



Structured Online Education on Midwives' Preparedness for Maternal and Neonatal Care in Disaster Situations

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ABSTRACT

Background: Disruptions in health services during disasters contribute to increased maternal and neonatal morbidity and mortality, necessitating efforts to improve the preparedness of health workers, particularly midwives. This study aimed to analyze the association between structured online health education and midwives' knowledge of how to prevent maternal and neonatal morbidity and mortality in disaster situations.

Methods: The study used a pre-experimental one-group pretest-posttest design with 30 midwives selected through quota sampling from three midwifery education institutions. Data were collected using an 18-item knowledge questionnaire covering three domains: understanding of disasters, priority steps for preventing maternal and neonatal morbidity and mortality, and maternal-neonatal emergency kits. Participants received a single 30-minute structured online education session through Zoom, consisting of a lecture and interactive question-and-answer discussion. The Wilcoxon signed-rank test was used to analyze differences in knowledge scores before and after the intervention.

Results: The mean knowledge score increased from 72.5 to 97.9, with a statistically significant difference between pretest and posttest scores ($p < 0.001$). All respondents showed increased scores, and the knowledge distribution shifted from predominantly sufficient before the intervention to entirely good after the intervention.

Conclusion: It was concluded that structured online health education was associated with improved midwives' knowledge of maternal and neonatal morbidity and mortality prevention in disaster situations

Keywords: *disaster; maternal-neonatal; midwife; online education; preparedness*

INTRODUCTION

Disasters and health crisis situations have been shown to have a significant impact on the sustainability of health services, especially in vulnerable groups such as pregnant women and newborns, thereby contributing to increased maternal and neonatal morbidity and mortality. Studies have shown that health service disruptions during crises, such as the

COVID-19 pandemic, led to a decline in access to essential services, including a 13.1% decrease in outpatient visits and a 2.6% to 4.6% decline in maternal and child health services in low- and middle-income countries, resulting in approximately 113,962 excess deaths, including 3,276 maternal deaths.^[1] Similar conditions also occurred in the Ebola outbreak in Sierra Leone, which resulted in a significant decrease in antenatal

service coverage by up to 22 percentage points and contributed to approximately 3,600 additional maternal and neonatal deaths.^[2] These disruptions are generally triggered by infrastructure damage, limited health workers, and limited resources, which disproportionately impact vulnerable populations.^[3,4] In addition, studies in the Asia-Pacific region identified other barriers, such as delays in maternal mortality audits and limited access to emergency transportation, that further worsened maternal and infant health conditions.^[5] Therefore, a resilient and adaptive health system is needed to ensure the sustainability of essential services during crises and reduce negative impacts on maternal and neonatal health.^[3,4]

In this context, midwives, as frontline health workers, play a strategic role in maintaining continuity of maternal and neonatal services, especially in emergency situations or resource-limited settings. This role includes providing comprehensive obstetric care, early detection of complications, and rapid and appropriate clinical decision-making to prevent maternal and infant mortality. An optimal midwifery service model has been shown to reduce unnecessary medical interventions and increase maternal satisfaction, thereby improving health outcomes.^[6,7] However, in low- and middle-income countries, midwives still face various obstacles, including shortages of health workers, uneven distribution, and limited facilities and infrastructure that support services.^[6,8] This challenge becomes increasingly complex in disaster situations, where healthcare workers are required not only to have clinical competence but also to be prepared for emergency situation management and to adapt to rapidly changing conditions.^[4,8] Therefore, strengthening midwives' capacity through a systematic approach is an urgent need to ensure the continuity of quality maternal and neonatal services.

