Original research

Knowledge and attitude among Bangladeshi healthcare workers regarding the management and infection prevention and control of Nipah virus

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ABSTRACT

Background: The Nipah virus (NiV) is a zoonotic pathogen that belongs to the Paramyxoviridae family. It can cause severe respiratory and neurological diseases in humans, with varying clinical symptoms. Recognized as a critical public health concern by the World Health Organization, it requires concerted efforts in research and development to prevent outbreaks.

Methodology: An analytical cross-sectional study was conducted on 455 healthcare workers across four major regions in Bangladesh from April 2022 to May 2023. Using multistage convenient sampling and face-to-face interviews with a semi-structured questionnaire, we have examined the level of knowledge, attitudes, and individual perceptions of the preparedness for NiV. Data analysis included univariate and bivariate analyses, followed by binary logistic regression to ascertain the association with demographic factors.

Results: The study identified a gender disparity favoring female healthcare workers (HCWs). Approximately 46.15 % of participants demonstrated a good knowledge about NiV, with doctors showing significantly higher knowledge odds (OR = 5.197, p < 0.001). Interestingly, graduate and post-graduate education levels did not yield a statistically significant correlation with knowledge. Specific training received was positively associated with knowledge levels (OR = 1.832, p = 0.014), highlighting the gap in routine infection prevention education. Regional differences were notable, with participants from Chittagong having a lower level of knowledge compared to Dhaka (OR = 0.307, p = 0.004). Attitudes towards NiV were predominantly positive, although higher education inversely correlated with positive attitudes, suggesting a potential gap between theoretical knowledge and practical attitudes.

Conclusion: While the attitude towards NiV is generally positive among Bangladeshi HCWs, there is a need to enhance knowledge levels, especially in primary care settings and certain regions. To effectively prepare for NiV outbreaks, it is crucial to prioritize continuous education and practical training. The study underscores the importance of implementing uniform educational strategies to equip HCWs across all categories and regions with adequate NiV knowledge and preparedness.

1. Introduction

Nipah virus (NiV), part of the Henipavirus genus in the Paramyxoviridae family, was identified about 20 years ago as the cause of a zoonotic illness. This genus also includes the Hendra virus (HeV) and Cedar virus, although the Cedar virus has not shown pathogenicity.[1] The NiV and HeV can cause fatal neurological and respiratory diseases in a wide range of hosts.[2] NiV initially caused febrile respiratory infections in veterinary populations.[3] Certain bat species are recognized as reservoir hosts for viruses that can infect humans and other animals.[4] NiV transmission occurs through various excretions and secretions from infected bats, including feces, saliva, urine, and birthing fluids. Bats themselves show no symptoms, and their extensive migrations make them effective hosts for viruses and pathogens.[5]

Human infections with NiV are rare, suggesting infrequent transmission from bats to humans. When NiV infects humans, it causes a range of clinical manifestations, from asymptomatic to fatal encephalitis.[3] The virus spreads within the human body through the CNS and respiratory system,[6] with high level of detection in cerebrospinal fluid. The incubation period ranges from four days to two weeks, followed by symptoms like fever, headache, vomiting, and dizziness, as well as specific symptoms such as segmental myoclonus and abnormal pupillary reflexes.[7] The serum neutralization test (SNT) is the most reliable diagnostic method, with ELISA as an alternative.[8,9] In the absence of effective pharmaceutical interventions, treatment is primarily supportive, with a single approved horse vaccine currently available. Preventive measures are crucial until specific treatments are developed.[9,10]

NiV is a WHO priority disease requiring urgent research and development for outbreak prevention.[6] The Coalition for Epidemic Preparedness Innovations (CEPI) and the UK Vaccine Network prioritize developing a vaccine for NiV.[11,12] First discovered in Sungai Nipah, Malaysia, in 1998, NiV outbreaks have also occurred in Singapore, linked to pig handling and slaughter.[13–16] The virus is prevalent in the Indian subcontinent, Indonesia, Southeast Asia, Pakistan, southern China, northern Australia, and the Philippines, with outbreaks recorded in Bangladesh, India, and Pakistan between 2001 and 2012.[17] In Bangladesh, NiV infections typically occur from December to May, with annual cases ranging from 0 to 67 since the first documented case in 2001.[16,18] Recent cases from January to February 2023 resulted in eight fatalities out of 11 cases, with a Case Fatality Rate (CFR) of 73 %.[19]

