nodes. This virus can be spread to multiple organs, including the central nervous system, heart, liver, and skin [2]. Severe cases may lead to cardiopulmonary or neurological complications. At present, there is no specific pharmaceutical intervention for HFMD [1]. HFMD remains a major public health concern in Asia, with frequent outbreaks reported in Malaysia, Japan, Singapore, Vietnam, and Cambodia. The outbreak impacts to hospital admission, economic losses, and healthcare costs [3-9].

In Thailand, reports of HFMD during each year from 2014 to 2019 indicated that the morbidity rates per 100,000 population were 101.20, 62.21, 122.14, 107.28, 105.06, and 101.25, respectively. During the COVID-19 pandemic (2020–2021), the rates decreased to 48.64 and 29.11 per 100,000 population due to COVID-19 prevention measures but increased to 151.37 per 100,000 population in 2022. The reported death rates from 2014 to 2019 were 2, 3, 3, and 2 cases, respectively. Among the provinces in Thailand, Phitsanulok is in Health Region 2, including Uttaradit, Sukhothai, Tak, Phetchabun, and Phitsanulok Provinces, Phitsanulok had the highest incidence rates in 2018, 2019, and 2022, at 145.77, 130.75, and 256.19, respectively [10].

Childcare centres take care of children aged 0–4 years, and children have close contact and social interactions there, which can cause the transmission of infectious diseases due to poor management and low immunity in young children. Teachers and child caregivers manage children's daily routines, promote development and learning, monitor growth, and modify undesirable behaviours in collaboration with families. They also ensure a safe and hygienic environment and facilitate communication between childcare centres, parents, organizations, and the community. Teachers hold the primary role, with support from child caregivers. The Ministry of Public Health (MOPH) introduced the guidelines, which was a guide for teacher and childcare caregiver to address childcare centre design in four areas: (1) management, (2) staff, (3) facilities and hygiene, and (4) disease prevention equipment. Healthcare providers supervise HFMD management in each region by evaluating management and practices on the basis of these guidelines and providing recommendations to teachers and childcare caregivers to improve childcare centres. In Phitsanulok, 70 of 225 childcare centres (31.11%) completed the assessment, with 67 (95.71%) meeting the standards and three (4.29%) not meeting the criteria in terms of delayed reporting, and a lack of training for child caregivers in disease prevention contributed to high HFMD rates [11].

Studies conducted among parents, teachers and child caregivers in the childcare centres and private kindergartens in Singapore and Thaildand have shown that the factors influencing HFMD control are level of education, training history, knowledge, task assignments, knowledge and equipment support from health performing personnel, and community involvement [9, 12–14]. However, gender, age, job position, work experience, student-toteacher ratios, and policy perceptions are not correlated with HFMD control efforts [15]. In Bangkok childcare centres, age, teaching experience, and training on HFMD prevention predict positive prevention behaviours [16]. Additionally, factors such as the presence of children under 2 years of age, household size, and parental knowledge are correlated with HFMD cases [12].

For nonpharmaceutical public health interventions to promote and sustain preventive behaviours effectively, leveraging evidence on social, cognitive, and psychological factors is essential. This approach aligns with the knowledge, attitude, and practices (KAP), highlighting the importance of enhancing knowledge, fostering positive attitudes, and encouraging sustained practice within the community. The KAP model, which was developed from Bandura's learning theory in 1976 [17], states that individual behaviour is learned through social context. This idea aligns with Ajzen's theory [18] that behavioural intention is related to behavioural attitudes. Both theories are consistent with prior studies [19] on the relationships among KAP. Ajzen [18] noted that positive attitudes and behaviours lead to good intentions towards issues and are influenced by social factors such as health personnel support and health information from various sources. This social context helps identify KAP that lead to better public health practices in preventing and controlling HFMD. Public health practices involve four areas: (1) preventing causative factors; (2) maintaining behaviours and reducing risk factors; (3) responding to disease control plans; and (4) reporting abnormal events, illnesses, and deaths [11, 20]. Research using the KAP helps identify knowledge gaps, attitudinal barriers, and practices, leading to better training and improved public health practices regarding the prevention and control of HFMD. However, the prevention and control practice guidance launched by the MOPH has not been investigated. The aims of this study were to investigate the KAP related to the prevention and control practices of HFMD according to the guidance of Thailand MOPH and to identify the factors associated with the practices among teachers and child caregivers in childcare centres in Phitsanulok Province.

