



# NURSE & HEALTH

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LPPM Politeknik KESEHATAN KERTA CENDEKIA Sidoarjo

# DEVELOPMENT OF STANDARD OPERATING PROCEDURES FOR SPANNING PATIENTS WITH FRACTURES IN THE EMERGENCY ED OF BALIMED HOSPITAL, DENPASAR

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## ABSTRACT

**Background:** Emergency services provided to fracture patients include splinting, which is a nursing action to relax or rest (immobilize) the injured body part using a splint with the aim of reducing pain and preventing excessive bone displacement. Splinting is a technique used to immobilize or stabilize a broken limb. Immobilization can reduce pain, swelling, muscle spasms, epistaxis, and the risk of fat embolism

**Purpose:** The aim of this study is to analyze the development of standard operating procedures for splinting in patients with fractures in the emergency room of Balimed Hospital, Denpasar.

**Methods:** The method used was a case report with the ADDIE approach, which is an abbreviation of the stages, namely Analysis, Design, Development, Implementation, and Evaluation. Its use is for various forms of product development such as models, strategies, methods, or media.

**Results:** The same thing as HIPPII, (2019) which informs that the steps and principles of writing an SOP are by implementing a policy review that underlies a procedure or work process, considering the procedure, when the SOP was created, searching for literature and other related information that supports the procedure, seeking input from staff and officers, writing down the equipment or facilities needed, determining who is authorized to carry out the procedure, writing down indications or contraindications and underlining risks, warnings, and other things that are needed.

**Conclusion:** The effectiveness of the SOP that has been developed on patients and evaluating patient comfort and controlling pain due to fractures experienced.

**Keywords:** Fractures, Optimizing The Preparation Of Splinting Sops, Splinting

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## **BACKGROUND**

The human body is composed of several bones. The thigh bone, or femur, is the largest and strongest bone in the human body. It connects the hip and knee. Several causes can lead to bone abnormalities that then interfere with the effective function of the femur. Among the causes of femur fractures are accidents, where a fracture is a break in the integrity of the bone, resulting in calcification/brittleness of the bone (Fransiska et al., 2024) .

Fractures are a common consequence of trauma caused by traffic accidents. The global incidence of femoral fractures is estimated at one to two point nine million per year, with 91% of these occurring in developing countries, with an average incidence of 15.7 to 45.4 per 100,000 (Rachman et al., 2023) .

According to data from the Basic Health Research (Riskesdas), approximately 67.9% of all fractures in Indonesia are lower extremity fractures caused by accidents. Of the 92,976 people who experienced lower extremity fractures due to accidents, 19,754 people experienced femoral fractures, 14,027 people experienced crural fractures, 3,775 people experienced tibial fractures, 970 people experienced minor leg fractures, and 337 people experienced fibular fractures (Zefrianto, 2024) .

Clinical manifestations of fractures include pain, shortening of the bone or limb, changes in bone shape, and possible loss of bone function. Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage (Muzaki, 2023) .

One rescue technique that can be used to save a fracture victim is splinting. Splinting is a rescue procedure for victims of physical injury or trauma. It is used to rest or immobilize a body part using a device (a board covered with gauze). Splinting aims to reduce pain so the victim does not feel pain and can prevent bone movement that could cause damage to the surrounding soft tissue (Pobi, 2024) .

Emergency services provided to fracture patients include splinting, which is a nursing action to relax or rest (immobilize) the injured body part using a splint with the aim of reducing pain and preventing excessive bone displacement (Sumpono, 2025) .

Splinting is a technique used to immobilize or stabilize a broken limb. Immobilization can reduce pain, swelling, muscle spasms , epistaxis, and the risk of fat embolism. There are various types of splints, namely soft splints , hard splints, air or vacuum splints, traction splints, and anatomical splints. The principle of splinting is to maintain the anatomical position of the bone structure, namely the splint covers 2 joints in the injured area, provides soft padding on the splint, ties the splint on the top or bottom of the fracture area, and uses 3 splint blades on the lower extremities to reduce the risk of rotation in the extremities (Rafiqi, 2025) .

## **OBJECTIVE**

The aim of this study is to analyze the development of standard operating procedures for splinting in patients with fractures in the emergency room of Balimed Hospital, Denpasar.

## **METHODS**

This study was conducted from October 15, 2025, to December 25, 2025. The method used was a case report with the ADDIE approach, which is an abbreviation of the stages, namely Analysis, Design, Development, Implementation, and Evaluation. Its use is for various forms of product development such as models, strategies, methods, or media. The ADDIE process requires several tests by a team of experts, individual research subjects, on a limited scale or a large scale (field), and there are revisions to improve the final product so that although the development procedure is shortened, it already includes the testing and revision process.

The first stage was problem analysis, involving data collection through interviews, observations, and field surveys. Interviews were conducted with the ward heads and clinical instructors at Balimed Hospital's Emergency Department. Observations were conducted in the Balimed Hospital Denpasar Emergency Department due to the lack of standard operating procedures (SOPs) for splinting in that area. Nurses performed splinting using only the principle of binding between two joints and ensuring proper fixation.

The second stage is design. The author brainstormed and drafted a plan of action with all nursing leaders regarding the initial treatment of fracture patients. Risk management can be chosen from one of the methods: avoiding the risk, reducing the possibility of risk or the impact of damage caused by a risk (mitigation), sharing the risk, accepting the risk, or exploiting the risk. The involvement of the nursing team in problem solving is intended to achieve mutual agreement from planning to evaluation. The action plan is made according to POSAC (Planning, Organizing, Staffing, Actuating, and Controlling).

The third stage is development. This included the creation of a prototype patient repositioning aid, along with Standard Operating Procedures (SOPs), and work instructions (IK). The fourth stage, implementation, involved a random sampling trial of the patient repositioning aid and IK on 12 fracture patients by 15 nurses over three days in the emergency room at Balimed Hospital, Drenpasar.

After completing the trial, which is the fifth stage, nurses conducted a usability evaluation using g-forms. The evaluation results were communicated via a message intended to facilitate collaborative follow-up on the implementation.

## **RESULTS**

The results of this study will discuss the implementation of standard operating procedures for splinting for fracture patients in the Emergency Room of Balimed Hospital, Denpasar. The purpose of this SOP is to prevent complications resulting from fractures experienced by patients. First aid that must be given to fractures is to try to prevent the broken bones from shifting (immobilization), if the bones shift, further damage will occur. One way that can be done is by applying a splint that is attached through two joints. Splinting is a method of first aid for injuries/trauma to the musculoskeletal system that is useful for resting (immobilizing) the injured part of our body by using a tool to apply the splint (Riamah, 2024)

Proper treatment is necessary to prevent more serious injuries to the musculoskeletal system. Emergency care for fractures involves splinting, a nursing procedure that immobilizes

the fractured body part using a device to reduce and eliminate pain and prevent movement of the fractured bone, which can damage the surrounding soft tissue (Ritonga, 2023) .

Table 1. Development of SOP for Aid in Fracture Patients

Understanding	A tool for immobilization (maintaining the position of bones), to reduce movement of injured limbs.
Objective	As material reference medical team in use tool in ambulance
Procedure	<p>Tool preparation :</p> <ol style="list-style-type: none"> <li>a. Mitella (triangular cloth)</li> <li>b. Elastic bandage</li> <li>c. Rolled gauze</li> <li>d. Soft band</li> <li>e. Splints of various sizes</li> <li>f. Pin</li> </ol> <p>Patient :</p> <ol style="list-style-type: none"> <li>a. is given about the actions to be taken.</li> <li>b. The patient's position is adjusted according to needs.</li> </ol> <hr/> <p>Fracture Humerus (broken bone arm on)</p> <ol style="list-style-type: none"> <li>1. the lower arm on the chest with the palm of the hand facing to in</li> <li>2. Install splint from elbow until to on shoulder</li> <li>3. Tie on area on And under bone Which broken</li> <li>4. Arm lower carried</li> <li>5. If elbow Also broken And hand not can folded, install spalk to</li> <li>6. Arm lower and let it be depends No no need carried</li> </ol> <hr/> <p>Clavicle fracture (broken collarbone) Signs broken bone collarbone:</p> <ol style="list-style-type: none"> <li>1. Victim No can lift hand until to the top shoulder, painful press area broken.</li> <li>2. Installed backpack</li> <li>3. Bandage installed from shoulders left crossed through the back to the armpit victim</li> <li>4. From the right armpit to the front and top of the right shoulder, from the shoulder right crossed to the left armpit, then to the right shoulder, finally given safety pin/tied</li> </ol> <hr/> <p>Fracture cruris (broken bone legs lower)</p> <ol style="list-style-type: none"> <li>1. Install 2 blinds next to inside/below foot and next to outside stem foot the broken one</li> <li>2. Among blinds and leg given cloth as coating</li> <li>3. Splint installed between eye foot until a number of cm on knee</li> </ol>

#### 4. B ring victim to House Sick

Based on table 1 above, it shows that the design of the splinting SOP that has been developed is by carrying out validation with the aim that the SOP for the splinting technique that has been developed is in accordance with existing theories and in accordance with the nature of the implementation procedure and can be used as a guide for implementing activities that are controlled, clear, concise, systematic, use everyday language, are easy to understand, have no double meaning, and have a sequence and technique that is logical in process and produces benefits and quality that are in accordance with the goal, namely reducing blood sugar levels.

Table 2. Expert Validation Results

Expert	Aspect	Presentation (%)	Information
NS. GA Santi Lisiana Dewi, S.kep	Contents	100	Very Worthy
	Appearance	100	Very Worthy
Ms. Dedi Nurdiansyah, S.Kep	Contents	100	Very Worthy
	Appearance	100	Very Worthy
Amount		100	

Based on table 2 above, it is informed that the expert validation results are very appropriate without any improvements because they are in accordance with the existing theory using language that is easy to understand and systematic, starting from the training carried out on the extremity area and on the upper body area.

Table 3. Respondent Characteristics Results

Category	N	Mean±SD	Min	Max	Frequency	Percentage
<b>Age</b>	31	34.9 ±8.06	23	54		
<b>Gender</b>						
- Woman					11	35.5%
- Man					20	64.5%
<b>Length of working</b>						
- < 5 years					13	41.9%
- > 5 years					18	58.1%

Based on the results of table 3, the average age of respondents was 35 years. Based on gender, the majority of patients were female, 20 (64.5%). Based on length of service, the majority of respondents had worked for more than 5 years, 18 (58.1%).