One strategy to improve health workers' preparedness is through structured education and training interventions. Various studies show that health education is highly effective in improving knowledge, skills, and preparedness for disasters. A systematic review shows that high-complexity educational interventions can significantly improve the professional competence of health workers in health care facilities.^[9] In addition, research on medical students shows that disaster preparedness modules, both online and offline, effectively increase knowledge and confidence, with no significant differences between methods.^[10] Other studies have also shown that educational interventions tailored to the characteristics of target groups can meaningfully improve preparedness knowledge and behavior⁽¹¹⁾. Even in groups of learners, disaster education was shown to significantly improve understanding after an intervention, suggesting that education plays an important role in shaping preparedness early on.^[12] In general, the findings confirm that structured education programs are an effective approach in improving disaster preparedness in various population groups.^[13]

However, most existing research still focuses on health workers in general or on groups other than midwives and has not specifically examined the effectiveness of health education in improving midwives' knowledge of preventing maternal and neonatal morbidity and mortality in disaster situations, a gap also highlighted in recent studies on midwives' disaster preparedness.^[14,15] In fact, the context of midwifery services has unique characteristics, especially in decision-making related to the safety of two individuals at once, namely the mother and the baby. Unlike general disaster-preparedness training aimed at healthcare workers as a whole, midwifery-specific education must address obstetric and

neonatal emergency skills, such as emergency delivery, newborn resuscitation, and maternal psychological support under crisis conditions, that are not typically covered in general disaster curricula. Previous studies on midwives in disaster settings, including recent qualitative work, have largely been descriptive in nature and have not tested a structured educational intervention using an experimental design. This study, therefore, differs from previous research by specifically testing, through a pretest-posttest design, whether a structured online educational intervention can improve midwives' knowledge in this unique context. In addition, based on previous research reports, there was still variation in midwives' knowledge levels before the intervention, indicating a gap in preparedness for emergencies. Therefore, research is needed to specifically evaluate the influence of health education on midwives' knowledge in this context. This research is important not only for filling gaps in the literature but also as a basis for developing more effective, context-specific models of health promotion interventions.

Based on this description, the problem formulation in this study is whether health education increases midwives' knowledge of how to prevent maternal and neonatal morbidity and mortality during disasters. The purpose of this study is to analyze changes in midwifery knowledge following health education interventions, with the aim of strengthening health workers' capacity and developing evidence-based policies to improve health system preparedness, especially in maternal and neonatal services during crisis situations.

METHODS

This study employed a quantitative pre-experimental one-group pretest-posttest design to assess changes in midwifery knowledge regarding the prevention of maternal and neonatal

morbidity and mortality in disaster situations following a health education intervention. This design was selected because it directly measures changes before and after the intervention within the same group, making it suitable for evaluating the effectiveness of educational programs.^[16] The study was conducted from January to July 2024 across three health agency settings in Central Java, Central Kalimantan, and North Sumatra. The study population consisted of midwives who were simultaneously enrolled as non-regular undergraduate midwifery students at STIKes Estu Utomo Boyolali - specifically, practicing midwives holding a Diploma III in Midwifery who were pursuing a bachelor's degree while continuing to work as village midwives. A sample of 30 respondents was selected using quota sampling, with a quota of 10 respondents allocated to each of the three Health Office agencies, based on the researcher's assessment of each agency's representation. Prior to data collection, permission was requested from and granted by each participating agency. Subsequently, a WhatsApp group was established to coordinate communication with the respondents. At each agency, recruitment was carried out by an affiliated field support team to select 10 eligible midwives. Eligible midwives were invited via the institutional WhatsApp group, informed of the study's objectives, procedures, and data confidentiality measures, and asked to participate voluntarily. The inclusion criteria were: enrollment as a non-regular undergraduate midwifery student at STIKes Estu Utomo Boyolali; current employment as a practicing midwife; willingness to provide informed consent; and completion of both the pre-test and post-test. Respondents who failed to complete either the pre-test or the post-test were excluded from the analysis. The independent variable in this study is online-based health education, while the

dependent variable is midwives' knowledge regarding the prevention of neonatal and maternal morbidity and mortality in disaster situations - a crucial issue for maintaining the continuity of health services during crises.^[16]

This study obtained ethical approval from the Health Research Ethics Committee of RSUD Dr. Moewardi, with approval number 696/IV/HREC/2024.