The Ministry of Health and Family Welfare in Bangladesh has enhanced surveillance, case management, infection prevention and control measures, and risk communication programs.[18,19] Healthcare professionals (HCPs) play a critical role in managing outbreaks and educating patients. Their adequate knowledge is essential for promoting public health practices and mitigating NiV spread. The objective of this study is to evaluate the knowledge, attitudes, perception of risk, and preparedness (KAP) regarding NiV among HCPs in Bangladesh. While they may possess good knowledge about NiV, they might underestimate its public health impact and have stigmatized attitudes towards NiV infection and treatment due to its high infectivity and fatality rates.

2. Methodology

2.1. Study design

This analytical cross-sectional study was conducted in different primary, secondary, tertiary and specialized healthcare settings in Dhaka, Chittagong, Khulna, and Rangpur from April 2022 to May 2023 among 455 healthcare workers. A multistage convenient sampling method was used to select participants to ensure maximum diversity nationwide. First, we decided on four divisions conveniently. Then, we chose different health facilities from these four divisions according to the researcher's convenience in terms of residence, travel cost, distance, and access to the healthcare institution. For the third stage, the volunteering sampling method was used to select healthcare workers (HCWs) from different healthcare settings.

Data was collected by face-to-face interview method. A semi-structured questionnaire including four domains for socio-demographic and other related variables, Knowledge of HCWs about NiV infection management and infection prevention control, attitudes, and preparedness of HCWs towards NiV was designed to be used as a tool to collect data from participants. The questions consisted of 33 items: 7 socio-demographic and other information, 17 knowledge-related items about the epidemiology of NiV disease, clinical features, diagnosis, treatment, and complications of NiV disease; six attitude-related items were used to assess feelings and beliefs towards NiV and its prevention and control measures. There were also three questions to evaluate views on preparedness for NiV and other emerging infectious diseases among participants. The questionnaire was finalized after pretesting to check for the reliability, appropriateness, and consistency of the variables used in the study. We found a Cronbach's alpha score of 0.760 for knowledge and 0.697 for attitude with a separate sample, consistent for all the variables used. We initially prepared the questionnaire in English and then translated it into Bengali, further back translated into English to see its appropriateness.

As our target population was HCWs and all interviewers, doctors, and non-doctors had access to their assigned healthcare settings, we conducted face-to-face interviews to collect data. Authors conducted these interviews by using the Kobo Toolbox. Informed verbal consent was taken from participants before the interview, ensuring strict data confidentiality. The study used the questionnaire's validated English and Bengali versions according to respondent preferences. Authors started cleaning procedures after data collection. In the KOBO Toolbox, the chance of missing and irrelevant data was very low. Interviewers rechecked each questionnaire to see whether appropriately filled, and only selected completed questionnaires for the final analysis.

2.2. Statistical analyses

Using a percentage distribution, we have conducted univariate analyses to assess differences in demographic variables, knowledge, and attitudes among HCWs. We have conducted a bivariate analysis using the Chi-Square test between knowledge and attitude (dependent variable) with all the socio-demographic and other related variables. First, we have assessed an unadjusted odds ratio separately for all the independent variables with knowledge and attitude. Then, we have run an adjusted binary logistic regression model to see the actual effect of different demographic factors on the knowledge and attitude of the participants. We used adjusted odds ratios (aOR) and their 95 % confidence intervals (CIs) as indicators for the strength of the association. We performed all statistical analysis by using STATA/SE version 15.