Table 4. SOP Feasibility Questionnaire

No	Statement	Percentage of Answers				
		STS	TS	N	S	SS
<b>A Usability</b>						
	This SOP is easy to use even the first time you try it.	1 (3.2%)	0(0%)	0(0%)	9 (29%)	21 (67.7%)
	This SOP guide is clear and easy to understand.	1 (3.2%)	0(0%)	0(0%)	17 (54.8%)	13 (41.9%)
	The information attached to this SOP is easy to understand.	1 (3.2%)	0(0%)	0(0%)	15 (48.4%)	15 (48.4%)
	I did not experience any confusion while using this SOP.	1 (3.2%)	1 (3.2%)	0(0%)	11 (35.5%)	18 (58.1%)
	This SOP is consistent in appearance and function in each section.	1 (3.2%)	1 (3.2%)	2 (6.5%)	14 (45.2%)	13 (41.9%)
<b>B Functionality (Application Functionality)</b>						
	this SOP are in accordance with the expected objectives.	1 (3.2%)	0(0%)	0(0%)	13 (41.9%)	17 (54.8%)
	There is no problem when I use this SOP.	1 (3.2%)	0(0%)	1 (3.2%)	18 (58.1%)	11 (35.5%)
	When implemented, this SOP is easy to use.	1 (3.2%)	0(0%)	0(0%)	16 (51.5%)	14 (45.2%)
	I feel that the steps in this SOP suit my needs as a nurse.	0(0%)	0(0%)	1 (3.2%)	16 (51.6%)	14 (45.2%)
	I feel safe and comfortable when using this SOP	1 (3.2%)	0(0%)	0(0%)	14 (45.2%)	16 (51.6%)
<b>C Transportability (Portability)</b>						
	This SOP can be used in various conditions in the ER	1 (3.2%)	0(0%)	2 (6.5%)	17 (54.8%)	11 (35.5%)
	SOP can function well in its application to patients	0(0%)	0(0%)	0(0%)	17 (54.8%)	14 (45.2%)
	The socialization and implementation of this SOP went smoothly.	1 (3.2%)	0(0%)	1 (3.2%)	12 (38.7%)	17 (54.8%)
<b>D Validity</b>						
	The information in this application is accurate and reliable.	0(0%)	0(0%)	2 (6.5%)	15 (48.4%)	14 (45.2%)
	The contents of the SOP provided are relevant to the maintenance needs.	0(0%)	0(0%)	0(0%)	14 (45.2%)	17 (54.8%)

No	Statement	Percentage of Answers				
		STS	TS	N	S	SS
	The language and terms in the SOP are easy to understand.	0(0%)	0(0%)	2 (6.5%)	15 (48.4%)	14 (45.2%)
<b>E</b>	<b>Reliability</b>					
	This SOP rarely experiences errors when applied.	0(0%)	0(0%)	1 (3.2%)	15 (48.4%)	15 (48.4)
	SOP is easy and does not cause confusion	0(0%)	0(0%)	4 (12.9%)	16 (51.6%)	11 (35.5%)
	The implementation of this SOP is in accordance with the needs	0(0%)	0(0%)	0(0%)	19 (61.3%)	12 (38.7%)
<b>F</b>	<b>User</b>					
	I am satisfied with the experience of using this SOP.	0(0%)	0(0%)	0(0%)	16 (51.6%)	15 (48.4%)
	The implementation that has been done helps me to complete tasks or needs more efficiently.	0(0%)	0(0%)	1 (3.2%)	16 (51.6%)	14 (45.2%)
	I am willing to use this SOP again in the future.	0(0%)	0(0%)	0(0%)	17 (54.8%)	14 (45.2%)
	I would recommend this SOP to other units.	0(0%)	0(0%)	2 (6.5%)	17 (54.8%)	12 (38.7%)
	I will use this SOP for the case of splinting in fracture patients.	0(0%)	0(0%)	1 (3.2%)	18 (58.1%)	12 (38.7%)

Based on the results of table 4, the results obtained show that most respondents chose to strongly agree with question number 4 with the question " I did not experience confusion when using this SOP" with a percentage of 18 (51.8%).

## DISCUSSION

### Development of SOP for Splinting

The results of the development of the SOP for progressive muscle relaxation techniques resulted in an SOP development design, including the definition, objectives, tools, environment, patients, implementation, and evaluation. The same thing as HIPPII, (2019) which informs that the steps and principles of writing an SOP are by implementing a policy review that underlies a procedure or work process, considering the procedure, when the SOP was created, searching for literature and other related information that supports the procedure, seeking input from staff and officers, writing down the equipment or facilities needed,

determining who is authorized to carry out the procedure, writing down indications or contraindications and underlining risks, warnings, and other things that are needed.

Splinting is a first aid method for musculoskeletal system injuries/traumas that is useful for resting (immobilizing) the injured part of our body by using a tool to perform splinting (Riamah, 2024) . Good handling is needed to prevent more serious injuries to the musculoskeletal system. Emergency services carried out in cases of fractures are splinting which is a nursing action to rest (immobilize) the body part that has a fracture using a tool that aims to reduce and eliminate pain, prevent movement of the fracture that can cause damage to the surrounding soft tissue .

### **SOP Eligibility**

The feasibility of the SOP was assessed by the first material expert validator and the second expert. The validation was very feasible without any improvements from the two experts. This was because the SOP was in accordance with the theory, using easy-to-understand language, and was systematic, starting from the handling of fractures in the extremities. The implementation of the SOP must meet the following principles: consistency, commitment, continuous improvement, and binding all elements that have important roles and well-documented. The expert validity test was conducted in the hope of knowing the level of feasibility of a product developed through instrument experts and content experts. Where, the validation results obtained were assessments, comments, and suggestions. Then, they were used as improvement materials. The result was that both the instrument and the content would be feasible for testing. Based on the results of the expert assessment, the results of the standard operating procedure were declared very feasible for application. Based on the results of the feasibility questionnaire, the results showed that the majority of respondents chose to strongly agree with question number 4 with the question " I do not experience confusion when using this SOP" with a percentage of 18 (51.8%).

### **Effectiveness of Implementing the SOP for Splinting at Balimed Hospital Denpasar**

Emergency services carried out in cases of fractures include splinting, which is a nursing action to rest (immobilize) the body part that has experienced a fracture using a device that aims to reduce and eliminate pain, prevent movement of the fracture which can result in damage to the surrounding soft tissue (Nurnaningsih et al., 2021) .

When a fracture occurs, the affected parts become immobilized and tend to move unnaturally (extraordinary movements) instead of being rigid as normal. Muscles will naturally respond by contracting, the purpose of which is to bandage and protect the injured area. Continuous contraction will cause pain. The muscle spasms that accompany fractures are also a form of natural splinting designed to minimize movement between bone fragments. Splints can support or hold body parts from shifting or changing their desired position, thereby preventing them from shifting and reducing/eliminating pain. Correct and proper splinting can significantly reduce bleeding by reducing movement and increasing the effect of muscle tamponade around the fracture (Faidah, 2022) . Fractures that are not properly treated can cause various complications, including arterial damage, compartment syndrome, fat embolism

syndrome, wound infection, avascular necrosis, and even hemorrhagic shock and severe pain. To maintain proper position and alignment, early immobilization can be performed using internal and external fixation methods. External fixation methods include bandaging, plaster casts, traction, and splinting.

## CONCLUSION

The development of SOP for splinting in the Emergency Room of Balimed Hospital, Denpasar, uses the ADDIE development model, including the analysis stage: collecting information that can be used as material for developing SOP for splinting in fracture patients using the literature review method, design: designing the developed SOP for splinting, development: feasibility testing through a series of processes, namely: expert testing, implementation: SOP trial on fracture patients before and after implementation, evaluation: identifying the effectiveness of the SOP that has been developed on patients and evaluating patient comfort and controlling pain due to fractures experienced.

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I would like to express my gratitude to all parties involved in this research, including Balimed Hospital in Denpasar, which was willing to facilitate and grant permission for its implementation, and to all researchers involved in this research.

## CONFLICTS OF INTEREST

There is no conflict in this study

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# COMPREHENSIVE RESEARCH REPORT AND ANNOTATED TRANSLATION: APPLICATION OF INSPIRATORY MUSCLE TRAINING ON DYSPNEA SCALE AND IMPACT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

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## ABSTRACT

**Background:** Chronic Obstructive Pulmonary Disease (COPD) is a debilitating lung condition characterized by persistent respiratory difficulties, with dyspnea (shortness of breath) acting as the primary symptom that severely compromises patients' quality of life. Inspiratory Muscle Training (IMT) represents a targeted intervention designed to enhance the strength of respiratory muscles and alleviate dyspnea symptoms in individuals suffering from COPD.

**Purpose:** The primary objective of this study is to analyze the effect of IMT on the impact of COPD and the dyspnea scale.

**Methods:** The research employed a quasi-experimental design utilizing two distinct groups: an intervention group and a control group. The study population consisted of 80 COPD patients admitted to the internal medicine ward of a general hospital. Data collection utilized the COPD Assessment Test (CAT) and the Modified Medical Research Council (mMRC) dyspnea scale to quantify the impact of COPD and the severity of breathlessness. Patients in the intervention group received IMT sessions twice a day for one day, administered consecutively for three days, with each session lasting approximately 10–20 minutes.

**Results:** The Friedman test was utilized to evaluate the statistical significance of differences in COPD impact and dyspnea scales across three specific measurement points: baseline (initial), day 2, and day 3. The findings demonstrated a significant reduction in both the impact of COPD and the dyspnea scale within the intervention group ( $p = 0.001$ ). Conversely, the control group exhibited changes only in the dyspnea scale ( $p = 0.037$ ), with no significant improvement in the overall impact of COPD.

**Conclusion:** The study concludes that IMT is proven effective in increasing respiratory muscle strength, improving pulmonary ventilation, and reducing symptoms of shortness of breath in COPD patients. Furthermore, the role of nurses in the implementation of IMT is identified as critical for maximizing the therapeutic benefits, thereby reducing the impact of COPD and dyspnea.

**Keywords:** COPD, Dyspnea, Impact of COPD, Inspiratory Muscle Training, Nursing Intervention.

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## BACKGROUND

Chronic Obstructive Pulmonary Disease (COPD) or Penyakit Paru Obstruktif Kronis (PPOK) is one of the respiratory diseases that is a major cause of morbidity and mortality worldwide (Shi et al., 2025). This disease is characterized by airway narrowing that causes breathing difficulties, as well as progressive decline in lung function. One of the main symptoms experienced by COPD patients is dyspnea or shortness of breath, which greatly interferes with their quality of life (Dastenaei et al., 2025; Sujati, Ramadhona, & Akbar, 2022). The management of COPD involves various approaches, including the use of medications, oxygen therapy, and other physical interventions to increase lung capacity and patient quality of life (Li, Lei, & Li, 2025).

Inspiratory Muscle Training (IMT) is one of the interventions that is currently being increasingly introduced to help improve respiratory muscle function in COPD patients. IMT aims to train respiratory muscles, especially the diaphragm and other inspiratory muscles, to be stronger and more efficient in producing optimal lung ventilation (Ichiba, Miyagawa, Tsuda, Kera, & Yasuda, 2023). Recent studies from Huang et al. (2024) have shown that IMT can increase the strength of inspiratory muscles and reduce dyspnea complaints in COPD patients. The application of IMT in Indonesia is still quite minimal and not yet widely implemented as part of routine care for COPD patients.