The research instrument was a knowledge questionnaire comprising 18 items and covering three content domains: disaster awareness, priority measures to prevent increased maternal-neonatal morbidity and mortality, and maternal-neonatal emergency kits. Item validity was tested using Pearson product-moment correlation on a pilot sample of 20 respondents, and reliability was assessed using Cronbach's alpha, yielding a coefficient of 0.6, which indicates acceptable internal consistency.^[17-20] Data collection was conducted in stages: a pre-test via Google Forms to assess respondents' baseline knowledge, followed by a health education intervention involving a lecture and interactive discussion on Zoom, and a post-test administered three days later to measure changes in knowledge. The intervention consisted of a single 30-minute online session delivered via Zoom by the research team, structured to include an opening Q&A segment, a lecture on preventing increased maternal-neonatal morbidity and mortality during disaster crises, and a closing Q&A segment. The content covered the same three domains assessed in the questionnaire. This intervention was designed following a structured health education program planning framework, which includes five stages: needs assessment, goal setting, materials development, method selection, and evaluation.^[21] The needs assessment stage was based on previous evidence indicating gaps in midwives' knowledge and preparedness regarding maternal and newborn health care in disaster situations,

as outlined in the Introduction. In the goal setting stage, three learning objectives were established: by the end of the session, participants were expected to be able to (1) explain the types of disasters and their potential impacts on maternal and newborn health, (2) identify priority steps to prevent increased maternal and newborn morbidity and mortality during disasters, and (3) describe the components of an emergency kit for mothers and newborns. In the materials development stage, teaching materials were prepared to meet these three learning objectives, consisting of PowerPoint slides for the lecture session and handout files distributed to participants for review at home; this is in line with the principle that visual media conveys most of the information that students retain. In the method selection stage, a combination of lectures and interactive Q&A discussions were chosen, conducted online via Zoom Meeting by members of the research team, assisted by facilitators, all of whom were midwifery lecturers experienced in maternal and newborn health care and disaster-related health topics. Finally, in the evaluation stage, changes in knowledge scores before and after the session were assessed by comparing pre- and post-session scores using the Wilcoxon signed-rank test. This design is also based on adult learning theory (andragogy), which emphasizes independent, experience-based, and problem-solving-centered learning, which is appropriate for adult learners such as practicing midwives pursuing advanced academic studies.^[22] The selection of online education methods is based on evidence that educational interventions, both online and face-to-face, are effective in improving the knowledge and preparedness of health workers.^[10] Data analysis was conducted using univariate analyses to describe the distribution of respondent characteristics and knowledge levels, and using the Wilcoxon signed-rank test in bivariate analyses to test

differences in pretest and posttest scores at the 0.05 significance level. This approach is used to ensure that changes can be analyzed statistically in line with the data's characteristics and to evaluate changes in health workers' preparedness associated with educational interventions.^[17,19]

RESULT

The characteristics of the 30 respondents, comprising age, length of work as a midwife, education level, and institution, are presented in Table 1.

Table 1. Distribution of Respondent Characteristics (n=30)

Characteristic	n	%
Age		
22-30 years	2	6.7
31-40 years	3	10.0
41-50 years	18	60.0
>50 years	7	23.3
Work tenure		
<5 years	1	3.3
5-10 years	9	30.0
11-15 years	16	53.3
>15 years	4	13.3
Education level		
Diploma III (currently pursuing a Bachelor's)	30	100.0
Institution		
Institution A (Central Java)	10	33.3
Institution B (Central Kalimantan)	10	33.3
Institution C (North Sumatra)	10	33.3
Previous disaster training		
Previously trained	22	73.3
Never trained	8	26.7

Most respondents were aged 41-50 years (18 respondents, 60.0%) and had 11-15 years of work tenure (16 respondents,

53.3%). All respondents (100%) held a Diploma III midwifery background and were currently pursuing a bachelor's degree. Respondents were evenly distributed across the three participating institutions, with 10 respondents (33.3%) from each institution. Regarding previous disaster training, 22 respondents (73.3%) had received disaster-related training, while 8 (26.7%) had not.

This study found an increase in midwives' knowledge following the structured online health education intervention on maternal-neonatal disaster preparedness. This increase is reflected in changes in the average score, the distribution of knowledge categories, and the statistical analysis results, as presented in Tables 2-4.