2.3. Inclusion and exclusion criteria

We have included all health professionals (doctors, nurses, midwives, medical assistants, laboratory technologists, and others), irrespective of age and sex, working in different healthcare settings in Bangladesh at the time of the study. We have excluded the ex-employees and those who had refused to continue the interview in the middle of the interview.

2.4. Ethical consideration

The ethical approval for this study was provided by the Institutional Review Board (IRB) of North South University (2022/OR-NSU/IRB/ 1204). The study adhered to the ethical guidelines outlined in the Declaration of Helsinki, 1964, and its subsequent revisions, as well as equivalent ethical norms. All eligible participants were informed about the survey details, and we have obtained their informed written consent before beginning data collection. The authors are committed to maintaining the confidentiality of all parts of the interview and will not disclose this information to any unauthorized persons under any circumstances, thereby ensuring that all ethical considerations are met, and the privacy rights of human subjects are upheld.

2.5. Measures

2.5.1. Independent variables

Several variables were evaluated to identify the association of knowledge and attitude on NiV with the socio-demographic and other related variables. The items were adapted from studies related to knowledge and attitude of NiV infection adopted from different previous studies, such as age, gender, type of employment, education, professional experience, type of working institution, residence, training, and years before training.[20–24]

2.5.2. Dependent variables

Our dependent variable was knowledge of and attitude towards NiV. The questionnaire was constructed to answer on the knowledge scale either "true," "false," or "do not know." Knowledge was assessed by giving 1 mark to a right answer and 0 to a wrong answer or marking 'don't know.' The scale measured knowledge from a highest score of 30 to a minimum one of 0, he higher the score, the higher the level of knowledge. Seventy percent or more of the correct answers were considered arbitrarily as good knowledge of the participant of the different components about NiV disease. Therefore, the acceptable score was assumed as 21 overall (on a total of 30). For attitude, responses was recorded on a Likert scale, ranging from 1 to 5, with one representing 'Strongly disagree' and 5 'Strongly agree.[24]

3. Results

Table 1 illustrates the descriptive analysis of the demographic characteristics of study participants. A total of 455 individuals were involved in this cross-sectional study, with a mean age of 34.73 years (±7.47). Gender distribution showed that 61.98 % were female and 38.02 % male. Among participants, 33.85 % were doctors and 66.15 % non-doctors, with non-doctor participants comprising medical assistants/SACMO (4.64 %), medical technologists (6.95 %), midwives (4.97 %), and nurses and other professions, both at 41.72 %. In terms of educational qualifications, 45.27 % were graduates, 27.27 % were postgraduates, and 27.47 % were undergraduates. Participants had an

Table 1
Characteristics of the respondents (N = 455).

Characteristics	N (percentage)
Age (years)	34.727 ± 7.467
Gender	
Female	282(61.98)
Male	173 (38.02)
Profession	
Doctor	154 (33.85)
Non-doctor	301 (66.15)
Profession of Non-doctor (302)	
Medical assistant/SACMO	14 (4.64)
Medical technologist	21 (6.95)
Midwife	15 (4.97)
Nurse (Male and Female)	126 (41.72)
Other	126(41.72)
Education	
Graduate	206 (45.27)
Post-graduate	124 (27.27)
Undergraduate	125 (27.47)
Professional Experience in Years	9.374 ± 6.748
Training on Infection Prevention (IPC)	
No	259 (56.92)
Yes	196 (43.02)
Years Passed after Participated in IPC training	
1 year	92 (45.10)
2–5 Years	90 (44.12)
More than 5 Years	22 (10.78)
Division	
Chittagong	48 (10.55)
Dhaka	120(26.37)
Khulna	137(30.11)
Rangpur	150(32.97)
Level of Hospital	
Primary	207(45.49)
Secondary	83(18.24)
Tertiary	145(31.87)
Specialized	20(4.40)
Knowledge on Nipah Virus Infection	
Poor knowledge	245(53.85)
Good knowledge	210(46.15)
Attitude towards Nipah Virus Infection	
Poor attitude	62(13.63)
Good attitude	393(86.37)

*Continuous data was expressed as Mean ± SD and Median (IQR).

average professional experience of 9.37 years (±6.75). The majority (56.92 %) had not undergone specific infection prevention training, while 43.02 % had received such training. Among those trained, 45.10 % had received it within a year, 44.12 % between 2 and 5 years, and 10.78 % more than 5 years prior to the study (Fig. 1).