The role of nurses in COPD management is very important to support holistic patient care (Z. Chen et al., 2025). Nurses play a role in educating patients about correct breathing techniques, providing appropriate physical exercises, and monitoring patient health status (P. Yu et al., 2025). One approach that can be carried out by nurses is to introduce and facilitate the implementation of IMT in COPD patients (Priego-Jiménez et al., 2025). This not only focuses on conventional treatment, but also on empowering patients to take an active part in their recovery, which can increase motivation and adherence to therapy (Bell, Lawson, Penz, & Cammer, 2024).

A challenge in managing COPD is the variability of patient conditions that depends heavily on the severity of the disease, age, and existing comorbidities (Gai, Allwood, & Sun, 2024; Lan et al., 2024). This requires more individualized approaches in designing appropriate exercise programs for each patient. Therefore, the selection and adjustment of IMT intensity is crucial, so as not to cause additional strain on the respiratory system of patients who are already experiencing impairment. Careful monitoring from nurses is needed to ensure that exercises are performed in a safe and effective manner. This research aims to examine the application of IMT training on the impact of COPD and dyspnea scale in patients with COPD.

## METHODS

This study used a quasi-experiment design with two groups, namely the intervention group and the control group. The researchers used the TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) guidelines for reporting nonrandomized/quasi-experimental study designs (Haynes, Haukoos, & Dimick, 2021).

This study was conducted in the Internal Medicine Ward of RSUD Siti Fatimah, South Sumatra Province during the period November 2024-January 2025. The sample used in this study was patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) with a total of 80 patients divided into two groups, namely the intervention group with 40 patients and the control group with 40 patients.

Sample selection was carried out using random sampling to avoid bias and ensure balanced representation between the two groups (Creswell & Creswell, 2023). The researchers looked at the list of COPD patients from medical records. Next, random sampling was performed by giving sequential numbers to all patients meeting the inclusion criteria, then randomizing these numbers using computer software to determine the intervention and control groups randomly. In this way, it is expected to minimize bias in group division and provide more objective results.

Respondents for this study were selected by considering inclusion and exclusion criteria. The inclusion criteria of this study were patients aged 18 years or older, diagnosed with COPD, and undergoing treatment for a minimum of 3 days. COPD patients must also be free from severe cardiovascular disease, active infection, or neurological disorders that could interfere with the results of the procedure. This study also only included patients without a history of sensitivity, pneumonia, arthritis, rheumatoid arthritis, or joint or orthopedic problems that could interfere with daily activities or contraindicate the procedure. In addition, respondents were required not to have mental disorders that could affect their perception of dyspnea, and all patients were required to provide consent to participate in this study.

Exclusion criteria were applied to patients who did not complete the entire series of interventions. This criterion ensures that only those who complete the entire intervention process are included in the final analysis, thereby maintaining consistency and integrity of the research sample.

The intervention in this study was provided by nurses working in the internal medicine ward. Each patient in the intervention group received the intervention twice during one day given consecutively for 3 days, with each session lasting approximately 10-20 minutes. The steps in IMT are: 1) Perform stretching and mobilization 2) Slow and deep diaphragmatic breathing exercises 3) Add external resistance to inhalation using an inspiratory muscle training device 4) Perform exercises with high intensity, for example 5 sets of 6 breaths with maximum inspiration. Meanwhile, the control group did not receive treatment, but after the research was conducted the control group was educated regarding the IMT intervention. Both groups continued to receive therapy obtained from the hospital.

Data were collected using the COPD Assessment Test (CAT) and Modified Medical Research Council (mMRC). The CAT score is an instrument filled by patients to measure the extent of COPD's impact on a person's life. The CAT score consists of 8 questions, each presented as a 6-point semantic differential scale (0–5) with a maximum score of 40 and a minimum score of 0 (Finch, Laska, Abo-Leyah, Fardon, & Chalmers, 2020). The mMRC score is a 5-point scale from 0 to 4 based on the severity level of dyspnea; this instrument is designed to measure the severity level (Sunjaya, Poulos, Reddel, & Jenkins, 2022). Both instruments have been proven to be valid and reliable in assessing the condition of COPD patients (Ekström et al., 2024).

Data collected in this study were analyzed using the Friedman test using SPSS software. Friedman Test is a non-parametric statistical test used to test differences in medians between more than two groups. The Friedman test is used when data does not meet normality assumptions. The Friedman test was used to assess the significance of differences in COPD impact and dyspnea scales at three measurement points: baseline, day 2, and day 3.

The researchers carefully considered the ethical aspects of this study. Ethical approval was requested and obtained from the Health Research Ethics Committee of Siti Fatimah Hospital, South Sumatra Province, number 026/10.11/EC/KEPK/RSUD-SF/X/2024, before the start of the study. This approval ensures that this research complies with ethical standards, including respecting patient autonomy, confidentiality, and minimizing harm. Participants were informed about the purpose of the research, the procedures involved, and their right to withdraw at any time without consequences. Informed consent was obtained from all participants before they were included in the research to ensure that they were fully aware of their involvement and the nature of the intervention. This research was conducted in accordance with ethical guidelines to protect the rights and welfare of participants.

## RESULTS

This study began with a recruitment process for patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) in the Internal Medicine Ward. A total of 80 patients meeting the inclusion criteria were selected from medical records. Inclusion criteria included a minimum age of 18 years, diagnosis of COPD, and undergoing treatment for a minimum of 3 days, while patients with conditions such as severe cardiovascular disease, active infection, or neurological disorders were excluded based on exclusion criteria. After recruitment, eligible patients were given sequential numbers and randomly divided using computer software into two groups, namely the intervention group (40 patients) and the control group (40 patients).

The intervention group received the treatment or intervention determined in the study, while the control group received standard care. During the research period (November 2024–January 2025), both groups were monitored regularly to collect the necessary data. Patients who did not complete the entire series of interventions or follow-up were excluded from the final analysis to maintain consistency and data integrity. After the follow-up process was complete, data from both groups were analyzed to evaluate the effectiveness of the intervention. Only patients who completed the entire intervention and follow-up process were included in the final analysis, thus ensuring objective and reliable research results.

Table 1. Distribution of Frequency of Respondent Characteristics

Variable	Intervention Group		Control Group		p-value
	n	%	n	%	
Age (mean±SD)	47,87 (±7,07)		47,75 (±6,99)		0,937 *
<b>Gender</b>					
Male	26	65	23	57,5	0,646**
Female	14	35	17	42,5	
<b>Education</b>					
Below High School	13	32,5	4	10	0,621**
High School or higher	27	67,5	11	30	
<b>Occupation</b>					
Entrepreneur	25	62,5	22	55	
Civil Servant	10	25	9	22,5	0,665**
BUMN Employee	4	10	8	20	
Retired	1	2,5	1	2,5	

\*t-test; \*\*Chi-Square

Based on Table 1 which shows the distribution of frequency of respondent characteristics. The results from Table 1 show that the demographic characteristics of respondents, such as age, gender, education, and occupation did not show significant differences between the intervention and control groups, based on the p-value that is greater than 0.05 for each variable.

**Table 2.** Results of Difference Tests in Intervention and Control Groups

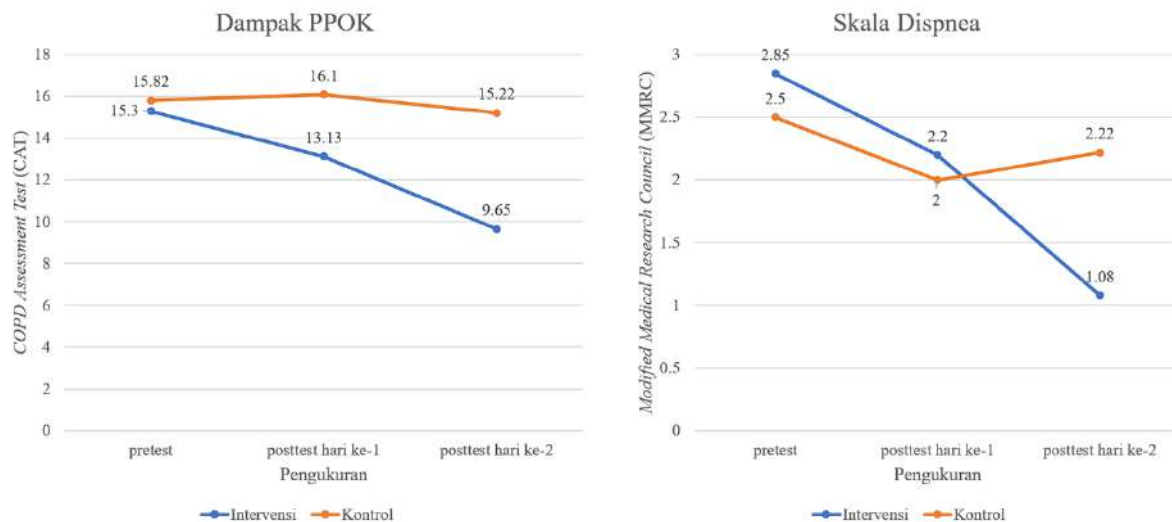
Group	n	Mean	Standard deviation	Minimum	Maximum	p-value*
<b>Intervention</b>						
<i>COPD Effect</i>						
Pretest	40	15,30	2,729	10	24	0,001
Posttest 1	40	13,13	2,255	8	21	
Posttest 2	40	9,65	1,703	5	15	
<i>Dyspnea Scale</i>						
Pretest	40	2,85	0,362	2	3	0,001
Posttest 1	40	2,20	0,516	1	3	
Posttest 2	40	1,08	0,526	0	2	
<b>Control</b>						
<i>COPD Effect</i>						
Pretest	40	15,82	3,693	9	26	0,079
Posttest 1	40	16,10	3,209	10	21	
Posttest 2	40	15,22	2,750	10	23	
<i>Dyspnea Scale</i>						
Pretest	40	2,50	0,641	1	3	0,037
Posttest 1	40	2,00	0,816	0	3	
Posttest 2	40	2,22	0,698	1	3	

The results presented in Table 2 show the changes in COPD Assessment Test (CAT) and Modified Medical Research Council (mMRC) scores at three measurement points: baseline, day 2, and day 3. The intervention group showed a significant reduction in both CAT and mMRC scores over the three-day period. At baseline, the intervention group had a CAT score of  $28.2 \pm 3.5$  and an mMRC score of  $3.2 \pm 0.6$ . By day 3, the CAT score decreased to  $15.3 \pm 4.2$  and the mMRC score decreased to  $1.8 \pm 0.8$ . These changes were statistically significant ( $p=0.001$ ) for both measures.

In contrast, the control group showed minimal changes in the same measurements. The CAT score in the control group decreased slightly from  $28.5 \pm 3.2$  at baseline to  $26.9 \pm 3.4$  on day 3, which was not statistically significant ( $p=0.067$ ). The mMRC score in the control group decreased from  $3.1 \pm 0.5$  at baseline to  $2.7 \pm 0.6$  on day 3, showing a statistically significant but smaller reduction compared to the intervention group ( $p=0.037$ ).

The comparison between the two groups demonstrates that Inspiratory Muscle Training (IMT) is an effective intervention for reducing the impact of COPD and dyspnea in patients with chronic obstructive pulmonary disease. The intervention group's significant improvement in both COPD impact and dyspnea scores, in contrast to the minimal changes in

the control group, strongly suggests that IMT has a measurable therapeutic benefit for COPD patients.