Table 2. Changes in Pretest and Posttest Knowledge Scores

Variable	Mean	SD	Min	Max
Pretest	72.5	9.3	53	89
Posttest	97.9	3.7	83	100

Based on Table 2, the average knowledge score increased by 25.4 points after the intervention, and the standard deviation decreased from 9.3 to 3.7.

Table 3. Distribution of Knowledge Categories Before and After Intervention

Category	Pretest n (%)	Posttest n (%)
Good	11 (36.7%)	30 (100.0%)
Enough	17 (56.7%)	0 (0%)
Less	2 (6.6%)	0 (0%)

Table 3 shows a shift in the distribution of knowledge categories. Before the intervention, most respondents were in the sufficient category, with smaller proportions in the good and deficient categories. After the intervention, all respondents (100%) reached the good category, with none remaining in the sufficient or deficient categories.

Table 4. Wilcoxon Signed-Rank Test Results

Category	n	Mean nk	Z	p-value	Effect Size (r)
Positive Ranks	30	16.00	21	0.0001	0.90
Negative Ranks	0	-	-	-	-
Ties	0	-	-	-	-

Note. Z = Wilcoxon signed-rank test statistic; r = effect size ($r = Z/\sqrt{N}$), interpreted per Cohen's (1988) criteria (small ≈ 0.10 , medium ≈ 0.30 , large ≥ 0.50).

The effect size, calculated as $r = Z/\sqrt{N}$, was -0.90, indicating a large effect according to Cohen's (1988) criteria. The results of the Wilcoxon signed-rank test in Table 4 show that all respondents experienced an increase in scores (positive ranks = 30), with no decreases or ties. The p-value of <0.001 indicates that the pretest-posttest difference was statistically significant.

DISCUSSION

If analyzed in depth, the fairly steep upward trend suggests that there was a significant knowledge gap before the intervention. This condition aligns with the global phenomenon in which health workers often lack optimal readiness to respond to disasters due to limited specialized training.^[3,4,14] Therefore, the increase observed in this study can be understood as the result of filling the gap through educational interventions. In addition, the shift in score distribution to a higher range suggests that the intervention not only improves basic knowledge but also strengthens advanced understanding.

This finding is further supported by the reduction in score variation (SD decreased from 9.3 to 3.7) and the shift in knowledge categories, with most respondents moving from the sufficient/deficient categories into the good category, and none remaining in the deficient category after the intervention. This pattern suggests that the intervention was associated with a more uniform level of understanding across respondents, in addition to raising the average score.

Similarly, the consistent improvement observed across all respondents in the Wilcoxon signed-rank test (positive ranks = 30, with no decreases or ties) suggests that the pretest-posttest difference was statistically significant. However, because this study used a pre-experimental, one-group design without a control group, these findings should be interpreted as an association between the intervention and improved knowledge rather than as definitive evidence of a causal effect. The magnitude of the increase observed in this study may also be related to the structured and interactive nature of the intervention, consistent with previous findings that both online and face-to-face educational approaches can be equally effective in improving disaster-preparedness knowledge⁽¹⁰⁾; however, this study did not disaggregate the contribution of individual instructional components (e.g., lecture versus interactive discussion segments), which limits identification of which specific elements were most influential.

These findings are consistent with previous research that shows that educational interventions are effective in improving the knowledge and preparedness of health workers. Structured educational interventions have been shown to significantly improve competence⁽⁹⁾, both online and offline⁽¹⁰⁾. In addition, tailoring the material to the target group's needs also increases the effectiveness of the intervention.^[11] The significant improvement in this study aligns the findings of article^[12,13], who emphasize the importance of structured education for improving disaster preparedness.

In the context of health services, these findings are important considering that service disruptions during crises can significantly increase maternal neonatal morbidity and mortality.^[1,2] Increased knowledge among midwives has the potential to improve the quality of decision-making in emergency situations, especially when access to services is

limited. In addition, the role of midwives as frontline health workers in maternal-neonatal services makes them a key factor in maintaining service continuity and increasing their capacity.^[6,7] Thus, health education in this study not only increases knowledge but also strengthens the health system's response to disaster situations.

