



## **SI-BENING: SIMULATION-BASED FIRST AID TRAINING INNOVATION TO IMPROVE COMMUNITY KNOWLEDGE IN EARLY DETECTION AND FIRST AID FOR HYPOGLYCEMIA**

**Rahmalia Amni<sup>\*1</sup>, Fikriyanti<sup>2</sup>, Abul A'la Tarigan<sup>3</sup>**

<sup>1,2,3</sup>Faculty of Nursing, University Syiah Kuala, Banda Aceh, Indonesia

e-mail: \*rahmalia.amni@usk.ac.id

### **ABSTRACT**

Hypoglycemia is an emergency condition that requires fast and appropriate treatment. Currently, public knowledge in conducting early detection and first aid is very limited. Training with educational methods is less effective in increasing public knowledge, because it does not involve the community in real life. Therefore, simulation-based training is believed to be more effective in increasing public knowledge. The purpose of this study is to analyze the effectiveness of Si-Bening (Simulation-Based First Aid Training) on public knowledge in conducting early detection and first aid for hypoglycemia emergency conditions. The research method is quasi-experimental with one group pre-post test without control and the research sample was 105 teachers in Banda Aceh City using convenience sampling technique. Data were analyzed using the Wilcoxon Signed-Rank test. Result showed that the majority of respondents had sufficient first aid knowledge (57.1%) and early detection was lacking (42.9%). After the intervention, the majority had high first aid knowledge (95.2%) and high early detection (94.3%). Significant improvements were seen in both early detection knowledge ( $Z = -8.710$ ;  $p < 0.05$ ) and first aid ( $Z = -8.556$ ;  $p < 0.05$ ). Training using the Si-Bening method effectively improved community skills related to early detection and first aid for hypoglycemia. It is recommended that further research utilize the Si-Bening method.

Keywords: Early Detection, Hypoglycemia, Community Knowledge, First Aid, Simulation Training

### **INTRODUCTION**

Hypoglycemia is a medical emergency that can occur in people with diabetes and requires a rapid response due to the risk of serious complications such as loss of consciousness or seizures. According to the international first aid consensus, rapid glucose administration is a crucial intervention in hypoglycemia first aid (Singletary *et al.*, 2020). However, community service studies indicate that the general public's knowledge and preparedness regarding hypoglycemia prevention and first aid remain low. Misbah Nurjannah *et al.* reported an increase in community knowledge scores after a health education intervention that included simulations combined with lecture and discussion methods (Nurjannah, 2025).

While basic education through lectures and discussions has been shown to improve understanding, this method often lacks practical exercises and active participant engagement. Simulation-based approaches have been widely used in medical training to improve clinical skills and emergency preparedness. For example, clinical simulations have been shown to improve hypoglycemia management knowledge and skills in nurses and nursing students in a pre-post-

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test study (Souza *et al.*, 2020). Furthermore, participant perceptions of first-aid simulation training highlight team dynamics, emotional distress, and the effects of debriefing as critical aspects of learning effectiveness (Plch *et al.*, 2023).

To address this gap at the pre-hospital level, this study developed a simulation-based training innovation called Si-Bening, specifically designed for the general public to improve knowledge of early detection and first aid for hypoglycemia. The aim of this study was to analyze the effectiveness of Si-Bening (Simulation-Based First Aid Training) on the public's knowledge of recognizing warning signs and providing first aid in hypoglycemia emergencies in the pre-hospital phase.

## METHODS

This study employed a quasi-experimental design with a one-group pre-test and post-test approach, meaning the intervention and measurements were conducted on only one group, with no control group. The sampling technique used was convenience sampling, involving 105 teachers from two high schools in Banda Aceh City as respondents.

The research instrument was a new questionnaire adapted from a previous instrument and modified based on the latest theories and procedures of the International Diabetes Federation. It covered aspects of knowledge regarding early detection and first aid for hypoglycemia. The questionnaire used closed-ended statements consisting of positive and negative statements, with two alternative answers: "yes" and "no." Content validation was conducted through expert judgment by a competent lecturer in Emergency Nursing from the Faculty of Nursing, Syiah Kuala University. Reliability testing demonstrated that the instrument had a good level of reliability for use in this study.

The intervention was carried out in two stages. In the first stage, the researcher (presenter) explained the theory related to warning signs and pre-hospital first aid for hypoglycemia using lecture and discussion methods. Then, in the second stage, the researcher conducted a simulation of warning signs and first aid measures for hypoglycemia during pre-hospital emergency situations. The simulation activity was carried out with the help of a proband (a person who played the role of a hypoglycemia patient). This activity was also guided by a case study prepared by the researcher before the intervention. The case study was based on real-life experiences and theories related to warning signs and first aid measures for hypoglycemia at the pre-hospital stage. The presenter was an expert in this field of research and was a lecturer in the emergency nursing department.