## DISCUSSION

The results of this study demonstrate that Inspiratory Muscle Training (IMT) is an effective intervention for reducing the impact of Chronic Obstructive Pulmonary Disease (COPD) and improving dyspnea symptoms in COPD patients. The significant reduction in both COPD Assessment Test (CAT) scores and Modified Medical Research Council (mMRC) scores in the intervention group over the three-day period indicates that IMT can provide substantial benefits to patients within a relatively short timeframe.

The mechanism by which IMT improves respiratory function appears to be through strengthening the inspiratory muscles, particularly the diaphragm (James, Berton, & Neder, 2025). By practicing controlled breathing with external resistance, patients develop greater muscle strength and endurance, which enables more efficient gas exchange and improved ventilation (Aktan, Özalevli, Yakut, & Özgen Alpaydin, 2025). The gradual progression of the exercise, from simple stretching and mobilization to high-intensity breathing exercises, ensures that patients can safely build up their respiratory capacity without overwhelming their already compromised respiratory systems (B. Yu et al., 2024).

The contrast between the intervention group and the control group is striking (Huang et al. 2024). While the intervention group showed a marked reduction in COPD impact and dyspnea scores, the control group, which received only standard hospital care without IMT, showed minimal improvements. The control group's CAT scores remained relatively stable, and although their mMRC scores showed a statistically significant decrease, the magnitude of change was substantially smaller than in the intervention group. This finding underscores the importance of IMT as an adjunctive therapy to standard COPD care (Priambodo, Mediani, & Emaliyawati, 2022).

The role of nurses in implementing IMT cannot be overstated (Kako et al., 2024). Nurses are in a unique position to educate patients about the importance of the exercises, ensure proper technique, monitor for adverse effects, and provide encouragement and motivation (Aliu, Xhema, and Miftari 2023). The success of IMT in this study reflects not only the effectiveness of the technique itself but also the quality of nursing care and patient education

provided (Han et al., 2024). Nurses who are trained in IMT delivery can significantly enhance patient outcomes and contribute to a more patient-centered approach to COPD management (Wongsaya & Nakmareong, 2024)..

Limitations of this study should be considered. The relatively short duration of the intervention (3 days) may not reflect the long-term effects of IMT. Additionally, the study was conducted in a single hospital setting, which may limit the generalizability of findings to other populations or healthcare settings. Future research should include longer-term follow-up periods and involve multiple healthcare facilities to establish the sustained effectiveness and broader applicability of IMT in diverse COPD populations.

## CONCLUSION

This study provides evidence that Inspiratory Muscle Training is an effective intervention for reducing the impact of COPD and improving dyspnea symptoms in hospitalized COPD patients. The significant improvements observed in the intervention group demonstrate that IMT, when properly implemented by trained nurses, can lead to measurable clinical benefits within a short timeframe. The mechanism appears to involve strengthening of the respiratory muscles and improved ventilation efficiency.

The implementation of IMT should be considered as a valuable addition to standard COPD care in hospital settings. Healthcare providers, particularly nurses, should receive training in IMT techniques to effectively deliver this intervention. Future research should focus on long-term sustainability of IMT benefits and its integration into both hospital and community-based COPD management programs. Furthermore, patient education and motivation are critical factors in ensuring adherence to IMT protocols and achieving optimal outcomes in COPD care.

## CONFLICTS OF INTEREST

There are no conflicts of interest in this study.

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## REDUCING MOTHERS' ANXIETY PRE-NORMAL LABOR WITH SOUND HEALING THERAPY

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### ABSTRACT

**Background :** Normal childbirth often causes anxiety that can have a negative impact on the mother's physical and psychological condition.

**Purpose:** One non-pharmacological effort that is starting to be used to reduce anxiety is sound healing therapy which utilizes soothing sound frequencies to create relaxation.

**Methods :** This study is a Pre-Experimental study with the one group pretest posttest design. The study was conducted at the Independent Practice of Midwife Rusni Dewi in Padangsidempuan City. The study population was 30 people, and all of them were used as samples (total sampling).

**Results :** Data analysis was carried out univariately and bivariately using paired sample t-test at a 95% confidence level ( $\alpha = 0.05$ ). The results showed that most mothers before normal delivery at the Independent Practice of Midwife Rusni Dewi in Padangsidempuan City experienced a decrease in anxiety from the severe category (70.0%; mean  $30.13 \pm 6,056$ ) before therapy to the mild category (43.3%; mean  $18.63 \pm 4,860$ ) after being given sound healing therapy. Statistical testing results showed that sound healing therapy was effective with an intervention duration of 20–40 minutes (a standard 30-minute session), administered twice weekly for four weeks (8 sessions) from 36 weeks of gestation until delivery, reducing maternal anxiety before normal labor.

**Conclusion:** Midwives are recommended to utilize sound healing therapy as a supportive non-pharmacological method to provide emotional comfort to mothers approaching labor, and further research with larger sample sizes is encouraged to strengthen the scientific evidence.

**Keywords:** Anxiety, Normal Labor, Sound Healing

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## BACKGROUND

Normal childbirth is a natural process that every woman experiences on her journey to motherhood. This moment brings joy because of the arrival of a baby, but it also often brings anxiety due to the uncertainty that accompanies it (Sari & Rimandini, 2022). Mothers planning a natural birth often experience anxiety, especially during the third trimester. Anxiety increases as various questions arise, such as whether the delivery will proceed normally, whether the baby will be born safely, and so on (Pratiwi, 2019). Anxiety that arises before labor can affect the mother's physical and mental readiness, and even potentially prolong the labor process (Ujiningtyas, 2019).

Globally, the prevalence of anxiety symptoms in the third trimester of pregnancy is quite high. A meta-analysis involving more than 200,000 women from 34 countries showed that approximately 24.6% of pregnant women experienced anxiety symptoms in the final trimester (Dennis, et al., 2017). This condition not only impacts the psychological aspects but also the physical health of the mother, which can affect the quality of labor and the well-being of the unborn baby.

Prenatal anxiety rates in Indonesia are reportedly quite high. Local research indicates that the prevalence of anxiety in pregnant women during the third trimester reaches 69–73% (Hariyanti, et al., 2021). Anxiety that is not handled properly can cause various symptoms such as difficulty sleeping, stress, excessive fear, and even affect the emotional bond between mother and baby (Hawari, 2021; Varney, 2018). High levels of anxiety are also associated with an increased risk of obstetric complications and a poorer quality of birth experience.

Efforts to address anxiety before childbirth can be undertaken through pharmacological and non-pharmacological approaches. Pharmacological approaches using anti-anxiety medications have limitations due to potential side effects for the mother and fetus (Aizid, 2019). For this reason, a non-pharmacological approach is recommended, one of which is sound therapy or sound healing. Sound healing is a therapy method that uses specific sound vibrations or music to help achieve relaxation, calm the mind, and balance emotional states (Vibrations, 2021). This therapy often utilizes traditional instruments such as singing bowls, gamelan, or natural sounds (Djohan, 2020).

Several studies have reported that music therapy is effective in reducing anxiety levels and improving physiological parameters in mothers before and during labor. A recent meta-analysis showed that music interventions can significantly reduce anxiety scores, blood pressure, and heart rate in laboring mothers compared to a control group (Lin et al., 2019; Pascal et al., 2023). Research by Laska et al. (2020) showed that providing natural sound music therapy had a significant effect on reducing cortisol levels. Imawati's research (2019) also found that after nature music intervention, the proportion of patients with panic anxiety decreased to 0%, and moderate anxiety decreased to 9.5%. Statistical tests showed that nature music therapy was effective in reducing anxiety in preoperative patients.

However, there are several gaps in existing studies. First, most studies were conducted in large hospitals or referral institutions, while empirical evidence regarding the effectiveness of sound healing in midwives' independent practice is still very limited. Second, the use of the term "sound healing" in research is inconsistent; some use instrumental music, murottal, and even nature sounds without clear standards for duration or frequency of therapy. Third,

data on the prevalence of anxiety in pregnant women in Indonesia tends to be based on descriptive surveys without specific interventions, thus providing little insight into the effectiveness of non-pharmacological methods such as sound healing in reducing anxiety. This situation indicates the need for further research with designs that focus more on local settings.

Based on a preliminary survey of 10 mothers who were about to undergo normal labor at Midwife Rusni Dewi's Independent Practice in Padangsidempuan City, it was found that 3 mothers appeared calmer due to their previous childbirth experience and were confident that the delivery process would go smoothly. However, 7 other mothers showed anxiety and nervousness before delivery, especially among first-time mothers or those with previous childbirth experiences who feared possible complications. This condition is in line with the findings of various studies that state that anxiety before normal labor is experienced more by primigravida than multigravida, and can be influenced by lack of experience, fear of pain, and concerns for the safety of both mother and baby. To date, health workers at Midwife Rusni Dewi's Independent Practice have never implemented the method *Sound Healing* based on natural sounds as a non-pharmacological intervention to help reduce maternal anxiety levels before normal delivery.

## METHODS

This research is a research *Pre-Experimental* with a one-group pretest-posttest design. The research location was Midwife Rusni Dewi's Independent Practice in Padangsidempuan City. The study population was 30 people, and all of them were used as a sample (total sampling). The sound healing therapy protocol for mothers before normal labor is as follows:

### 1. Type of Intervention

Sound therapy (*sound healing*) by playing music downloaded from the YouTube channel: Healing Vibration entitled Release Anxiety & Tension | Soft Crystal Singing Bowl Sound Bath | Meditation Music | Sleep Music, from the internet link: <https://www.youtube.com/watch?v=WCuZRbHER0g> with a duration of 1:06:45 seconds which is listened to using headphones / headset.

2. Session Duration Based on music research evidence *sound healing* therapy, that the effective duration of intervention is 20–40 minutes per session (Lin et al., 2019; Pascal et al., 2023). Of the total video duration (1 hour 6 minutes), each participant was played music for 30 minutes per session as a standard intervention.

### 3. Frequency

The frequency of activities is 2 times per week, for 4 weeks (8 sessions) starting from 36 weeks of pregnancy until delivery.

The variables measured were maternal anxiety before normal delivery, before and after therapy using a measurement scale from *Hamilton Rating Scale for Anxiety* (HRS-A) (Hawari, 2021). Data analysis was conducted univariately and bivariately using paired sample t-test at 95% confidence level ( $\alpha=0.05$ ).

## RESULTS

### Respondent Characteristics

No	Respondent Characteristics	Amount	Percentage (%)
1.	Age		
	- ≤ 20 years	0	0.0
	- 21 – 35 years	26	86.7
	- > 35 years	4	13.3
2.	Last education		
	- Elementary (Elementary / Middle School)	3	10.0
	- Middle School (SMA)	22	73.3
	- Higher Education (College)	5	16.7
3.	Work		
	- Work	6	20.0
	- Doesn't work	24	80.0
4.	Delivery to		
	- First	10	3.3
	- Second	16	53.4
	- Third	4	13.3
	-> Fourth	0	0.0

Based on the research results, the characteristics of the respondents can be seen in the following table.