## **Materials and methods**

This study employed a cross-sectional survey conducted in 2024 in Phitsanulok Province, which encircles the medical hub of the lower northern region. A report from health region 2 indicated that the total number of HFMD cases in Phitsanulok Province was the highest in 2023. Phitsanulok Province consists of nine districts: Bang Krathum, Bang Rakam, Chat Trakan, Mueang Phitsanulok, Nakhon Thai, Noen Maprang, Phrom Phiram, Wang Thong, and Wat Bot (Fig. 1) [21, 22]. There is a total of five hundred and seven teachers and child caregivers at two hundred and twenty-five childcare centres. The sample size was calculated by using the finite population proportion estimation formula from N4Studies, in which N=507, P is the proportion of moderate and high scores for preventive behaviour against HFMD among caregivers of children, and d is the allowable error, set at 10% of the standard deviation (SD). In accordance with previous study [23], P is assumed to be 84%. With a significance level ( $\alpha$ ) of 0.05, the required sample size is calculated to be 224. Considering the 20% nonresponse rate, the sample size increases to 268.8. When this number is rounded to the nearest whole number, the final total sample size is 270.0.1 times

The sampling is conducted using stratified sampling, for one stratum based on districts, with a total of 9 districts. Populations within the same district will have similar characteristics, whereas different districts will have different characteristics. Proportional allocation was used to allocate the sample size in each stratum to be proportional to the number of sampling units in that stratum. The researchers selected the teachers and child caregivers in childcare centres as the research subjects (Table 1). The inclusion criteria were (1) being a teacher or child caregiver working in a childcare centre for a local





- Phitsanulok Province consists of nine districts as follows: 1 Mueang Phitsanulok 2 Nakhon Thai
- 2 Nakhon Tha
- 3 Chat Trakan
- 4 Bang Rakam
- 5 Bang Krathum
- 6 Phrom Phiram
- 7 Wat Bot
- 8 Wang Thong
- 9 Noen Maprang

Fig. 1 Map of study setting in nine districts of Phitsanulok Province. Source: https://commons.wikimedia.org/wiki/File: Thailand\_Phitsanulok\_locator\_m ap.svg; https://commons.wikimedia.org/wiki/File: Districts\_Phitsanulok\_province.png

District	Population			Sample				
	Number of teachers	Number of childcare givers	Sum of teachers and childcare givers	Number of childcare centres	Number of teachers	Number of childcare givers	Sum of teachers and childcare givers	Number of child- care centres
Chat Trakan	21	27	48	20	11	14	25	12
Nakhon Thai	28	32	60	27	15	17	32	16
Noen Maprang	20	17	37	20	11	9	20	12
Bang Krathum	16	23	39	13	9	12	21	8
Bang Rakam	20	33	53	16	11	17	28	10
Phrom Phiram	30	50	80	47	16	27	43	28
Mueang Phitsanulok	53	50	103	36	28	27	55	22
Wang Thong	28	36	64	35	15	19	34	21
Wat Bot	10	13	23	11	5	7	12	7
Total	226	281	507	225	121	149	270	135

#### Table 1 The population and sample of this study

administrative organization or municipality in Phitsanulok Province, with at least six months of work experience and having an age between 20 and 59 years; (2) being able to communicate and understand Thai; and (3) being willing to participate in the research project. The exclusion criterion was planning to relocate their workplace within six months during the time of the research project.