The research procedure began with measuring respondents' knowledge before the intervention, followed by Simulation-Based First Aid Training (Si-Bening). After the training was completed, knowledge levels were measured again to assess changes. The data obtained were then analyzed using descriptive statistics and the Wilcoxon Signed-Rank test, because the results of the normality test showed that the data were not normally distributed.

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## RESULT AND DISCUSSION

### 1. Distribution of respondent characteristics

Table 1. Respondent Demographic Characteristics (N=114)

Respondent Characteristics	Frequency (f)	Percentage (%)
<b>Age</b>		
Young Adults (20-24 years)	0	0,0
Adults (25-59 years)	103	98,1
Seniors (≥60 years)	2	1,9
<b>Gender</b>		
Male	12	11,4
Female	93	88,6

Based on the distribution of respondent characteristics in table 1, it can be seen that most of the respondents are in the adult age group (25–59 years), namely 103 people (98.1%), while respondents with elderly age (≥60 years) numbered 2 people (1.9%), and there were no respondents in the young adult age group (20–24 years). Based on the results of the study, which showed that the majority of respondents were in the adult age group (25–59 years; 98.1%), this finding is in line with the andragogy theory, which emphasizes that adult learners respond more effectively to training methods that are hands-on experience, relevant to real-life contexts, and problem-centered.

This reinforces the relevance of using simulation in the Si-Bening intervention, given that simulation-based education has been shown to significantly improve participants' knowledge, skills, and confidence in various nursing and emergency training programs (Asegid and Assefa, 2021; Alrashidi *et al.*, 2023; Alharbi *et al.*, 2024). Furthermore, empirical evidence suggests that the use of simulated patients in first aid training can improve knowledge retention and the lay public's ability to respond to emergencies, including hypoglycemia (Avau *et al.*, 2022).

Table 1 also shows that the majority of respondents were female, amounting to 93 (88.6%), while 12 (11.4%) were male. Therefore, it can be concluded that the majority of respondents in this study were adult women. Based on the finding that the majority of respondents were female (88.6%) in the adult group, this discussion indicates that the Si-Bening intervention is highly relevant for implementation in a population predominantly made up of adult women.

Theoretically, women in public health research tend to have higher social participation than men, which can increase the effectiveness of community-based programs and simulations (Ong *et al.*, 2024). Furthermore, studies on gender and health knowledge indicate that women generally have higher health literacy than men, which can accelerate the understanding of training materials on hypoglycemia detection and first aid (Chakraverty *et al.*, 2022). Because women are more active in seeking health services and often take caregiving roles in the family, interventions such as Si-Bening are very strategic in empowering them as primary agents of early detection and first aid for hypoglycemia (Rata Mohan *et al.*, 2025).

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2. Distribution of knowledge on early detection and first aid for hypoglycemia conditions.

Table 2 Distribution of knowledge of early detection of hypoglycemia before the implementation of the Si-Bening intervention (N=105)

No.	Level of Knowledge	Frequency (f)	Percentage (%)
1	Low (<56%)	30	28,6
2	Moderate (56-75%)	60	57,1
3	High (>75-100%)	15	14,3

Based on Table 2, it is known that before the Si-Bening intervention, the majority of respondents' knowledge about early hypoglycemia detection was in the adequate category, amounting to 60 respondents (57.1%). Meanwhile, 30 respondents (28.6%) had low knowledge, and 15 (14.3%) had high knowledge. These results indicate that before the intervention, most respondents had adequate knowledge, but a significant proportion still had insufficient knowledge. Therefore, the implementation of the Si-Bening training program is considered crucial to improving public understanding of early hypoglycemia detection.

The majority of respondents had adequate knowledge about early hypoglycemia detection (57.1%), but a large proportion had insufficient knowledge (28.6%), underscoring the urgency of training due to limited public literacy about hypoglycemia. This is consistent with research showing low public understanding of hypoglycemia symptoms and the importance of appropriate first aid education (Siswanto *et al.*, 2024).