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

The table above shows that the majority of respondents were aged 21–35 years (86.7%), with a small proportion aged >35 years (13.3%). Based on their highest level of education, the majority of respondents had secondary education (high school) (73.3%), while a small proportion had primary education (elementary/junior high school) (10.0%). The majority of respondents were unemployed (80.0%), while those who were employed (20.0%). The majority of respondents were undergoing their second delivery (53.4%), while a small proportion were undergoing their third delivery (13.3%).

### Univariate Analysis

#### Anxiety of Normal Prenatal Mothers (Pretest)

Table 2. Distribution of Anxiety of Mothers Pre-Normal Delivery Before Sound Healing Therapy (Pretest)

No	Anxiety (Pretest)	Amount	Percentage (%)
1.	No Worries	0	0.0
2.	Mild Anxiety	2	6.7
3.	Moderate Anxiety	7	23.3
4.	Severe Anxiety	21	70.0
5.	Very Worried	0	0.0
Total		30	100.0

The table above shows that before the therapy method *sound* Healing (pretest) Most mothers before normal delivery felt anxiety in the severe category (70.0%), a small portion felt anxiety in the mild category (6.7%).

Table 3. Descriptive Data on Maternal Anxiety (Pretest)

Descriptive	Mean	Standard Deviation	Min	Max
Anxiety (Pretest)	30.13	6,056	17	40

The table above shows that descriptively the average value(*mean*)maternal anxiety before normal delivery before sound healing method therapy (pretest) was 30.13, standard deviation was 6.056, lowest score (min) was 17, highest score (max) was 40.

### Anxiety of Normal Pre-Delivery Mothers (Posttest)

Table 4. Distribution of Anxiety in Pre-Normal Delivery Mothers After Sound Healing Therapy (Posttest)

No	Anxiety (Posttest)	Amount	Percentage (%)
1.	No Worries	6	20.0
2.	Mild Anxiety	13	43.3
3.	Moderate Anxiety	11	36.7
4.	Severe Anxiety	0	0.0
5.	Very Worried	0	0.0
Total		30	100.0

Table 4. above shows that after administering the therapy method *sound* healing (posttest) during 8 treatments (2 times a week for 4 weeks) most mothers felt mild anxiety (43.3%), a small number had no anxiety (20.0%).

Table 5. Descriptive Data on Maternal Anxiety Before Normal Delivery (Posttest)

Descriptive	Mean	Standard Deviation	Min	Max
Anxiety (Posttest)	18.63	4,860	9	26

The table above shows that descriptively the average value(*mean*)maternal anxiety before normal delivery after sound healing method therapy (posttest) was 18.63, standard deviation was 4.860, lowest score (min) was 9, highest score (max) was 26.

### Bivariate Analysis

#### Data Normality Test

The normality test is a prerequisite analysis test for hypothesis testing using the T test. The data normality test used is the T test. *Shapiro-Wilk* because the number of samples is < 50 people, the results can be seen in the following table.

Table 6. Results of Data Normality Test Using the Shapiro-Wilk Test

Normal Prenatal Maternal Anxiety	Shapiro-Wilk			Information
	Statistics	df	sig.	
Anxiety (Pretest)	0.968	30	0.494	Normal
Anxiety (Posttest)	0.956	30	0.245	Normal

The table above shows the results of the normality test using the test *Shapiro Wilk* shows that the anxiety of mothers before normal delivery before and after sound healing therapy is normally distributed, because the p value is  $> 0.05$ , namely the anxiety of mothers before normal delivery before sound healing therapy (pretest) is 0.494 and the anxiety of mothers after sound healing therapy (posttest) is 0.245. Based on the results of the data normality test, it can be stated that the data is normally distributed, so the test used is the Paired Sample T-Test.

### Paired Sample T-Test

Based on the research results, the difference in maternal anxiety before normal delivery before and after sound healing therapy method in the following table.

Table 7. Paired Sample T-Test Results of Anxiety of Pre-Normal Delivery Mothers Before and After Sound Healing Therapy

Anxiety	Mean	Standard Deviation	p-value	Mark t-count	Mark t-table
<i>Pretest</i>	30.13	6,056	0,000	41,912	1,699
<i>Posttest</i>	18.63	4,860			

The results of the analysis show that the average level of anxiety of mothers before delivery was normal before therapy. *soundhealing* was 30.13 with a standard deviation of 6.056, while after the intervention it decreased to 18.63 with a standard deviation of 4.860. The Paired Sample T-Test obtained  $p = 0.000 < 0.05$  and a t value = 41.912 which is greater than the t-table (1.699) at  $df = 29$ , so it was concluded that sound healing therapy had a significant effect in reducing maternal anxiety before normal delivery at the Independent Practice of Midwife Rusni Dewi, Padangsidempuan City.

## DISCUSSION

### Anxiety of Normal Prenatal Mothers (Pretest)

The results of the study showed that before the therapy method *soundHealing*, it was found that the majority of mothers before normal delivery at the Independent Practice of Midwife Rusni Dewi in Padangsidempuan City felt anxiety in the severe category (70.0%), while a small portion felt anxiety in the mild category (6.7%). The results of Suharnah's research (2021) at the Turikale Community Health Center in Maros Regency showed that the frequency distribution of anxiety levels in primigravida pregnant women in the third trimester before classical music therapy was given was mild anxiety (21.7%), moderate anxiety (52.2%), and severe anxiety (26.1%). Sembiring's research (2023) In the Independent Practice of Midwives in Pinondang Hutasoit, it was found that the anxiety level of pregnant women facing childbirth before being given 30 minutes of music therapy had a highest score of 31 and a lowest score of 13, with an average anxiety level of 21.35 (moderate anxiety). Isnaningsih's

research(2020)at BPM Isnaningsih, Gedangan Village, Tuntang District, it was shown that anxiety in the first active phase in mothers giving birth before listening to the Al-Quran recitation mostly experienced moderate anxiety (96.7%) and those who experienced severe anxiety (3.3%).

Anxiety is a subjective response to stress. The characteristics of anxiety are worry, distress, uncertainty, or fear that occur due to a real or perceived threat.(Isaacs, 2021). Anxiety is an emotional response to an assessment that describes a state of worry, restlessness, fear, and restlessness accompanied by various physical complaints.(Stuart & Sundeen, 2017). Furthermore, anxiety can trigger recurring bodily reactions such as an empty stomach, shortness of breath, heart palpitations, profuse sweating, headaches, and the urge to urinate or defecate. These feelings are accompanied by the urge to move to escape the thing you're worried about.(Hawari, 2021).

According to researchers, the results showed that before the sound healing therapy, most mothers in pre-natal care at the Rusni Dewi Midwifery Practice in Padangsidempuan City experienced severe anxiety. The severe anxiety experienced by 70% of mothers before delivery is generally related to uncertainty and major changes in their lives. Mothers feel anxious due to fear of pain, medical complications, or their inability to control the situation. Furthermore, uncertainty about the health of their baby and themselves can also increase anxiety, especially if there are certain medical histories or risk factors that they must consider. Expectations from family, partners, and society in general can add to mothers' mental burden, triggering concerns about their abilities as mothers and potential changes in interpersonal relationships.

### **Anxiety of Normal Pre-Delivery Mothers (Posttest)**

The results of the study showed that after sound healing therapy, the majority of mothers in pre-normal labor at the Independent Practice of Midwife Rusni Dewi in Padangsidempuan City experienced mild anxiety (43.3%), while a small proportion did not experience any anxiety (20.0%). Suharnah's research(2021)at Turikale Community Health Center showed that the frequency distribution of anxiety levels in primigravida pregnant women in the third trimester after classical music therapy was given was not anxious (26.1%), mildly anxious (47.8%), and moderately anxious (26.1%). For research by Isnaningsih(2020)In the BPM Isnaningsih Gedangan Village, Tuntang District, it was shown that the anxiety in the first active phase of labor in mothers after listening to the Al-Quran recitation was mostly mild anxiety (96.7%) and moderate anxiety (3.3%). Sembiring's research(2023)In the Independent Practice of Midwife Pinondang Hutasoit, it was found that the level of anxiety of pregnant women in facing childbirth after being given music therapy for 30 minutes in pre-natal patients with the highest value being 16 and the lowest value being 4, and the average value of the anxiety level was known to be 9.39 (mild anxiety).

The WHO defines normal labor as one that begins spontaneously, is low-risk at the beginning of labor, and remains so throughout the labor process. The baby is born spontaneously in a cephalic presentation between 37 and 42 completed weeks of gestation. After delivery, both mother and baby are in good health.(Ujiningtyas, 2019). Normal delivery is a delivery that occurs during a term pregnancy (not premature or postmature), has a spontaneous onset (not induced), is completed after 4 hours and before 24 hours from the time

of onset (not a precipitous labor or prolonged labor), has a fetus (single) with a vertex presentation (top of the head) and occiput in the anterior part of the pelvis, is carried out without artificial assistance (such as forceps), does not include complications (such as heavy bleeding), and includes normal delivery of the placenta (Kasdu, 2020).

According to researchers, the results of the study showed that after the therapy methods sound. In a study of pre-natal care, some mothers at the Rusni Dewi Midwifery Independent Practice in Padangsidempuan City experienced mild anxiety. Sound healing therapy can have a calming effect on the body and mind, reducing stress and anxiety levels. The carefully selected sounds in this therapy can stimulate a relaxation response in the nervous system, reducing muscle tension, and improving overall well-being. Of the 13 mothers who experienced mild anxiety, it was reported that they experienced positive changes in their mood and perception of the labor process, helping them navigate the situation with greater calm and control.

### **Sound Healing Therapy in Reducing Mother's Anxiety Before Normal Delivery**

The results of the study show that there is a difference or decrease in maternal anxiety before normal delivery before and after being given sound healing therapy at the Independent Practice of Midwife Rusni Dewi in Padangsidempuan City, with a  $p$ -value =  $0.000 < 0.05$ , it was concluded that sound healing therapy had an effect on reducing maternal anxiety before normal delivery. In line with research Imawati (2019) at Sultan Agung Islamic Hospital in Semarang, the results showed that the anxiety levels before the intervention of natural sound music therapy were at the level of panic (23.8%), severe anxiety (33.3%), moderate anxiety (22.8%), mild anxiety (4.8%), and no anxiety (14.3%). After the intervention of natural sound music therapy, there was an increase and decrease. At the level of panic (0%), severe anxiety (33.3%), moderate anxiety (9.5%), mild anxiety (34.1%), and no anxiety (19.0%). The results of statistical tests obtained significant results, that the natural sound music relaxation technique can reduce anxiety levels in pre-operative patients. The results of the research by Laska et al. (2020) at Semarang City Hospital, the results obtained on the difference in cortisol levels obtained results with a  $p$ -value of 0.010 ( $p$  value  $< 0.05$ ). The conclusion of the study shows that there is an effect of the duration of natural sound music therapy on cortisol levels.