## Instrument and data collection

In accordance with the Disease-Free Childcare Evaluation Manual, which is used as a guideline for the prevention and control of HFMD [11], and related literature [9, 23], a self-administered questionnaire was used. Before data collection, permission was obtained from the district and provincial health offices, and the approval letter was forwarded to the sub-district health promoting hospital and local government. KC visited each childcare centre to recruit participants and provide information about the project. An online session was conducted for those willing to participate, explaining the study's objectives, contribution, and methodology, including instructions on completing and returning the questionnaire. This session lasted three hours, allowing participants to ask questions and engage in discussions until all concerns were addressed. Participants were given two weeks to complete the questionnaire. If responses were not received within the first week, gentle reminders were sent twice by telephone to the director of childcare centres. For the unreturned questionnaires, KC personally visited the childcare centre to collect them.

The paper-based questionnaire, administered in Thai, was divided into five sections: personal information, knowledge, attitudes, support information and equipment from the local government and healthcare sector, and the prevention and control practices of HFMD scale (Supplementary file 1). The personal information section consisted of 8 questions. The knowledge section comprised 11 questions, which were answered with "yes" or "no." The score of the correct answer of a single choice was 1, and the score of the incorrect answer was 0, with the highest score of 11. Knowledge was categorized into adequate and inadequate knowledge. The attitude section included 13 items scored on a five-point Likert scale (5: strongly agree to 1: strongly disagree), with the highest score of 65. The support information and equipment section that received support from the local government and healthcare sector consists of 13 items rated on a five-point Likert scale (5: strongly agree to 1: strongly disagree), with the highest score of 65. The prevention and control of HFMD scale consists of 24 items scored on a four-point rating scale (1: never, 2: sometimes, 3: often, and 4: always), with the highest score of 96. Higher scores indicate a more positive attitude, greater support received for HFMD prevention and control practices, and better HFMD prevention and control practices that align with the MOPH guidelines. Positive responses for the prevention and control of HFMD practices include high and low practices. The cut-off scores were determined based on a prior study [9], who used the 75th percentile of the observed scores for knowledge, attitudes, support information and equipment, and prevention and control practices of HFMD to classify respondents as having "high" or "low" scores in each domain.

The validity and reliability of the questionnaire were assessed. The content validity was verified using the content validity index (CVI) by a panel of five experts. The item-level content validity index (I-CVI) ranged from 0.8 to 1. The scale-level content validity index was based on an average (S-CVI/Ave), which is the average of the I-CVI, and it yields an S-CVI/Ave value of 0.99. The scale-level content validity index, universal agreement (S-CVI/UA) is 0.93. The value that is acceptable for the I-CVI is 0.78 [24]. The preliminary questionnaire was pilot-tested with 30 teachers and child caregivers. Kuder-Richardson

formula 20 (KR-20) was used to estimate reliability for dichotomous scales of knowledge. The Cronbach's alpha coefficient was used to evaluate the internal consistency of attitudes, support information and equipment, and prevention and control of HFMD. The value of the KR-20 was 0.60 and the Cronbach's alpha coefficients were reported for all scales as 0.72, 0.94, and 0.83. In social science research, a Cronbach's Alpha Coefficient and KR-20 value of 0.6 is generally accepted, with values of 0.7 or higher considered reliable [25–27]. Therefore, the values are acceptable levels of relativity for each domain.

## Data analysis

The dependent variable in this study was prevention and control of HFMD practices, and the independent variables were gender, age, marital status, highest education, number of years working in childcare, HFMD training experience within the last year, experienced in caring for child infected with HFMD, knowledge, attitude, support information and equipment received from local government and healthcare sector regarding HFMD. Descriptive analysis was performed to describe the sociodemographic characteristics of the participants. The negative items in the knowledge, attitude, support information and equipment, and prevention and control practices regarding HFMD were converted from negative data into positive data by reverse coding [28]. Bivariable logistic regression was used to examine the relationship

