Effectiveness of Dispatcher-Guided Simulation Training on Lay Responder Performance in Managing Foreign Body Airway Obstruction

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Abstract

Background: Foreign body airway obstruction (FBAO) is a life-threatening emergency in which early bystander intervention is critical. However, gaps in practical skills and confidence among lay responders remain a major challenge. Simulation-based training combined with dispatcher guidance may improve first-aid performance in community settings.

Objective: To evaluate the effectiveness of dispatcher-guided simulation training in improving lay responder performance for managing FBAO.

Materials and Methods: A quasi-experimental, single-arm simulation study was conducted among 30 adult community volunteers with no prior Heimlich maneuver training. Participants managed a simulated choking scenario using an Act+Fast Anti-Choking Trainer while receiving real-time telephone guidance based on the National Institute for Emergency Medicine (NIEMS) protocols. Performance was assessed using predefined critical procedural steps.

Results: Participants who correctly followed key procedural steps—particularly appropriate hand positioning and forceful upward thrusts—demonstrated significantly higher success rates in relieving airway obstruction ($p<0.05$). The training approach also enhanced participant confidence, although challenges related to communication clarity and procedural understanding were observed.

Conclusion: Dispatcher-guided simulation training improved lay responder performance in managing FBAO in a controlled setting. This approach may serve as a scalable educational strategy to enhance community preparedness for choking emergencies. Further studies with controlled designs and real-world settings are needed to confirm these findings.

Keywords: Foreign body airway obstruction; Dispatcher guidance; Simulation training; Lay responders; Emergency education; Heimlich maneuver

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Foreign body airway obstruction (FBAO) is a critical public health issue worldwide, presenting life-threatening emergencies that can lead to severe complications or death if not managed promptly[1,2]. It affects individuals across all age groups but poses a disproportionately higher risk to vulnerable populations such as children and the elderly. Physiological factors like underdeveloped swallowing mechanisms in children or reduced reflexes in the elderly contribute to an increased likelihood of choking incidents.

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What is already known about this topic?

- FBAO is a life-threatening emergency requiring immediate intervention.
- The Heimlich maneuver is the standard first-aid technique for relieving airway obstruction.
- Lay responders often lack adequate knowledge, skills, and confidence in managing choking emergencies.
- Dispatcher-assisted guidance and simulation-based training have been proposed to improve emergency response performance.

What does this study add?

- This study demonstrates that dispatcher-guided simulation training improves lay responder performance in managing FBAO.
- Specific procedural steps, particularly correct hand positioning and forceful upward thrusts, significantly influence success rates.
- The findings support the integration of dispatcher-assisted protocols with simulation-based training as a scalable community education strategy.

Mealtimes are particularly hazardous, with choking often caused by semi-solid foods such as jelly products, sticky rice, or other high-risk items. In Japan, nearly eight thousand FBAO-related fatalities were recorded in 2019[3], highlighting the pressing need for targeted preventive measures and effective interventions.

The Heimlich maneuver, first introduced by Heimlich in 1974, remains the cornerstone of FBAO management[4]. This simple yet life-saving technique expels obstructions by creating an artificial cough through a forceful upward thrust to the diaphragm. However, its effectiveness depends on prompt and accurate application, which requires basic knowledge and practical skills. Gaps in knowledge and skills among laypersons remain a major challenge in real-world emergency situations[2].

Recent advancements in FBAO management include dispatcher-assisted emergency protocols and simulation-based training tools such as the Act+Fast Anti-Choking Trainer (Act+Fast LLC, CA). These approaches aim to improve practical skills and confidence among lay responders, enhancing readiness to respond to choking incidents.

Immediate and appropriate intervention is critical to prevent severe complications such as cardiac arrest or hypoxia. Evidence suggests that improved outcomes are associated with rapid bystander intervention and early airway clearance[5]. Integrating simulation-based training into community education programmes can help address knowledge gaps and improve emergency preparedness.

This study investigates the role of guided simulation training combined with dispatcher-assisted protocols to enhance first-aid readiness among community health volunteers.