Participants were geographically distributed across Chittagong (10.55 %), Dhaka (26.37 %), Khulna (30.11 %), and Rangpur (32.97 %). They reported working in primary (45.49 %), secondary (18.24 %), tertiary (31.87 %) and specialized (4.40 %) level hospitals. In terms of knowledge about NiV infection, 53.85 % had a poor level of knowledge, while 46.15 % a good level knowledge (Fig. 2). However, in terms of attitude, the majority (86.37 %) showed a good attitude towards NiV while 13.63 % a poor attitude (Fig. 3).

Table 2 presents factors that influenced the level of knowledge among respondents. Findings indicate that HCWs classified as "Doctor (Clinician)" demonstrated a significantly higher likelihood of possessing knowledge about NiV compared to non-doctors, as evidenced by an odds ratio of 5.197 (p < 0.001, 95 % CI: 2.882–9.370). Furthermore, the analysis suggests that individuals with a "Graduate" or "Post-graduate" education level had higher odds ratios (1.618 and 1.919, respectively), although associations were not statistically significant (p = 0.142, p = 0.063, respectively). Healthcare workers who had received specific training (categorized as "Yes") had a statistically significant association with a higher likelihood of demonstrating knowledge about NiV, as indicated by an odds ratio of 1.832 (p = 0.014, 95 % CI: 1.130–2.973).

There is a significant difference in levels of knowledge about NiV among different divisions, with individuals from "Chittagong" displaying a lower likelihood of appropriate knowledge (OR = 0.307, p = 0.004, 95 % CI: 0.138–0.681) compared to the reference category (Dhaka). Healthcare workers in "Secondary" healthcare settings had notably higher odds (OR = 4.892, p < 0.001, 95 % CI: 2.192–10.915) of having appropriate knowledge compared to those in primary healthcare settings. The odds ratio for "Tertiary and above" healthcare settings was 2.946, although this result did not reach statistical significance (p = 0.413, 95 % CI: 0.222–39.122). Findings indicate that doctors, those who had received a specific training, and those working in certain divisions or higher-level healthcare settings were more likely to ehave appropriate knowledge about NiV.

Table 3 outlines the determinants of participant attitudes towards NiV infection. The analysis indicates that "Doctor (Clinician)" professionals did not display a statistically significant correlation with good attitude towards NiV when compared with non-doctors. The odds ratio of 1.714 (p = 0.153, 95 % CI: 0.818–3.589) suggests that there is no meaningful dissimilarity in this regard.

There was a significant difference in the type of attitudes towards NiV between educational categories. Healthcare workers with a "Graduate" education level had lower odds (OR = 0.327, p = 0.024, 95 % CI: 0.124–0.862) as compared to those with an undergraduate education level. The "Post-graduate" category also had a lower likelihood of good attitude, though it was not statistically significant (p = 0.073). Healthcare workers who received a specific training ("Yes") did not exhibit a statistically significant association with good attitudes towards NiV with an odds ratio of 1.237 (p = 0.487, 95 % CI: 0.679–2.252).

Among the various divisions, "Khulna" and "Rangpur" displayed significantly higher odds ratios of 26.022 (p = 0.037, 95 % CI: 1.213–558.317) and 55.204 (p = 0.011, 95 % CI: 2.504–1216.824), respectively, as compared to Dhaka. This suggests a potential connection with good attitudes related towards the virus. Healthcare workers in "Secondary" healthcare settings showed significantly higher odds (OR = 10.693, p = 0.043, 95 % CI: 1.082–105.667) of demonstrating good attitudes compared to those in primary healthcare settings. Similarly, "Tertiary and above" healthcare settings had higher odds (OR = 24.273, p = 0.040, 95 % CI: 1.152–511.430), although not statistically significant.