Table 3 Distribution of knowledge of early detection of hypoglycemia after the implementation of the Si-Bening intervention (N=105)

No.	Level of Knowledge	Frequency (f)	Percentage (%)
1	Low (<56%)	0	0,0
2	Moderate (56-75%)	6	5,7
3	High (>75-100%)	99	94,3

Based on Table 3, after the Simulation-Based First Aid Training intervention, there was a significant increase in respondents' knowledge regarding early detection of hypoglycemia. The majority of respondents (99 respondents) had a high level of knowledge, namely 94.3%. Six respondents (5.7%) were in the adequate category, and no respondents were in the poor category (0.0%). These findings indicate that the Si-Bening intervention was effective in improving public knowledge about early detection of hypoglycemia. Nearly all respondents experienced an increase in knowledge to a high level after the training. Following the Si-Bening intervention, there was a very significant increase in knowledge regarding early detection of hypoglycemia, with 94.3% of respondents in the high category and none in the poor category, demonstrating the effectiveness of simulation training in improving public understanding. This is consistent with findings from experimental studies using simulated patients in first aid training, which reported rapid increases in knowledge and long-term retention after one year of training (Avau *et al.*, 2022).

In addition, community service research in schools using simulation methods shows that simulation is very effective in increasing pre-test to post-test knowledge scores in the emergency context, confirming that the simulative

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approach is able to transform theoretical understanding into practical readiness (Oktaviani, Feri and Susmini, 2020; Irwadi, Nursyam, and Saputra, 2025). Therefore, the results of this study support that the Si-Bening intervention can be a very effective educational strategy to improve hypoglycemia literacy in the general population.

Table 4 Distribution of knowledge of first aid for hypoglycemia before the implementation of the Si-Bening Intervention (N=105)

No.	Level of Knowledge	Frequency (f)	Percentage (%)
1	Low (<56%)	45	42,9
2	Moderate (56-75%)	32	30,5
3	High (>75-100%)	28	26,7

Based on Table 4, before the Simulation-Based First Aid Training (Si-Bening) intervention, the majority of respondents (45 respondents, 42.9%) had a low level of knowledge regarding first aid for hypoglycemia. Furthermore, 32 respondents (30.5%) were in the moderate category, and 28 respondents (26.7%) were in the high category. These results indicate that before the intervention, most respondents lacked adequate knowledge regarding first aid for hypoglycemia. This situation indicates the need for simulation-based training, such as Si-Bening, to improve community knowledge and preparedness in dealing with hypoglycemia.

Before the Si-Bening intervention, the results in Table 4 show that 42.9% of respondents were still at a low level of knowledge regarding first aid for hypoglycemia, while only 26.7% had high knowledge, indicating low community preparedness to handle this emergency situation. This condition aligns with findings from community service research showing that public knowledge about first aid for hypoglycemia is still very limited (Nurjannah, 2025), and that health education is very effective in increasing understanding and preparedness through interactive methods such as lectures and simulations (Sharoh *et al.*, 2023). Therefore, simulation-based training such as Si-Bening is essential to strengthen public health literacy and improve initial response skills to hypoglycemia.

Table 5 Distribution of knowledge of first aid for hypoglycemia after the implementation of the Si-Bening Intervention (N=105)

No.	Level of Knowledge	Frequency (f)	Percentage (%)
1	Low (<56%)	0	0,0
2	Moderate (56-75%)	5	4,8
3	High (>75-100%)	100	95,2

Based on Table 5, after the Si-Bening intervention, there was a very significant increase in respondents' knowledge regarding first aid for hypoglycemia. The majority of respondents (100 respondents) were in the high category, with 95.2% of respondents in the moderate category, and no respondents were in the poor category (0.0%). These results indicate that the Si-Bening training program was effective in improving respondents' knowledge regarding first aid for hypoglycemia. All respondents experienced an improvement in their knowledge after participating in this simulation-based training. After the Si-Bening intervention, there was a significant increase in

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respondents' knowledge regarding first aid for hypoglycemia, with 95.2% of respondents in the high category and none in the poor category.

These results demonstrate the effectiveness of simulation-based training in improving public understanding of first aid for hypoglycemia. These findings align with empirical evidence showing that educational simulations improve participants' knowledge in dealing with emergency situations, including hypoglycemia, through a realistic and structured hands-on approach (Saputra *et al.*, 2024; Irwadi, Nursyam, and Saputra, 2025). This significant improvement indicates that simulation-based learning methods are an effective strategy for strengthening public health literacy and emergency preparedness.