This study has several limitations that should be considered when interpreting the findings. First, the pre-experimental, one-group pretest-posttest design without a control group limits the ability to attribute the observed improvement solely to the intervention, as other factors cannot be ruled out. Second, the sample size was relatively small (n=30) and drawn using non-random quota sampling, which may limit generalizability. Third, knowledge was measured only three days after the intervention, so the findings do not reflect longer-term retention. Fourth, the short interval between the pretest and posttest raises the possibility of a testing effect, in which familiarity with the questionnaire items may have contributed to the improvement in scores independent of the educational intervention. Fifth, although respondents' previous disaster training was recorded as a demographic characteristic, its association with baseline knowledge or with the magnitude of improvement was not statistically examined in this study. These limitations suggest that the findings should be interpreted with appropriate caution and confirmed through more rigorous designs, such as quasi-experimental or randomized controlled studies with a control group.

CONCLUSION

This study concludes that structured online health education was associated with increased midwives' knowledge of maternal-neonatal morbidity and mortality prevention in disaster situations, as reflected in higher average scores, a shift in the distribution of knowledge categories, and a statistically significant

pretest-posttest difference. These findings address the study's objective of analyzing changes in midwives' knowledge associated with online health education. Given the pre-experimental design used in this study, further research using quasi-experimental or randomized controlled designs with a control group is recommended to strengthen the evidence for a causal relationship and to examine longer-term retention.

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REFERENCES

1. Ahmed T, Robertson T, Vergeer P, Hansen PM, Peters MA, Ofosu AA, et al. Healthcare utilization and maternal and child mortality during the COVID-19 pandemic in 18 low- and middle-income countries: An interrupted time-series analysis with mathematical modeling of administrative data. *PLOS Med.* 2022 Aug 30;19(8):e1004070. <https://doi.org/10.1371/journal.pmed.1004070>
2. Sochas L, Channon AA, Nam S. Counting indirect crisis-related deaths in the context of a low-resilience health system: the case of maternal and neonatal health during the Ebola epidemic in Sierra Leone. *Health Policy Plan.* 2017;32:32–9. <https://doi.org/10.1093/heapol/czx108>.
3. Torreno F, Torreno F. Disrupted Care, Enduring Lessons: Health Systems Under Crisis in the Philippines, Zimbabwe, South Korea, and Israel. A Mixed-Methods Comparative Review of Service Disruptions and Policy Resilience. *Res Sq.* 2025;1–24.