The majority of respondents (50.77 %) cited academic knowledge as their primary source of information about NiV. Other significant sources
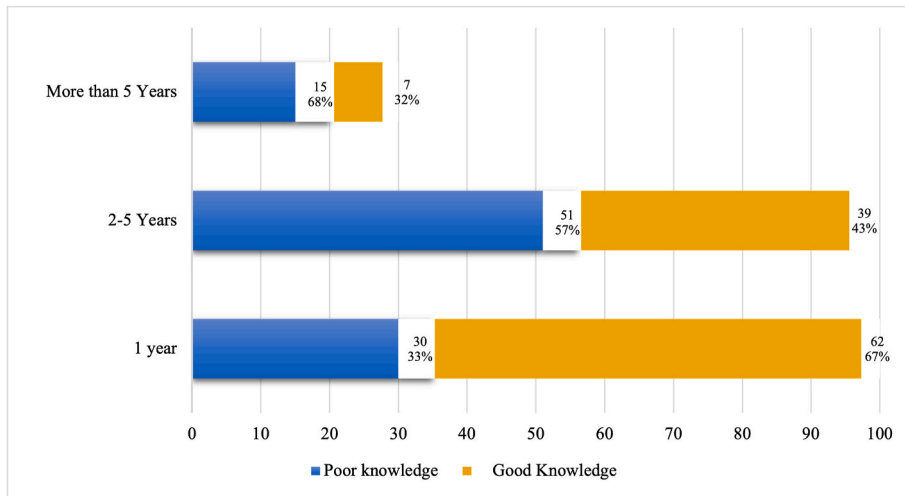
Fig. 1. Knowledge level and years passed after last infection prevention control (IPC) training.
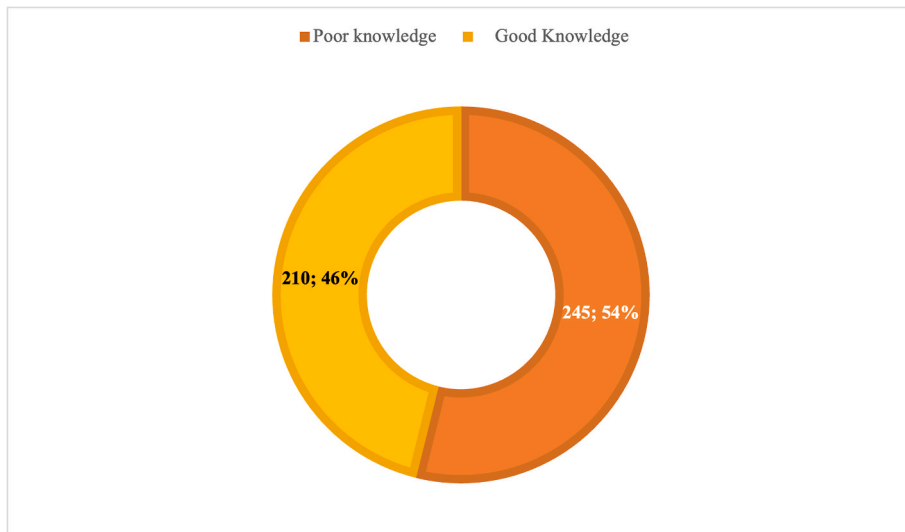