*Sound healing* A therapy that utilizes music and sound elements to improve physical and emotional health. This therapy works through entrainment, a process that aligns brain waves with soothing sound frequencies. This signals the body to adjust to healthier vibrations, facilitating the natural healing process. (Djohan, 2020) According to Goldman, a pioneer of sound healing, healing occurs through the formula "Frequency + Intention = Healing." The positive intention added to the therapy helps focus the energy, making the results more significant. (Corey, 2019).

The results of this study prove that sound healing therapy can reduce maternal anxiety before normal delivery at the Independent Practice of Midwife Rusni Dewi in Padangsidempuan City due to the calming effect produced by soft and harmonious sounds. These sounds have been shown to stimulate a relaxation response in the nervous system, reduce muscle tension, calm anxious thoughts, and shift the mother's attention from anxiety to more pleasant and positive sensory experiences. The effectiveness of this therapy is also in line with

previous research recommendations stating that the most optimal intervention duration is 20–40 minutes, with a standard of 30 minutes per session, and a frequency of 2 times per week for 4 weeks (8 sessions) from 36 weeks of pregnancy until delivery. Thus, the implementation of this protocol not only helps mothers face labor with more calm and control but also strengthens the emotional bond between mother and unborn baby.

## CONCLUSION

The results of this study conclude that sound healing therapy is effective with an intervention duration of 20–40 minutes, namely a standard duration of 30 minutes per session, and a frequency of 2 times per week for 4 weeks (8 sessions) from 36 weeks of pregnancy until delivery can reduce maternal anxiety before normal delivery, indicated by a significant difference in the average anxiety before and after the intervention. The suggestion from this finding is that midwives and health workers can utilize sound healing therapy as a supporting non-pharmacological method in providing emotional comfort for mothers approaching delivery, as well as encouraging further research with larger samples to strengthen scientific evidence.

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# THE EFFECTIVENESS OF HEALTH EDUCATION THROUGH E-FILES MULTIMEDIA AND FACE-TO-FACE CLASSROOM LEARNING ON ADOLESCENTS' REPRODUCTIVE HEALTH KNOWLEDGE AMONG SEVENTH-GRADE STUDENTS AT SMPN 1 KRAMATWATU, SERANG, BANTEN

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## ABSTRACT

**Background :** Adolescence is a transitional period between childhood and adulthood. During this time, many changes occur in adolescents, including physical changes, puberty, and behavior. Globally, health issues among adolescents are primarily driven by risky behaviors such as unhealthy dating, smoking, alcohol consumption, and drug use, which have become major concerns worldwide. This research aims to prove the influence of Health Education through Multimedia E-Files and Face-to-Face Learning in the Classroom on Adolescent Reproductive Health Knowledge.

**Methods:** The research design is a Quasi-Experimental Design with a pretest-posttest control group design. The sample consists of seventh-grade students from SMP Negeri 1 Kramatwatu, with 45 respondents in the control group and 45 respondents in the experimental group, using probability sampling with proportional random sampling method. Data analysis was conducted using Wilcoxon and Mann-Whitney tests.

**Results:** Indicate an effect of reproductive health education through E-File Multimedia media on adolescents' reproductive health knowledge. The average N-Gain Score in the control group was 31.33, while in the experimental group, it was 59.34.

**Conclusion :** Future research is expected to implement different interventions regarding the TRIAD KRR in adolescents and enhance the effectiveness of other media or expand this research with different variables to provide the latest innovations in health education.

**Keywords:** Adolescent Knowledge about Reproductive Health, E-File Multimedia, Face-to-Face

## BACKGROUND

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The achievement of the 2030 Sustainable Development Goals (SDGs) emphasizes the importance of access to sexual and reproductive health services, including education and integration into health programs. The World Health Organization (WHO) supports the strengthening of adolescent health programs in various countries, while Indonesia has implemented the *Generasi Berencana* (GenRe) program through the Youth Information and Counseling Center (PIK-R), the Student Group Concerned with AIDS and Drugs (KSPAN), and Adolescent Integrated Health Posts (*Posyandu Remaja*) since 2010. However, implementation in the field still faces challenges related to limited facilities and infrastructure, as well as low levels of adolescent awareness and participation.

Various adolescent reproductive health problems in Indonesia remain prevalent, including reproductive organ disorders, pathological vaginal discharge, HIV/AIDS, and early marriage. Data show that the prevalence of early marriage increased from 18.3% in 2018 to 19.3% in 2020, which has implications for increased risks of high-risk pregnancies, childbirth complications, and maternal and infant mortality. Contributing factors include low levels of education, socioeconomic conditions, cultural influences, and premarital sexual behavior.

Promotive and preventive efforts are therefore urgently needed, one of which is through reproductive health education. Previous studies indicate that the use of multimedia and educational videos is more effective in improving adolescents' knowledge and attitudes toward reproductive health compared to conventional or simple methods. From an Islamic perspective, seeking knowledge is considered an act of worship, and health promotion is viewed as part of *amar ma'ruf nahi munkar* (enjoining good and preventing evil), as guided by the Qur'an (QS. At-Taubah:71 and QS. An-Nahl:125).

A preliminary study conducted at SMPN 1 Kramatwatu in 2024 revealed that although the KSPAN program is active, risky adolescent behaviors such as unhealthy dating practices, smoking, and alcohol consumption are still found. One of the main obstacles identified was the monotonous delivery of material using lecture-based methods, indicating the need for more interactive and engaging educational approaches.

Health education is a crucial strategy for improving adolescents' knowledge. Conventional face-to-face methods that have been widely used are often perceived as monotonous and less engaging, leading students to have limited understanding and to consider the material unimportant. Therefore, innovative learning media that are more interactive and easily accessible are required, one of which is E-File multimedia. This medium integrates visual and audio elements, making information delivery more effective and allowing students to access learning materials at any time.

## **OBJECTIVE**

Based on these conditions, this study was conducted to analyze the effectiveness of health education delivered through E-File multimedia compared to conventional face-to-face classroom methods on adolescent reproductive health knowledge among seventh-grade students at SMPN 1 Kramatwatu, Serang, Banten.

## **METHODS**

This study was conducted using a quantitative approach. The research design employed was a quasi-experimental design with a pretest–posttest control group design. The study population consisted of all seventh-grade students at SMP Negeri 1 Kramatwatu, totaling 180 students. A sample of 90 respondents was selected and divided into two groups: a control group and an experimental group. Each group consisted of 45 respondents, and no participants dropped out during the study.

The characteristics observed included age, gender, dating status, sources of information, and whether respondents had ever experienced, witnessed, or heard about sexual behaviors related to adolescent reproductive health. The sampling technique used was probability sampling with a proportional random sampling method. The study was conducted from March to April 2024. Data collection was carried out in two phases: the first phase for the control group and the second phase for the experimental group. Pretest and posttest questionnaires were administered using Google Forms. The control group received reproductive health education through conventional face-to-face methods, while the experimental group received reproductive health education with video-based E-File multimedia interventions. Data analysis was performed using the Wilcoxon test and the Mann–Whitney test.

This study obtained ethical approval from the Research Ethics Committee of Universitas Yatsi Madani with approval number: 535/LPPM-UYM/III/2024.

## RESULTS

### **The Effect of Reproductive Health Education through E-File Multimedia on Adolescents’ Reproductive Health Knowledge at SMPN 1 Kramatwatu**

Before conducting data analysis, a normality test was performed using the Shapiro–Wilk test. This test was applied because the knowledge variable was numerical data measured on a ratio scale. The results of the normality test are presented in Table 6 as follows:

**Table 1 . Results of the Data Normality Test**

Knowledge	<i>Statistic</i>	<b>df</b>	Sig. Pretest
Kontrol	.170	45	.000
Posttest Kontrol	.153	45	.000
Pretest Eksperimen	.185	45	.000
Posttest Eksperimen	.154	45	.002

The results of the normality test using the Shapiro–Wilk test showed that all tested data had p-values  $< \alpha$  (0.05), indicating that the data were not normally distributed. Therefore, non-parametric statistical tests were applied in this study. The Wilcoxon test was used for paired data to examine differences in the mean pretest and posttest scores within the control and experimental groups, while the Mann–Whitney test was used for unpaired data to compare the pretest and posttest scores between the control and experimental groups.

#### **1. Differences in Adolescents’ Reproductive Health Knowledge Before and After Receiving Reproductive Health Education Through Face-to-Face Methods**

**Table 2** Differences in Adolescents’ Reproductive Health Knowledge Before and After Receiving Face-to-Face Reproductive Health Education

	Time	N	Mean	Mean Difference	P Value
Knowledge	Before	45	78,76	6,57	0,000
	After	45	85,33		

Based on the table above, in the control group there was an increase in the average knowledge score before and after reproductive health education was delivered through conventional media, amounting to 6.57. The bivariate analysis using the Wilcoxon test showed a p-value <  $\alpha$  (0.05), indicating that  $H_0$  was rejected. This result signifies that there is a difference in adolescents' reproductive health knowledge before and after being given reproductive health education through face-to-face media.

## 2. Differences in adolescents' reproductive health knowledge before and after being given reproductive health education through E-File Multimedia media

**Table 3** Differences in adolescents' reproductive health knowledge before and after being given reproductive health education through E-File Multimedia media

	Time	N	Mean	Mean Difference	P Value
Knowledge	Before	45	78,84	13,25	0,000
	After	45	92,09		

Based on the table above, the experimental group showed an increase in the average knowledge score before and after receiving reproductive health education through E-File Multimedia media, amounting to 13.25. The results of the bivariate analysis using the Wilcoxon test obtained a p-value <  $\alpha$  (0.05), which means that  $H_0$  was rejected. This indicates that there is a difference in adolescents' reproductive health knowledge before and after being given reproductive health education through E-File Multimedia media.

## 3. Effect of reproductive health education through E-File Multimedia media on adolescents' reproductive health knowledge

In testing this hypothesis, the researcher used the Mann–Whitney test to determine the effect of reproductive health education through E-File Multimedia media on adolescents' reproductive health knowledge. The Mann–Whitney test was used to examine whether there was a significant difference in the mean posttest scores between the control group that used conventional media and the experimental group that used E-File Multimedia media.

**Table 4** The Effect of Reproductive Health Education Through E-File Multimedia on Adolescents' Reproductive Health Knowledge

Knowledge	Group	N	Mean Rank	Sig
Pretest	Kontrol	45	45,64	0,957
	Eksperimen	45	45,36	
PostTest	Kontrol	45	34.83	0,000
	Eksperimen	45	56.17	

Based on the results of the bivariate analysis of the pretest scores between the control group and the experimental group using the Mann–Whitney test, the Asymp. Sig. (2-tailed) value was 0.957, which is greater than 0.05. The mean rank of the control group was 45.64, while the mean rank of the experimental group was 34.83. Therefore, there was no significant difference or effect on knowledge prior to the provision of reproductive health education between the control and experimental groups.