Materials and Methods

A quasi-experimental, single-arm, non-randomized simulation study was conducted using a non-controlled design. This study was designed as a preliminary quasi-experimental simulation to explore feasibility and participant performance under controlled conditions, which is appropriate for early-phase educational intervention research. Recruitment was facilitated by reaching out to community leaders to provide detailed information about the project's methodology and to secure permission for community members to participate.

The study was conducted in Ban Donbak, Srisuk Subdistrict, Kantarawichai District, Mahasarakham Province, Thailand.

Inclusion Criteria

Volunteers were included if they met the following criteria:

1. Aged eighteen to sixty-five years
2. Willing to participate in the experiment
3. In good health
4. Lacked prior knowledge of the Heimlich maneuver

Exclusion Criteria

Participants were excluded if they:

1. Participated in the experiment but refused to perform the Heimlich maneuver.
2. Had a body mass index (BMI) greater than twenty-five kilograms per square meter.
3. Were shorter than one hundred and fifty-five centimeters.

Outcome Measures

The primary outcome was defined as successful performance of the Heimlich maneuver, indicated by correct execution of predefined critical procedural steps and successful expulsion of the simulated airway obstruction. Secondary outcomes included adherence to individual procedural steps and qualitative observations of performance during simulation.

Simulation Setup

The experiment was conducted in two separate rooms: one designated for telephone instruction and another for performance assessment using a simulated FBAO manikin. In the telephone instruction room, a researcher acting as an emergency medical dispatcher provided real-time guidance to community health volunteers based on the National Institute for Emergency Medicine (NIEMS) protocols. In the testing room, a paramedic instructor evaluated the volunteers' performance as they carried out the Heimlich maneuver following telephone instructions. The simulation setup and procedural positioning are illustrated in Figure 1 and 2.

Simulated Scenario

The simulated scenario involved a seventy-year-old male dining with family members. During the meal, the individual exhibited choking behaviors, including inability to speak, clutching the throat, and facial redness. Volunteers were instructed to simulate calling emergency services (1669). The dispatcher then guided them through a structured protocol, including symptom assessment and step-by-step airway management instructions.

Figure 1. Simulation-based training of the Heimlich maneuver using a choking rescue training vest. The rescuer demonstrates abdominal thrusts under dispatcher-guided instruction in a simulated choking scenario.

Figure 2. Demonstration of correct hand positioning for the Heimlich maneuver using a choking rescue training vest. The rescuer places the fist above the navel and below the sternum prior to delivering upward abdominal thrusts under dispatcher-guided instruction.

Details of the manikin

The Act+Fast Anti-Choking Trainer, also known as the "Choking Rescue Training Vest," was used for the simulation. This device allows users to practise abdominal thrusts (Heimlich maneuver) and back slap techniques. The vest includes a neoprene pocket containing a plastic air bladder positioned between the navel and rib cage, simulating airway obstruction relief. A foam plug inserted into the airway provides immediate feedback when the correct technique is applied. The device aligns with guidelines from the European Resuscitation Council, National Safety Council, and the International Red Cross and Red Crescent Movement.

This simulation-based approach was used to assess participants' procedural performance and adherence to dispatcher-guided instructions in managing FBAO.

Statistical Analysis

Statistical analysis was performed using descriptive statistics and chi-square tests to assess associations between procedural steps and success rates. A p-value less than 0.05 was considered statistically significant.

All eligible volunteers provided written and verbal informed consent prior to the commencement of the study. Before starting the experiment, each participant was briefed on the simulated scenario and provided with instructions on assisting adults with airway obstruction. The procedures were conducted in accordance with the emergency assistance protocol issued by the NIEMS of Thailand (2013 version)[6].

Ethical Approval

The study was approved by the Ethics Committee of Mahasarakham University, Thailand (Approval No. 066-505/2024).

Results

Based on the data, there were 8 male and 22 female participants with an average age of 49.9 years. The majority (63%) had a BMI in the range of 18 to 22.9. There were no significant differences in general characteristics such as sex, age, and BMI between volunteers who successfully removed foreign objects from the upper airway and those who did not (Table 1).