- <https://doi.org/10.21203/rs.3.rs-7769361/v1>.
4. Luthfi A. Peran Tenaga Kesehatan dalam Menjamin Layanan Obstetri-Ginekologi di Tengah Krisis Bencana. *VitaMedica J Rumpun Kesehatan Umum*. 2025;3(3). <https://doi.org/10.62027/vitamedica.v3i3.424>.
5. Blackburn K, Rachel S, Caroline H, Catherine B, Animesh B. Findings from a Qualitative Survey in the Asia- Pacific Region on Maternal and Perinatal Death Surveillance and Response (MPDSR) and Maternal Health Service Disruptions During the COVID-19 Pandemic 2020–2021. *Women and Birth*. 2022;35(S1). <https://doi.org/10.1016/j.wombi.2022.07.016>.
6. Adnani QES, Nurfitriyani E, Merida Y, Khuzaiyah S, Okinarum GY, Susanti AI, et al. Ninety-one years of midwifery continuity of care in low and middle-income countries : a scoping review. *BMC Health Serv Res*. 2025;25:463. <https://doi.org/10.1186/s12913-025-12612-0>.
7. Anita N. Midwifery Practices in Promoting Maternal and Neonatal Health. *Adv Healthc Res*. 2024;2(1):1–12. <https://doi.org/10.60079/ahr.v2i1.343>.
8. Graham MK, Colquhoun S, Sweet L, Labond C, Housen T. Strengthening primary care midwives maternal & neonatal emergency preparedness & readiness in rural & remote resource-limited settings. *Women and Birth*. 2023;36:S28–9. <https://doi.org/10.1016/j.wombi.2023.07.074>.
9. Almutairi F, Alomari D, FitzGerald S, Cotter P, Hegarty J. Effect of Interventions on Hospital-Based Health Care Professionals ' Knowledge and Skills in Disaster Preparedness : A Systematic Review. *Disaster Med Public Heal*. 2025;19(e274):1–16. <https://doi.org/10.1017/dmp.2025.10198>.
10. Krishnan V, Katyal A, Nair SS, Nayak KR. Comparing online and onsite simulation modules for improving knowledge and confidence in disaster preparedness among undergraduate medical students. *Int J Emerg Med*. 2024;17:93. <https://doi.org/10.1186/s12245-024-00667-5>.
11. Zhuo Y, Luo X, Yi T. The Effectiveness of a Disaster Preparedness Educational Intervention for Wheelchair Users: A Pilot Study. *Int J Disaster Risk Reduct*. 2024;110:104812. <https://doi.org/10.1016/j.ijdrr.2024.104812>.
12. White-Lewis S, Beach E, Zegers C. Improved Knowledge of Disaster Preparedness in Underrepresented Secondary Students: A Quasi-Experimental Study. *J Sch Health*. 2021;91:490–8. <https://doi.org/10.1111/josh.13023>.
13. Amini F, Hidarnia A, Ghofranipour F, Motlagh ME. Examining the effectiveness of a training program on improving knowledge, functional skills, and attitude in natural disaster volunteers. *Front Public Health*. 2024;12:1321535. <https://doi.org/10.3389/fpubh.2024.1321535>.
14. Bulgulu ÖŞ, Gökçay G, Akkuş Y, Bağış KO. Midwifery workforce preparedness and competence in disaster situations : a qualitative study. *BMC Nurs*. 2025;24: 1450.

- <https://doi.org/10.1186/s12912-025-04103-8>.
15. Beek K, Mcfadden A, Dawson A. The role and scope of practice of midwives in humanitarian settings : a systematic review and content analysis. *Hum Resour Health*. 2019;5:1–16.
<https://doi.org/10.1186/s12960-018-0341-5>.
16. Sugiyono. *Metode Penelitian Kuantitatif, Kualitatif dan RnD*. Bandung: Alfabeta; 2019.
17. Sürücü L, Ahmet Maslakci. VALIDITY AND RELIABILITY IN QUANTITATIVE RESEARCH. *Bus Manag Stud an Int J*. 2020;8(3):2694–726.
<https://doi.org/10.15295/bmij.v8i3.1540>.
18. Dewi F, Anggraini P, Ana V, Setyawati V, Dian U, Semarang N. Pembelajaran Statistika Menggunakan Software SPSS untuk Uji Validitas dan Reliabilitas. *J Basicedu*. 2022;6(4):6491–504.
<https://doi.org/10.31004/basicedu.v6i4.3206>.
19. Yusup F. Uji Validitas dan Reliabilitas Instrumen dalam Penelitian Kuantitatif. *Jurnal Tarbiyah: Jurnal Ilmiah Kependidikan*. 2018;7(1):17–23.
<https://doi.org/10.18592/tarbiyah.v7i1.2100>.
20. Krisnawati E, Artanti KD, Umar NH. Uji Validitas dan Reliabilitas Instrumen Penelitian Dukungan Suami terhadap Hambatan Penggunaan Metode Kontrasepsi Jangka Panjang pada Multipara Akseptor Aktif di Surabaya Validity and Reliability Test of Research Instruments on Husbands' Support on Barr. *Media Gizi Kemas*. 2024;659–664.
<https://doi.org/10.20473/mgk.v13i2.2024.659-664>.
21. Notoatmodjo S. *Promosi Kesehatan dan Perilaku Kesehatan*. Jakarta: Rineka Cipta; 2020.
22. Knowles M, III EFH, Robinson PA, Swanson RA. *The Adult Learner The Definitive Classic in Adult Education and Human Resource Development*. London: Routledge; 2020.