**Table 2** Demographics of the respondents (n = 270)

Variable	n	%
Sex		
Female	260	96.30
Male	10	3.70
Age (Years)		
<45	150	55.56
≥45	120	44.44
Mean (SD.) = 42.625 (8.892)		
Marital status		
Married	149	55.19
Single/Widowed/Divorced/Separated	121	44.81
Highest education		
University and above	204	75.56
Less than university	66	24.44
Number of years working in childcare (years)		
<13	140	51.85
≥13	130	48.15
Mean (SD.) = 12.755 (8.027)		
HFMD training experience within the last year		
No	175	64.81
Yes	95	35.19
Experienced in caring for child infected with HFMD		
No	90	33.33
Yes	180	66.67

between the dependent variable and each independent variable. The multicollinearity was checked by the variance inflation factor (VIF), yielding values of 1.23, and noncollinear covariates were included in the final multivariable logistic regression model to evaluate associations with the outcome variable. In bivariate logistic regression, all explanatory variables were analysed separately. Variables with a p-value < 0.25 were then selected for the multivariate analysis. This is a rule of thumb that any predictor with a *p*-value < 0.25 was considered as a potential predictor to be entered into the initial model [29]. The crude odds ratio (OR) was interpreted by comparing it to a specific reference category. Confounding factors were explored by comparing the difference between the adjusted odds ratio (AOR) in multivariate analyses and crude OR in bivariate analysis. AOR with 95% confidence intervals (CIs) were calculated to identify factors associated with the outcome variable, with statistical significance set at a *p*-value < 0.05.

This study was approved by the Naresuan University Research Ethics Committee on Human Research (COE No. 185/2024). Access to the field was obtained with permission from the provincial administrative organization prior to data collection. All the participants were fully informed and signed the informed consent form.

## Results

## Sociodemographic characteristics

The overall characteristics of the respondents are shown in Table 2. Most of the respondents were female (96.30%). More than half of the participants were aged less than 45 years (mean = 42.63, SD = 8.89) and were married (55.19%). The highest educational level for the majority of the respondents was at the university level and above (75.56%). More than half of the respondents had worked in childcare for less than 13 years (Mean = 12.75, SD = 8.03). Most of the participants had training in HFMD in the past year (64.81%). Approximately 33.33% had experienced caring for a child infected with HFMD.

Table 3 presents the categories and mean scores for knowledge, attitudes, support information and equipment received, and prevention and control of HFMD practices. Among the participants, 156 (57.78%) demonstrated inadequate knowledge levels (score <10), and while 114 (42.22%) demonstrated adequate knowledge (score  $\geq$ 10), with a mean score for knowledge of 8.918 (SD. = 1.65). The majority, 192 respondents (71.11%), had a negative attitude (score <60), whereas 78 respondents (28.29%) had a positive attitude (score  $\geq$ 60). The mean score for attitudes was 56.22 (SD. = 5.00). For support information and equipment received, 202 respondents (74.81%) reported receiving poor support (score <54), whereas 68 respondents (25.19%) received good support (score  $\geq$ 54), with a mean score of 45.31 (SD. = 11.27).

Group category and mean score	n	%
Knowledge		
Inadequate (< 10)	156	57.78
Adequate (≥10)	114	42.22
Mean (SD.) = 8.92 (1.65) Percentile 75 <sup>Th</sup> = 10		
Attitude		
Negative (<60)	192	71.11
Positive (≥60)	78	28.29
Mean (SD.) = 56.22 (5.00) Percentile 75 <sup>Th</sup> = 60		
Support information and equipment received		
Poor (< 54)	202	74.81
Good (≥ 54)	68	25.19
Mean (SD.) = 45.31 (11.27) Percentile 75 <sup>Th</sup> = 54		
Prevention and control of HFMD practices		
Low practice (< 95)	196	72.59
High practice (≥95)	74	27.41
Mean (SD.) = 90.10 (5.53) Percentile 75 <sup>Th</sup> = 95		

In terms of prevention and control of HFMD practices, 196 respondents (72.59%) reported low practice levels (score < 95), whereas 74 respondents (27.41%) practised at a high level (score  $\geq$  95), with a mean score of 90.10 (SD. = 5.53) (Table 3).

Bivariate logistic regression analysis revealed that age, experience caring for HFMD-infected patients, knowledge of HFMD, attitudes towards HFMD, and support information and equipment received were associated with the prevention and control of HFMD. The multivariate analysis indicated that respondents who had experience caring for children infected with HFMD (AOR = 2.57, 95% CI = 1.29–5.13, P = 0.007), respondents who had positive attitudes towards HFMD prevention (AOR = 2.69, 95% CI = 1.41–5.15, p = 0.003) and respondents who had good support information and equipment received (AOR = 6.26, 95% CI = 3.26–12.02, p < 0.001) were more likely to practice the prevention and control of HFMD (Table 4).