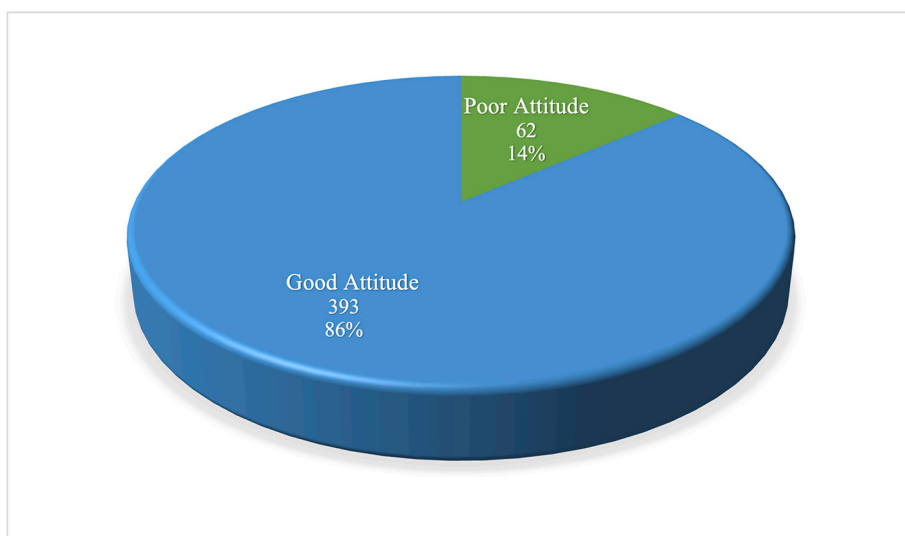**Fig. 2.** Knowledge level on Nipah virus infection.

Fig. 3. Attitude towards Nipah virus infection.

Table 2
Determinants of the level of knowledge on Nipah virus infection.

Characteristics	odds ratio (AOR)	P > |Z|	95 % CI
Profession			
Non-doctor	Ref		
Doctor	5.197	0.000	2.882, 9.370
Education			
Undergraduate	Ref		
Graduate	1.618	0.142	0.851, 3.075
Post-graduate	1.919	0.063	0.964, 3.817
Training on Infection Prevention			
No	Ref		
Yes	1.832	0.014	1.130, 2.973
Division			
Dhaka	Ref		
Chittagong	0.307	0.004	0.138, 0.681
Khulna	1.568	0.734	0.117, 20.969
Rangpur	0.527	0.633	0.0383, 7.267
Level of Hospital			
Primary	Ref		
Secondary	4.892	0.000	2.192, 10.915
Tertiary and above	2.946	0.413	0.222, 39.122

Table 3
Determinants of the level of attitude towards Nipah virus infection.

Characteristics	AOR	P > |Z|	95 % CI
Profession			
Doctor (Clinician/Admin)	1.714	0.153	0.818, 3.589
Non-doctor	Ref		
Education			
Undergraduate	Ref		
Graduate	0.327	0.024	0.124, 0.862
Post-graduate	0.379	0.073	0.131, 1.096
Training on Infection Prevention			
No	Ref		
Yes	1.24	0.487	0.679, 2.252
Division			
Dhaka	Ref		
Chittagong	0.732	0.491	0.300, 1.783
Khulna	26.022	0.037	1.213, 558.317
Rangpur	55.205	0.011	2.505, 1216.824
Level of Hospital			
Primary	Ref		
Secondary	10.693	0.043	1.082, 105.667
Tertiary and above	24.273	0.040	1.152, 511.430

were training (39.34 %) and information from colleagues/friends (40.66 %). The perception of HCWs about their knowledge level to fight NiV was mainly moderate (49.45 %), with a substantial proportion rating it as low (42.64 %). Additionally, most (69.45 %) study participants believed that HPs needed more educational courses. In terms of the level of preparedness of healthcare institutions to manage a NiV outbreak, responses were low (44.62 %), moderate (32.97 %), and high (22.42 %).

4. Discussion

This cross-sectional study sheds light on the knowledge and attitudes of HCWs in Bangladesh towards the management and prevention of Nipah virus disease (NiVD). Findings reflect the global trend of a feminized healthcare workforce, with a significant representation of female HCWs. These observations are consistent with those made in Kerala as identified by Varghese et al. in a previous study.[20]

One of the key findings of this study is the significant difference in knowledge levels between doctors and non-doctor HPs. Doctors demonstrated a high level of understanding of NiVD, which is consistent with the findings of Pavithra et al.[22] However, unlike the study by Varghese et al., this study found a pronounced divergence in knowledge between doctors and non-doctors.[20] This discrepancy may be due to

differences in curricula and continuing professional development opportunities available to various HCW categories in Bangladesh.