Based on the results of the Kolmogorov-Smirnov normality test, a p-value of 0.000 ( $p \leq 0.05$ ) was obtained for both the early detection and first aid data for hypoglycemia. These results indicate that the data are not normally distributed, therefore, a paired t-test cannot be used. As an alternative, bivariate data analysis in this study was conducted using the Wilcoxon Signed-Rank Test. This bivariate analysis aimed to assess the effect of the Si-Bening intervention on improving public knowledge regarding early detection and first aid for hypoglycemia by comparing results before and after training. Details of the test results can be seen in Table 6 and Table 7 below.

### 3. Analysis of the influence of Si-Bening on public knowledge in early detection of hypoglycemia using the Wilcoxon Signed-Rank Test

Table 6 Cross Tabulation of Respondents' Knowledge about Early Detection of Hypoglycemia Before and After the Si-Bening Intervention (N=105)

		N	Mean Rank	Sum Rank	Z-score	Asymp.Sig (2-tailed)
Pre-Post Test Pengetahuan	Negatif Rank	0	0,00	0,00	-8,710	p-value = 0,000
	Postif Rank	100	50,50	5050,0		
Deteksi Dini	Ties	5				
Total		105				

The Wilcoxon Signed-Rank test results in Table 6 show a Z value of -8.710 with a p-value of 0.000 ( $p < 0.05$ ), indicating a significant difference between respondents' knowledge levels before and after the Si-Bening intervention. A total of 100 respondents showed an increase in knowledge, no respondents experienced a decrease in knowledge, and 5 respondents had the same value before and after the intervention. These results indicate that the Si-Bening training effectively increased public knowledge regarding early detection of hypoglycemia. The Wilcoxon test results showed a significant increase in respondents' knowledge after the intervention ( $Z = -8.710$ ;  $p < 0.05$ ), which is in line with the finding that interactive practice-based simulation training significantly improved participants' knowledge (Sunarto and Ediyono, 2022; Elendu *et al.*, 2024).

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4. Analysis of the influence of Si-Bening on the level of public knowledge in providing first aid for hypoglycemia using the Wilcoxon Signed-Rank Test.

Table 7 Cross Tabulation of Respondents' Knowledge about First Aid for Hypoglycemia Before and After the Si-Bening Intervention (N=105)

		N	Mean Rank	Sum Rank	Z-score	Asymp.Sig (2-tailed)
Pre-Post Test Pengetahuan	Negatif Rank	1	5,00	5,00	-8,556	p-value = 0,000
	Postif Rank	96	49,46	4748,0		
Pertolongan Pertama	Ties	8				
	Total	105				

Based on the Wilcoxon Signed-Rank test results presented in Table 6, a Z value of -8.556 was obtained with a p-value of 0.000 ( $p < 0.05$ ), thus it can be concluded that there is a statistically significant difference between the level of knowledge of respondents before and after the Si-Bening intervention. A total of 96 respondents experienced an increase in their level of knowledge, 1 respondent showed a decrease in knowledge, and 8 respondents experienced no change. These results provide empirical evidence that the Si-Bening intervention significantly contributed to increasing public knowledge regarding first aid measures for hypoglycemia, confirming the effectiveness of the simulation-based training approach in increasing respondents' knowledge capacity. Based on the Wilcoxon Signed-Rank test results ( $Z = -8.556$ ;  $p = 0.000$ ), there was a significant difference in respondents' knowledge before and after the Si-Bening intervention, with 96 respondents experiencing an increase, 1 respondent experiencing a decrease, and 8 respondents experiencing no change.

These findings provide empirical evidence that simulation training is highly effective in improving community first aid knowledge for hypoglycemia, which is consistent with experimental research on first aid training using simulated patients: although immediate improvement was not significantly different between groups, long-term knowledge retention (over one year) was significantly better in the simulation group (Avau *et al.*, 2022). Furthermore, a quasi-experimental study of nursing vocational high school students showed that simulation significantly improved emergency anxiety knowledge (Setiyaningrum *et al.*, 2024), reinforcing the idea that simulation can be an effective educational strategy in the community.

### CONCLUSION

The results of this study indicate a significant difference in the level of community knowledge about warning signs and first aid for hypoglycemia before and after the Simulation-Based First Aid Training (Si-Bening) intervention. This finding indicates that the training is effective in improving the community's ability to apply the knowledge gained when facing hypoglycemia situations in themselves and their surroundings. Furthermore, this training model has the potential to be adapted by researchers and other parties involved in similar training activities. Considering that the intervention in this study was implemented simultaneously in one large class, it is recommended that future research implement training in small groups to make the learning process more conducive and interactive, and to achieve more optimal results. This research does not use a control group, so it is recommended that future researchers

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include a control group, so that the research results are more accurate and all confounding variables can be minimized.

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