It was observed that test items five and eight had a significant impact on the success rate of telephone

Table 1. General characteristics of the volunteers

Variables	Success rate; n (%)		Total n (%)	p-value
	Fail	Success		
Sex				0.90
Male	6 (75.00)	2 (25.00)	8 (26.67)	
Female	17 (77.27)	5 (22.73)	22 (73.33)	
Age (years)				0.50
Mean±SD 49.93±12.93				
18-25	3 (75.00)	1 (25.0)	4 (13.33)	
26-35	0 (0.00)	0 (0.00)	0 (0.00)	
36-45	2 (100)	0 (0.00)	2 (6.67)	
46-55	9 (81.82)	2 (18.18)	11 (36.67)	
≥56	9 (69.23)	4 (30.77)	13 (43.33)	
BMI (kg/m^2)				0.41
Mean±SD 21.96±1.70				
<18.5	1 (50.00)	1 (50.00)	2 (6.67)	
18.5-22.9	17 (89.47)	2 (10.53)	19 (63.33)	
≥23	5 (55.56)	4 (44.44)	9 (30.00)	

SD=standard deviation; BMI=body mass index

guidance in assisting patients with airway obstruction caused by foreign objects under simulated scenarios (Table 2), with a significance level of 0.05.

The researcher anticipated that specific telephone guidance instructions for managing airway obstructions would be crucial and could serve as a metric for assessing the success rate. Successful outcomes were associated with the completion of items five, six, and eight.

Telephone guidance for assisting patients with airway obstruction under simulated scenarios, particularly in items five, six, and eight, showed a significant association with success rates (Table 3) at a significance level of 0.05.

In addition to the quantitative findings, qualitative observations were recorded to identify common challenges encountered during the simulation (Table 4).

Key challenges included difficulties in patient assessment, misinterpretation of dispatcher instructions, incorrect positioning, and insufficient application of force. Communication barriers, particularly related to language and interpretation of standard instructions, were also observed. Furthermore, physical limitations, such as differences in participant height, affected the ability of some individuals to perform the procedure correctly.

Discussion

As the instructions were provided over the phone, it became evident that volunteers without prior knowledge often carried out assistance incorrectly. Additionally, the instructor was unable to verify whether the volunteers were performing the actions accurately.

Impact of Protocols

Our findings underscore that key elements, such

Table 2. Results on assisting with the removal of foreign objects from the upper airway under the guidance of the "Instructions for Assistance in FBAO" protocol by the NIEMS

Instructions for assisting the FBAO	Able	Success rate		p-value
		Fail	Success	
1. If the person is conscious: Pay attention, and I will guide you on what to do next. (Call out to them or gently tap their shoulder to gain their attention.)	No	5	2	0.708
	Yes	18	5	
2. Move the telephone closer to the patient or move the patient closer to the telephone. Then, switch on the speaker-phone if possible	No	2	0	0.419
	Yes	21	7	
3. Stand directly behind the patient	No	2	1	0.666
	Yes	21	6	
4. Position your legs slightly apart, aligning them approximately with the width of the patient's shoulders	No	4	1	0.847
	Yes	19	6	
5. Use both arms to wrap around the patient's chest. (If the patient is obese or pregnant, place your hands on the breastbone instead.)	No	12	0	0.014
	Yes	11	7	
6. Make a fist with your dominant hand, with the thumb side facing towards the body, and position the fist just above the patient's navel.	No	22	5	0.061
	Yes	1	2	
7. Place your other hand over the fist	No	15	2	0.087
	Yes	8	5	
8. Push the fist inward and upward forcefully and quickly towards the navel. Repeat this action until the obstruction is expelled or until the patient becomes unresponsive (in which case, proceed to resuscitation instructions).	No	12	0	0.014
	Yes	11	7	

FBAO=foreign body airway obstruction

Table 3. Demonstrates the relationship between the experimental results of items five, six, and eight and the success rate of telephone guidance for patients experiencing airway obstruction in simulated scenarios