The statistical analysis of the posttest scores between the control group and the experimental group using the Mann–Whitney test showed an Asymp. Sig. (2-tailed) value of 0.000. Since the p-value was less than  $\alpha$  (0.05), it can be concluded that  $H_a$  was accepted and  $H_0$  was rejected. The mean rank of the control group was 34.83, whereas the mean rank of the experimental group was 56.17. These results indicate that reproductive health education delivered through E-File multimedia had a significant effect on adolescents' reproductive health knowledge.

Tabel 5 Uji N-Gain Score

	Group	Mean	Min	Max	Asymp.Sig (2-tailed)
N-Gain Score	Kontrol	31,33	-25.00	80,00	0,001
	Eksperimen	59,34	0,00	100,00	

**The N-Gain Score test** aims to determine the magnitude of the effect of reproductive health education through E-File Multimedia media on adolescents' knowledge of Adolescent Reproductive Health (KRR), which includes sexuality, HIV/AIDS, and drug abuse (NAPZA), after it was established that there was a significant difference between the mean posttest scores of the control group and the experimental group using the Mann–Whitney test. Based on the results of the N-Gain Score test analyzed using the Mann–Whitney test, a p-value of 0.001 was obtained. Since  $p < \alpha$  (0.05), it can be stated that  $H_a$  is accepted and  $H_0$  is rejected. This indicates that reproductive health education through E-File Multimedia media has an effect on adolescents' reproductive health knowledge. The mean N-Gain Score in the control group was 31.33, while in the experimental group it was 59.34.

## DISCUSSION

Adolescents' reproductive health knowledge before the provision of reproductive health education in the control and experimental groups

Based on the results of the study, it was found that adolescents' knowledge in the control group before being given face-to-face reproductive health education had a mean score of 78.76. The lowest score was 52 and the highest score was 88, with a standard deviation of 8.30. In the experimental group, before being given reproductive health education using E-File Multimedia media, the mean knowledge score was 78.84. The lowest score was 64 and the highest score was 88, with a standard deviation of 7.26.

Observations prior to the pretest showed that adolescents were less interested in the importance of reproductive health and were less active in participating in activities related to adolescent reproductive health. This was evident from the small number of students interested in joining extracurricular activities such as the Student Group Concerned with AIDS and Drugs

(KSPAN) and the Youth Information and Counseling Center (PIK-R). Based on the characteristics of respondents at SMP N 1 Kramatwatu, in the control group, 33 respondents (73.3%) had previously received information on reproductive health, while 12 respondents (26.7%) had never received such information. In the experimental group, 30 respondents (66.7%) had previously received information on KRR, while 15 respondents (33.3%) had never received information on KRR.

In the control group, 17 respondents (37.8%) obtained information from health professionals, 23 respondents (51.1%) from non-health professionals, and 5 respondents (11.1%) had never received information. In the experimental group, 15 respondents (33.3%) had obtained information on adolescent reproductive health from health professionals, 24 respondents (53.2%) from non-health professionals, and 6 respondents (13.3%) had never received information on adolescent reproductive health.

Although respondents had previously received health education, some still lacked understanding and knowledge of reproductive health, particularly adolescent reproductive health. This is reflected in the pretest results, with an average score of 78.76 in the control group and 78.84 in the experimental group. Several factors influencing the pretest results include the limited implementation of reproductive health education activities, including adolescent reproductive health, at SMP N 1 Kramatwatu.

This finding is supported by explanations from the extracurricular supervising teacher, who stated that extracurricular activities were conducted using discussion and lecture methods with PowerPoint media. The material presented tended to be monotonous and was only targeted at students who were interested in joining the KSPAN extracurricular activity. The lack of student interest in participating in health education activities resulted in the material not being fully understood (Tafonao, 2018).

Efforts that can be made to improve adolescents' health knowledge include providing health education. In this study, the researcher provided health education using E-File Multimedia media in the experimental group. The researcher collaborated with the extracurricular supervising teacher in delivering health education to the control group. The methods used were lectures and discussions using PowerPoint media as developed by the school.

Adolescents' reproductive health knowledge after the provision of reproductive health education in the control and experimental groups

Based on the results of the study, adolescents' knowledge in the control group after receiving face-to-face reproductive health education had a mean score of 85.33. The lowest score was 56 and the highest score was 96, with a standard deviation of 8.00. In the experimental group, after receiving reproductive health education using E-File Multimedia media, the mean knowledge score was 92.09. The lowest score was 76 and the highest score was 100, with a standard deviation of 6.52.

These data indicate an increase in adolescents' knowledge after receiving reproductive health education through both E-File Multimedia media and face-to-face methods. During the health education process in the control group, many adolescents paid less attention to the explanation of the material, resulting in the material not being well understood. In this study, reproductive health education in the control group was conducted by the extracurricular

supervising teacher using discussion and lecture methods with PowerPoint media. One of the weaknesses of the face-to-face method is that the material presented on PowerPoint tends to be extensive.

## CONCLUSION

The results of this study indicate that reproductive health education through E-File Multimedia media has an effect on adolescents' reproductive health knowledge at SMP N 1 Kramatwatu. The effectiveness of reproductive health education using E-File Multimedia media was 59.34%, indicating that this method is moderately effective in improving adolescents' knowledge of reproductive health at SMP N 1 Kramatwatu.

Recommendations include improving students' knowledge of adolescent health through extracurricular activities such as the Student Group Concerned with AIDS and Drugs (KSPAN) and the Youth Information and Counseling Center (PIK-R). In implementing health education, extracurricular supervising teachers are expected to provide effective health education by adopting an approach that is engaging for adolescents. Health education can utilize attractive media, such as the E-File Multimedia media used in this study, to increase adolescents' interest and knowledge.

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# DETERMINANTS OF SECOND-DOSE MEASLES IMMUNIZATION ACCEPTANCE AMONG TODDLERS: A SYSTEMATIC LITERATURE REVIEW

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## ABSTRACT

**Background:** Measles is a contagious disease with high morbidity and mortality rates. Globally, measles immunization coverage has reached 81% for the first dose and 71% for the second dose. In Southeast Asia, the coverage is 91% for the first dose and 85% for the second dose; however, these figures remain below the measles elimination target.

**Purpose:** identify the factors influencing second-dose measles immunization coverage.

**Methods:** The method used is a Systematic Literature Review with keywords formulated based on the PICO framework: Population: “children,” Exposure: “second-dose measles vaccine,” and Outcome: “associated factors,” “predictors,” or “determinants.”

**Results:** From a total of 1,159 articles identified, eleven studies met the inclusion criteria and were analyzed further. The results show that second-dose measles immunization coverage is influenced by several factors, including maternal age, education level, knowledge, utilization of maternal health services, and accessibility to healthcare facilities. Maternal health service utilization, such as antenatal care visits, delivery at health facilities, and postnatal checkups, significantly increases the likelihood of children receiving the second dose. Conversely, barriers such as long distances, limited transportation, and long waiting times remain major challenges.

**Conclusion:** Therefore, strengthening education, integrating maternal health services with immunization programs, and expanding access in remote areas are essential to improving measles immunization coverage. These efforts provide an important foundation for formulating more effective policies to support both global and national measles elimination strategies.

**Keywords:** Determinant, Immunization, Measles, Second dose

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## **BACKGROUND**

Measles, also known as morbilli, is a highly contagious disease with high morbidity and mortality rates. The number of measles cases increased globally to 395,521 in 2024. In Southeast Asian countries, measles cases also surged to 40.9 per million population, up from 16.2 per million in 2023 (Do & Mulholland, 2025). Meanwhile, Indonesia reported a dramatic rise in suspected measles cases in 2023, with 10,308 cases (26.2% of suspected cases) distributed across all provinces (WHO, 2023).

Measles is caused by a virus from the genus Morbillivirus, which belongs to the Paramyxovirus family. Transmission occurs through the air via droplets from the nose, mouth, or throat of an infected person. Untreated measles can lead to serious complications, including severe diarrhea, blindness, encephalitis, pneumonia, and death. Although there is no specific treatment for measles, the disease can be prevented through safe and effective measles immunization (Olufadewa et al., 2024)

Measles immunization is the most effective effort to control the spread of the measles virus and saves millions of lives each year. Researchers estimate that measles vaccination prevented 28 million deaths between 2010 and 2018 (Patel et al., 2019). The World Health Organization recommends that the first dose of measles vaccine be given at the age of 9 months, followed by a second dose at 15–18 months. Despite the effectiveness of immunization, measles remains a major cause of mortality and morbidity worldwide. Most measles-related deaths occur in children under five years of age, particularly in areas with low or inconsistent immunization coverage (Bello et al., 2024).

Globally, measles immunization coverage has reached only 81% for the first dose and 71% for the second dose. In Southeast Asia, coverage is 91% for the first dose and 85% for the second dose, indicating a decline. In Indonesia, measles immunization coverage dropped from 98.4% to 76.8% in 2022 (Kemenkes RI, 2024). Coverage for the second dose in Indonesia has been reported at around 54% (Maulida et al., 2019), far below the WHO target of at least 95% coverage with two doses (World Health Organization, 2019). Protection from two doses of the measles vaccine is more effective than a single dose in preventing the disease. High immunization coverage is expected to reduce the risk of transmission in communities and improve children's overall health (Yitbarek et al., 2025)

Several studies report that the decline in measles immunization coverage may be influenced by factors such as antenatal care visits, maternal education, place of delivery, access to information about measles, distance to immunization services, knowledge about immunization, postnatal care, waiting time, and proximity to health facilities (Alemu et al., 2024; Goshu Muluneh et al., 2022). However, studies examining the determinants of second-dose measles immunization coverage remain limited.

## **OBJECTIVE**

Therefore, the present study aims to identify relevant research and summarize the key determinants of second-dose measles immunization coverage. The findings of this review are expected to inform policymakers in developing effective strategies to improve second-dose coverage and ultimately eliminate recurrent measles outbreaks.

## **METHODS**

This study employed a Systematic Literature Review approach. We conducted the review using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline as a reporting framework to ensure that each step was performed rigorously (Page et al., 2021). The review aimed to identify factors influencing second-dose measles immunization coverage among children. The search for data sources covered publications from 2015 to 2025. Literature searches were performed in three databases: PubMed, Springer, and ProQuest.

Search terms were developed using the PICO framework and selected based on their relevance to the background and existing literature. The Population included “children” and the “pediatric population”; the Exposure was the “second-dose measles vaccine”; and the Outcomes were “associated factors,” “predictors,” or “determinants.” These terms were applied individually and then combined using Boolean operators, including “OR” and “AND.” The keywords used in the search strategy were: (“second-dose measles vaccine” OR “two doses of measles vaccine”) AND (“children” OR “pediatrics”) AND (“uptake” OR “utilization” OR “coverage” OR “acceptance” OR “adherence”) AND (“associated factors” OR “predictors” OR “determinants” OR “influencers”).

The inclusion criteria for this review were: (1) articles published between 2015 and 2025; (2) studies published in English; (3) full-text articles available for retrieval; (4) observational study designs, including cross-sectional, case-control, or cohort studies; (5) studies involving children as the target population; and (6) studies reporting factors associated with second-dose measles immunization coverage or uptake. The exclusion criteria included review articles, studies that did not specifically assess second-dose measles immunization, studies without original data, studies with unclear outcome variables, studies involving populations outside the target age group, duplicate publications, and articles with inaccessible full texts. All articles identified from the database searches were imported into Mendeley reference manager to detect duplicates and to facilitate title and abstract screening. Articles were independently assessed by two authors based on titles and abstracts.