## Discussion

This study surveyed childcare centres in Phitsanulok Province, Thailand. The findings indicate that a significant number of participants had limited knowledge, negative attitudes, insufficient support for information and equipment from the local government and healthcare sector, and low levels of preventive and control practices related to HFMD. However, teachers and child.

caregivers who had experience caring for children with HFMD, had a positive attitude towards HFMD, and adequate support from local authorities and healthcare providers were more likely to engage in effective prevention and control practices.

The results revealed that 57.78% of the participants had inadequate knowledge of HFMD, which could hamper

efforts to prevent and control practices the disease. The three most common incorrect answers included the following: 61.11% provided answers concerning HFMD having a vaccine, 46.67% said that cleaning with soapy water and detergent was sufficient, and 31.85% said most cases improved within 5-7 days (Supplementary file 2). The finding from this study aligns with previous research indicating instability among childcare staff and the ineffectiveness of commonly used antiseptics such as Dettol® and detergent and water for cleaning that lack chlorine in controlling the virus [14]. Limited knowledge can contribute to disease spread and delay medical treatment, potentially resulting in severe complications such as meningitis and myocarditis, as noted in a study [30], which reported that 65.6% of parents had poor HFMD knowledge. Similarly to the previous study [9] reported an inadequate understanding of HFMD transmission among parents and teachers. In contrast, a study in Selangor, Malaysia, reported that 87.2% of caregivers had moderate knowledge of HFMD [31]. These discrepancies may be due to variations in geographic location and sociodemographic factors. The findings emphasize the importance of the content for training courses on HFMD prevention, including knowledge of the incubation period, hygiene practices, and environmental cleanliness.

In terms of attitudes, 71.11% of the respondents had negative attitudes, which may impact practices related to the prevention and control practices of HFMD. The three items for which negative attitudes were most noticeable included the belief that the childcare centres should remain open but not allow children infected with HFMD (72.59%), adults with HFMD who do not have visible blisters on their hands and mouth cannot spread the disease to children and others (69.26%), and contaminated food can cause HFMD in children (23.7%) (Supplementary file 2). This study's finding was consistent with the low scores on attitudes among caregivers of infants and toddlers towards HFMD in Guangzhou, China [32] but contrasts with previous studies that reported moderate attitudes [13, 33]. When the items from the attitude scale in the previous study were reviewed, the results aligned with the attitude of the teachers with high and low practice score of HFMD had similar attitudes in terms of (1) regular cleaning and disinfecting toys and high-contact surfaces, (2) school closures in response to HFMD outbreaks in their centres, and (3) learning more about HFMD [9]. Therefore, enhancing attitudes through training courses that include real-life scenarios will be beneficial for encouraging positive attitudes.

For the support information and equipment received from the local government. The three items related to poor support included the lack of encouragement for participation in programs or activities related to HFMD by public health officers (60.38%), not receiving documents,