The number of steps followed according to the telephone guidance protocol for assisting patients with airway obstruction in items five, six, and eight	Success		p-value
	No	Yes	
0	10	0	0.028
1	4	0	
2	8	5	
3	1	2	

Table 4. Problems identified from testing the telephone guidance protocol for assisting patients with airway obstruction due to foreign objects in simulated scenarios

Order number	Qualitative observations
1	Instructions for complete airway obstruction only: • Since it was a simulated scenario, the volunteers were nervous about assessing the patient. • The volunteers were unable to assess whether the patient was breathing. • The volunteers were unable to assess the patient's level of consciousness.
2	Unable to verify compliance with the telephone instructions
3	Placement of the phone: The volunteer placed the phone next to the patient's ear.
4	Understanding of instructions and positioning: • The volunteer did not understand the standard language of communication. • The volunteer did not stand behind the patient. • The volunteer did not understand the instruction to place their dominant leg between the patient's legs. • The volunteer was unable to separate the patient's legs. • The instructor was unable to communicate in the Northeastern local dialect.
5	Arm wrapping issues:
	• The volunteer was unable to correctly wrap their arms around the patient's chest.
	• The volunteer was shorter than the patient and unable to wrap their arms effectively (height limitation).
	• Some volunteers wrapped their arms around the patient's shoulders instead of the chest.
6	Fist positioning and thumb placement: • The volunteer was unable to identify the position below the sternum. • The volunteer did not understand the instruction to place the thumb inside the fist, facing the patient's body.
7	Incorrect fist formation: • The volunteer made a fist over the other fist.
8	Application of force and technique: • The volunteer was unable to understand the instruction to pull the fist inward towards the navel. • The volunteer was unable to pull the fist quickly and apply sufficient force to dislodge the obstruction.

as proper fist positioning and forceful upward thrusts (items five and eight), significantly influence the success of FBAO interventions. This is consistent with previous studies emphasising the importance of correct technique in airway clearance[7].

Role of Educational Interventions

Educational strategies play a pivotal role in improving layperson readiness for FBAO emergencies. Previous studies have demonstrated that structured education, including video-based learning and caregiver training, significantly improves knowledge and practical skills[8,9].

Challenges in FBAO management

Despite the effectiveness of training, several challenges persist. Language barriers and nervousness among volunteers were observed during the simulations, impacting procedural adherence. These findings reflect the complexity of real-time emergency response and underscore the need for simplified and context-adapted instructional protocols.

Emerging Technologies

Innovative anti-choking devices such as DeCHOKER and LifeVac have been explored as alternative interventions, particularly in situations where traditional manoeuvres may be difficult to perform[10]. These devices may provide additional options for airway clearance, especially among untrained responders or in physically challenging scenarios. However, their effectiveness and practical applicability in real-world settings remain uncertain. In the context of this study, structured training and clear procedural guidance remain essential to ensure effective first-aid response.

Implications for Public Health

Integrating structured FBAO training into broader public health initiatives can address existing gaps in knowledge and preparedness. The incorporation of dispatcher-assisted protocols and simulation tools into community training programmes offers a scalable solution to improve emergency response outcomes. Additionally, targeted educational campaigns, such as those focused on high-risk foods and household items, can further mitigate FBAO incidents, particularly in vulnerable populations[7,10].

Limitation and Future Directions

As a preliminary simulation-based study, this research was intended to assess feasibility and

participant performance under controlled conditions rather than to establish causal relationships.

The study was conducted in a single community with a relatively small sample size (n=30), which may limit the generalizability of the findings. However, this pilot study provides important preliminary insights to inform the design of larger, multi-site studies.

Further limitations should also be considered. First, the single-arm quasi-experimental design without a control group limits the ability to make direct comparisons with standard training or no intervention. Therefore, causal inferences should be interpreted with caution.

Second, the use of a simulation-based setting, while allowing controlled assessment of performance, may not fully replicate the stress, time pressure, and unpredictability of real-life emergency situations.

Third, participants were recruited from a single community, which may not represent broader populations with different socio-cultural or educational backgrounds.