Interestingly, educational attainment, such as graduate or postgraduate qualifications, did not significantly correlate with possessing knowledge about NiVD, despite indicating a higher likelihood of having such knowledge. This finding is not in line with the study findings of Attaullah et al.[23] Contrasting results were also identified by Hassan et al.[21] Practical experience and on-the-job learning may supplement formal education in the Bangladeshi healthcare context, which could explain the discrepancy.

The provision of specific training on infection prevention was positively correlated with a better level of knowledge of NiVD, highlighting the importance of targeted educational interventions. This finding is consistent with the conclusions drawn by Himes et al, which underscore the effectiveness of specialized training in improving disease-specific knowledge among HCWs.[24]

Significant regional variations in knowledge levels were found, with participants from Chittagong being less likely to possess adequate knowledge compared to their Dhaka counterparts. This regional discrepancy suggests that geographical factors may impact knowledge dissemination, necessitating a more homogeneous approach to education and training.

Surprisingly, having a graduate-level education was inversely related to exhibiting a good attitude towards NiVD management. This finding is in contrast to existing literature that shows a positive relationship between higher education and proactive health attitudes.[21] One possible explanation could be a sense of complacency or theoretical detachment in higher-educated individuals, which may not translate into practical, attitude-driven actions.

4.1. Strengths and limitations

The study strength lies in its robust sample size and the diversity of participants, allowing for a comprehensive analysis of various HCW subgroups. Additionally, the inclusion of participants from different geographical regions and healthcare settings enhanced the generalizability of the findings within the Bangladeshi context.

However, several limitations should be taken into account when interpreting the outcomes of this study. The study cross-sectional design precludes drawing causal inferences, and self-reported measures of knowledge and attitudes are subject to bias. The study did not capture the dynamic nature of knowledge and attitude evolution over time. Longitudinal studies are needed to understand how these attributes change with ongoing education and the impact of NiVD outbreaks.

5. Conclusion

Despite HCW positive attitude towards NiVD in Bangladesh, there is still a need for improvement in their knowledge, particularly in primary healthcare facilities and certain regions. To enhance preparedness for NiVD outbreaks, continuous education, including formal training and informal knowledge-sharing, is crucial. The study highlights that having higher education and experience does not necessarily equate to better knowledge and attitudes, indicating that practical, hands-on training may be more effective. Ensuring that all HCW categories and regions have the same level of knowledge should be a top priority for health policy and educational strategies in Bangladesh.

Data availability statement

The data underlying the results presented in this study will be provided on reasonable request to Dr. Delwer H. Hawlader. Email: mohammad.hawlader@northsouth.edu.

Funding information

CRediT authorship contribution statement

Tariful Islam: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing – original draft, Writing – review & editing. **Nur-E-Safa Meem:** Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Writing – original draft. **Mehedi Hasan:** Data curation, Formal analysis, Investigation, Resources, Software, Validation, Writing – original draft. **Archi Mutsuddi:** Conceptualization, Investigation, Resources, Validation. **Alberi Afifa Shifat:** Investigation, Resources, Validation. **Arpita Goutam:** Investigation, Resources, Validation. **M. Rashidul Bari:** Investigation, Methodology, Resources, Validation. **Fahima Nasrin Eva:** Investigation, Resources, Validation. **Md Faisal Kabir Rozars:** Investigation, Resources, Validation. **Sayla Sultana:** Investigation, Resources, Supervision. **Naifa Enam Sarker:** Investigation, Resources, Validation. **Mohammad Hayatun Nabi:** Investigation, Resources, Supervision, Validation, Visualization, Writing – review & editing. **Mohammad Delwer Hossain Hawlader:** Conceptualization, Investigation, Project administration, Resources, Supervision, Validation, Visualization, Writing – review & editing.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT and Grammarly in order to improve the readability and language of the manuscript. After using this service, the authors reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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