## **Table 4** Factors associated with the prevention and control of HFMD (n = 270)

Variable	n	High	Bivariate logistic		Multivariate logistic	
		practice (%)	Crude odd ratio (OR) (95% confident interval)	<i>p</i> -value	Adjusted odd ratio (AOR) (95% confident interval)	<i>p</i> -value
Gender						
Male	10	3 (30.00)	1.14 (0.31–4.12)	0.851		
Female	260	71 (27.30)	1			
Age (Years)						
<45	120	27 (22.50)	0.64 (0.37–1.10)	0.105	0.61 (0.33–1.13)	0.113
≥45	150	47 (31.33)	1		1	
Marital status						
Single/Widowed/Divorced/Separated	121	30 (24.79)	0.79 (0.46–1.35)	0.385		
Married	149	44 (29.53)	1			
Highest education						
Less than university	66	18 (27.27)	0.99 (0.53–1.84)	0.977		
University and above	204	56 (27.45)	1			
Number of years working in childcare (years)						
≥13	130	35 (26.92)	0.95 (0.56–1.63)	0.863		
<13	140	39 (27.85)	1			
HFMD training experience within the last year						
Yes	95	23 (24.21)	0.78 (0.44–1.37)	0.385		
No	175	51 (29.14)	1			
Experienced in caring for child infected with HFMD						
Yes	180	57 (31.66)	1.99 (1.08–3.65)	0.026	2.57 (1.29–5.13)	0.007*
No	90	17 (18.88)	1		1	
Knowledge of HFMD						
Adequate (≥ 10)	114	25 (21.92)	0.61 (0.35-1.07)	0.084	0.640 (0.34-1.21)	0.168
Inadequate (< 10)	156	49 (31.41)	1		1	
Attitude towards HFMD						
Positive (≥60)	78	30 (38.46)	2.10 (1.20-3.70)	0.009	2.690 (1.41–5.15)	0.003*
Negative (<60)	192	44 (22.91)	1		1	
Support information and equipment received						
Good (≥ 54)	68	37 (54.41)	5.32 (2.94–9.63)	< 0.001	6.262 (3.26-12.02)	< 0.001*
Poor (< 54)	202	37 (18.31)	1		1	

OR, odds ratio; \**p* < 0.05

leaflets, and posters about HFMD from the local government sector (61.85%), and not receiving materials related to the disease from the healthcare sector (62.23%) (Supplementary file 2). Moreover, 64.81% of the participants in this study had not experienced HFMD training in the past year. These results are consistent with those of a previous study, which suggested that staff should have appropriate training for HFMD control in childcare centres [14]. In addition, a previous study suggested that the government should facilitate the exchange of information and the provision of support across stakeholders [34]. In this respect, the local government sector should collaborate with the healthcare sector to support information and equipment regarding HFMD practices according to the guidelines of the MOPH, Thailand.

This study revealed that 72.59% of the respondents demonstrated low levels of HFMD prevention and

control practices, which is consistent with the prior study [9] findings of low practice levels among teachers (88.33%)[13]. The three items with the lowest practices scores included infrequent health checkups and chest X-rays (15.19%), infrequent reporting of surveillance data for clusters of HFMD cases (10.75%), and infrequent compiling of morbidity statistics regarding HFMD (8.15%) (Supplementary file 2). In this study, respondents who had experience caring for children infected with HFMD were more likely to engage in prevention and control practices of HFMD. Notably, 66.67% of the participants in this study had this experience. The findings can be explained by the fact that as we practice a skill, it becomes experience, and it improves ability. This finding is supported by the literature indicating that familiar experience occurs in almost any skill we practice; as our proficiency increases, the cognitive burden

decreases [35]. This result is consistent with a previous study reporting that experience in caring for children with HFMD influences preventive health behaviour regarding HFMD among caretakers and parents [36]. To enhance the prevention and control of HFMD practices, training programs should incorporate experiential-based learning (EBL), allowing participants to engage actively with the material through observation, discussion, social interaction, and reflection. This approach helps learners use their experiences to solve problems, gain practical insights, and apply solutions to real-world challenges [37].

The respondents who had a positive attitude towards HFMD were more likely to engage in prevention and control practices of HFMD. This result can be explained by the fact that if people have a positive attitude, they feel positive about practicing the prevention and control of HFMD. This situation was supportive, as people's knowledge, attitudes, and practices regarding the disease are the keys to ensuring success in the battle against the deadly disease [38]. The WHO indicates that knowledge, attitudes, and practices constitute a triad of interactive factors characterized by dynamism and unique interdependence [39]. Previous studies support the effect of attitude on practice [32, 40]. In addition, the literature indicates that determinants of health attitudes and behaviour are individual characteristics (including family and social environments), illness perceptions (personal meanings of disease), and interactions between patients and their healthcare providers [41]. Therefore, healthcare providers should design training to increase positive attitudes by delivering information about HFMD to make care providers more concerned about the illness to shape prevention practices and adherence to guidelines by the MOPH.