Fourth, the relatively small sample size may reduce statistical power and limit the detection of smaller effect sizes.

Fifth, exclusion criteria based on body mass index and height were applied to ensure safe and standardized use of the simulation equipment; however, this may introduce selection bias and limit external validity.

Sixth, the inclusion of participants with no prior Heimlich maneuver knowledge was intended to standardize baseline conditions; however, this may not reflect real-world variability in prior training or experience.

Seventh, the dispatcher role was performed by a trained researcher rather than a professional emergency dispatcher, which may differ from actual dispatch practices and communication dynamics.

Eighth, performance evaluation was conducted by a paramedic instructor, which may introduce observer bias despite the use of structured assessment criteria.

Ninth, voluntary participation may have resulted in self-selection bias, as participants could be more motivated or health-conscious than the general population.

Tenth, the outcome measures focused on procedural performance and adherence to critical steps rather than clinical outcomes such as patient survival or neurological status.

Eleventh, the study assessed performance in a single session without follow-up, limiting the ability to evaluate long-term retention of skills.

Twelfth, a pre-simulation briefing was provided to ensure participant safety and standardization; however, this may have influenced performance and does not fully reflect unprepared real-world responses.

Thirteenth, the statistical analysis was limited to descriptive and inferential methods appropriate for exploratory studies, which may not capture more complex relationships between variables.

Fourteenth, the study relied on NIEMS 2013 guidelines as the national standard at the time of protocol development; however, more recent international guidelines may provide updated recommendations.

Finally, environmental factors within the simulation setting, such as room layout, communication conditions, and potential distractions, were controlled but may not fully reflect real-world environments.

Future research should address these limitations by incorporating controlled comparative designs, larger and more diverse populations, real-world or hybrid simulation settings, and longitudinal follow-up to assess skill retention and clinical outcomes.

Conclusion

This study highlights the critical importance of structured training and dispatcher-assisted protocols in improving the success rate of interventions for FBAO. The findings demonstrate that specific procedural elements, such as correct fist positioning and forceful upward thrusts, significantly enhance the likelihood of successfully dislodging airway obstructions. These results emphasise the necessity of adhering to standardised emergency guidelines and protocols during choking incidents.

Innovative tools, such as the Act+Fast Anti-Choking Trainer, have proven valuable in enhancing the practical skills of volunteers, providing immediate feedback to improve technique and boost confidence. However, challenges such as language barriers, procedural misunderstandings, and volunteer nervousness underscore the need for tailored educational approaches to address these limitations. Emerging technologies, including anti-choking devices such as DeCHOKER and LifeVac, offer promising alternatives to traditional methods but require further refinement to maximise effectiveness and usability.

The findings emphasize the importance of rapid response in preventing severe outcomes such as hypoxia and cardiac arrest. The integration of simulation-based training into community health programmes can help bridge existing knowledge gaps, particularly in underserved regions with limited access to professional emergency services.

Future research should focus on refining training methodologies, integrating advanced technologies such as video-assisted dispatch systems, and evaluating the long-term outcomes of community-based interventions. By prioritising public education and preparedness, significant progress can be made in reducing the morbidity and mortality associated with FBAO, ultimately strengthening community resilience in emergency situations.

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Authors Contributions

CC, SO, WP, and CK contributed to data collection, simulation procedures, and participant assessment. CS contributed to study coordination and data interpretation. SC contributed to academic consultation and international collaboration support. NT conceptualized and supervised the study, performed data analysis, interpreted the findings, and prepared the manuscript. All authors reviewed and approved the final version of the manuscript.

Clinical Trial Registration

Not applicable. This study was a simulation-based educational study conducted in a controlled setting and did not involve a clinical trial requiring registration.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of Mahasarakham University, Thailand (Approval No. 066-505/2024).

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Use of Artificial Intelligence

Generative AI tools (e.g., ChatGPT, OpenAI) were used solely to assist in language editing and improving the clarity of the manuscript. These tools were not involved in study design, data collection, data analysis, or interpretation of the results. All scientific content and conclusions were developed by the authors.

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