Childcare centres that received adequate support in information and equipment from the local government and healthcare sector were more likely to engage in prevention and control practices of HFMD. In Thailand, childcare centres are under the responsibility of local governments, which collaborate with the health sector within the district health system. Because HFMD is contagious, preventing its spread through proper support, such as providing information, training, and disinfection supplies, is essential. This finding aligns with previous research emphasizing the importance of local government involvement in HFMD control in terms of staff qualifications and adherence to guidelines [14]. The results of this study support the findings of a previous study [42], indicating that good collaboration between childcare centres and local governments is one of the factors contributing to the prevention and control of HFMD. Therefore, effective collaboration among local governments, healthcare sectors, childcare centres, communities, and parents is crucial for preventing and controlling HFMD.

The strengths of this study are as follows. First, this study focuses on practices involving the guidelines of childcare centres, which will help the healthcare sector work together with the local government to use these guidelines in real situations. Second, the use of stratified random sampling methods can minimize selection bias. This study has several limitations. First, this is a crosssectional design that provides the relationships between the exposure and outcome variables. Thus, causality cannot be established, and the results should be regarded as associative rather than causal. Second, the generalizability of this study may be limited, as it was conducted within specific geographic and demographic contexts. Variations in the prevalence of HFMD and the support system of local governments across different regions and countries may affect the generalizability of our findings. Finally, social desirability bias may be present, as respondents, especially teachers, may be tempted to choose the 'right' answer rather than the 'true' answer, despite study anonymity. However, this study minimized this risk by explaining how to respond to each item honestly, and it did not affect participant work and freed them from omitting their names in the questionnaires.

## Conclusions

Despite the MOPH of Thailand issuing guidelines for teachers and child caregivers at childcare centres, and healthcare providers offering oversight, HFMD outbreaks continue to occur. Thus, improving practices for the prevention and control practices of HFMD, as evidenced by this study, is essential. The findings highlight the importance of including comprehensive content in training courses on HFMD prevention practices, covering topics such as the incubation period, hygiene practices, and environmental cleanliness. Furthermore, this study found the association of attitude and support information and equipment with the prevention and control practices of HFMD. Training programs should be designed by using experiential-based learning (EBL) to engage participants through observation, discussion, social interaction, and reflection. Local governments should collaborate with healthcare sectors to provide the necessary support for information and equipment, aligning with the MOPH guidelines in Thailand. Ultimately, effective collaboration among local governments, healthcare sectors, childcare centres, communities, and parents and guardians is essential for successfully controlling and preventing HFMD.

#### Abbreviations

HFMD	Hand, foot, and, mouth disease
MOPH	Ministry of public health
KAP	Knowledge, attitude, and practices

SD	Standard deviation
CVI	The Content validity index
I-CVI	The Item-level content validity index
S-CVI/Ave	The Scale-level content validity index, an average
S-CVI/UA	The Scale-level content validity index, universal agreement
KR-20	Kuder-Richardson 20
VIF	The Variance inflation factor
OR	Odds ratio
AOR	Adjusted odds ratio
95% Cls	95% confidence intervals

### **Supplementary Information**

The online version contains supplementary material available at https://doi.or g/10.1186/s12889-025-22351-w.

Supplementary Material 1: Supplement 1: Questionnaire.

**Supplementary Material 2: Supplement 2:** Descriptive statistics of each item on knowledge, attitude, support for information and equipment, and prevention and control practices among teachers and caregivers in childcare centres regarding HFMD.

#### Author contributions

K.C. assisted in the design of this study, developed the instrument, collected the data, and confirmed the data analysis. N.K. conceptualized the research design, performed the data analysis, drafted the original manuscript, and supervised the research. All the authors reviewed and approved the manuscript.

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None.

#### Data availability

No datasets were generated or analysed during the current study.

#### Declarations

#### Ethics approval and consent to participate

This study was approved by the Naresuan University Research Ethics Committee on Human Research (COE No. 185/2024). Access to the field was obtained with permission from the provincial administrative organization prior to data collection. All participants were fully informed and signed the informed consent form.

#### **Consent for publication**

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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