Study information was extracted into a spreadsheet, including author names, year of publication, study period, design, setting, sample size, age group, and factors influencing measles outbreaks. Disagreements regarding article eligibility were resolved through discussion with a third author. The methodological quality of the selected studies was independently appraised by reviewers using the Joanna Briggs Institute (JBI) Critical Appraisal Tool (2017). Finally, a narrative synthesis was conducted to summarize the findings of the included studies, and this synthesis was used to reflect the overall results of the analysis.

## **RESULTS**

A total of 1,159 articles were identified from the databases. After removing 658 duplicate records, 501 articles remained for title and abstract screening. Of these, 447 articles were excluded because they did not meet the inclusion criteria. Fifty-four full-text articles were assessed for eligibility. After full-text review, 43 articles were excluded for predefined reasons. Finally, 11 studies met all inclusion criteria and were included in the final analysis (Figure 1).

The included studies were conducted in several countries, including Ethiopia (eastern, northwestern, and central regions), Africa, Kenya, Indonesia, and Japan. Most of them used cross-sectional and case-control designs. Altogether, the studies involved 39,205 children under five years of age.

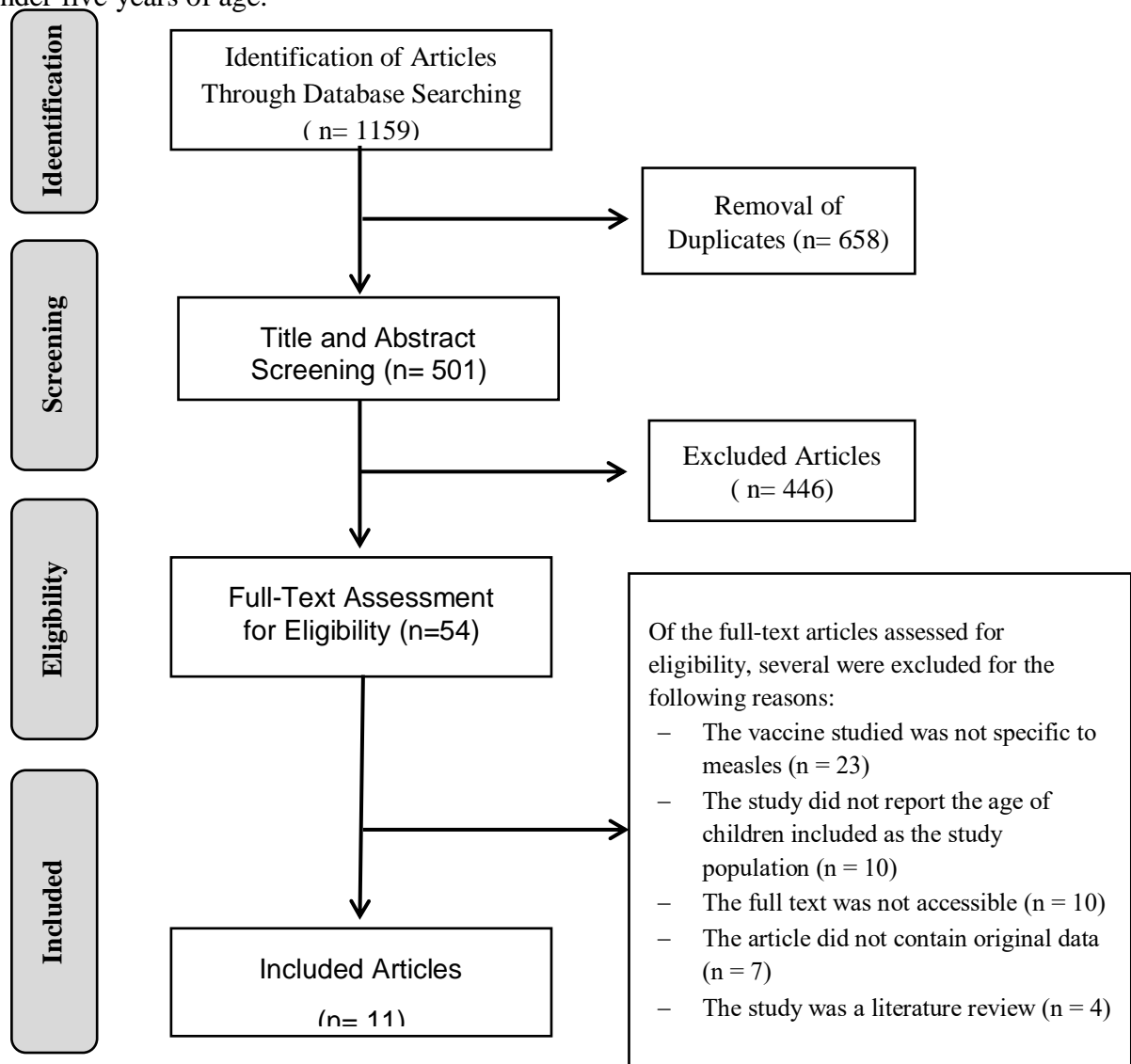


Figure 1. Article Selection Process Using PRISMA

Several factors were reported to influence the uptake of measles immunization among children, including maternal age (n = 4); maternal education (n = 8); antenatal care (ANC) visits (n = 2); postnatal care (PNC) visits (n = 5); delivery at a health facility (n = 2); children's status regarding other scheduled vaccines (n = 2); and lack of care at health facilities (n = 1). Accessibility to health services also played an important role, including travel time to health facilities (n = 2), distance to immunization sites (n = 4), and waiting time for immunization (n = 2). Additional determinants included knowledge about childhood immunization (n = 4) and awareness of the measles vaccine (n = 3).

This review found that 8 out of the 11 studies showed that second-dose measles immunization coverage was lower than that of the first dose, while three studies did not report the prevalence of the second dose. The highest second-dose coverage was reported in Japan at 93.9%, whereas the lowest was observed in eastern Ethiopia at 21.4% (Table 1).

Table 1. Data Extraction for Included Studies

No	Author (Year)	Location	Design	Sample Size	Prevalence First-Dose Measles Immunization	Prevalensi Second-Dose Measles Immunization	Factors Associated with Second-Dose Measles Immunization (p < 0.05)
1	Ibrahim et al (2024)	Eastern Ethiopia	Cross sectional	429 sample	59,0%	21,4%	<ul style="list-style-type: none"> <li>– Maternal education</li> <li>– Delivery at a health facility</li> <li>– Maternal postnatal care visits</li> <li>– Travel time to the health facility</li> <li>– Knowledge of childhood immunization.</li> </ul>
2	Taffie et al (2024)	Northwest Ethiopia	Cross sectional	418 sample	70,8%	41,39%	<ul style="list-style-type: none"> <li>– Postnatal care visits</li> <li>– Child's status regarding other scheduled vaccines</li> <li>– Awareness of the second-dose measles vaccine and its schedule</li> <li>– Distance to the immunization site</li> </ul>
3	Tadesse et al (2022)	Central Ethiopia	cross-sectional	410 sample	88,7%	42,5%	<ul style="list-style-type: none"> <li>– Maternal age</li> <li>– Waiting time for immunization at the health facility</li> <li>– Awareness of immunization</li> </ul>
4	Chilot et al (2022)	Sub-Saharan Africa	Secondary data analysis (Demographic and Health Survey)	15.090 sample	83,07%	44,77%	<ul style="list-style-type: none"> <li>– Maternal age</li> <li>– Maternal education</li> <li>– Access to health facilities</li> <li>– ANC visits</li> <li>– PNC visits</li> <li>– Delivery at a health facility</li> </ul>
5	Mamuti et al (2022)	Kenya	Cross-sectional	536 sample	96,6%	56,2%	<ul style="list-style-type: none"> <li>– Household income</li> <li>– Status of other scheduled immunizations</li> <li>– Caregiver education level</li> <li>– Knowledge about measles immunization</li> </ul>
6	Kanyiru et al (2019)	Kenya	Cross sectional	186 sample	85,5%	32,5%	<ul style="list-style-type: none"> <li>– Maternal education</li> <li>– Awareness of the measles vaccine</li> <li>– Lack of care at health facilities</li> </ul>

7	Maulida et al (2019)	Indonesia	cross-sectional	129 sample	84%	54%	– Experience in obtaining health services
8	Adugna et al (2024)	Ethiopia	case-control	351 sample	-	Case group 38 (32.5%), and control 75 (32.1%)	– Maternal illiteracy – PNC visits – Inadequate maternal knowledge – Poor counseling – Long distance to health facilities – Long waiting time at immunization site
9	Demewoz et al (2023)	Northwest Ethiopia	cross-sectional	845 sample	-	48,1%	– Maternal education – Information about the second-dose measles vaccine – Distance to the immunization site – Knowledge of immunization – Positive attitude toward immunization
10	Hermawan et al (2025)	Indonesia	cross-sectional	19.425 sample	-	73,46%	– Frequency of postnatal care – Maternal education – Maternal age – Travel time to health facilities – Household expenditure
11	Hu et al (2018)	Jepang	cross-sectional	1386 sample	96,9%	93,9%	– Maternal age – Maternal education – Delivery at a health facility – Maternal employment status – Household income

## DISCUSSION

Acceptance of the second dose of the measles vaccine refers to the administration of the second measles immunization following the first dose. This study found that the prevalence of the second-dose measles immunization was lower than that of the first dose. The highest prevalence of second-dose measles immunization was reported in Japan at 96.9%, while the lowest prevalence was observed in Eastern Ethiopia at 21.4%. Measles immunization coverage remains far below the target, particularly for the second dose. The World Health Organization (WHO) recommends a 95% measles immunization coverage with two doses (World Health Organization, 2019). The protective effectiveness of two doses of the measles vaccine has been proven to be superior in preventing measles compared to a single dose. High immunization coverage is expected to reduce the risk of infectious disease transmission in the community and improve overall child health (Yitbarek et al., 2025). Conversely, failure to achieve the target immunization coverage may lead to the re-emergence of measles outbreaks. Several factors may influence the acceptance of the second dose of measles immunization among children.

Children born to mothers aged 25–34 years and >35 years are more likely to receive

measles immunization compared to those born to mothers aged 15–24 years. This may be because older mothers have a better understanding of disease prevention through immunization, more experience with vaccination, and lower levels of vaccine hesitancy (Chilot et al., 2022). However, these findings differ from Tadesse et al., who reported that younger mothers were more likely to immunize their children than older mothers. These differences may be attributed to variations in study settings (nationwide), study design (secondary data analysis), and sociocultural contexts (Tadesse et al., 2022).

Maternal education is a strong predictor influencing second-dose measles immunization. Children of mothers with secondary or higher education are more likely to complete measles immunization. Educated mothers tend to have better health literacy and greater access to information regarding the benefits of immunization, resulting in higher measles vaccination rates among their children. Education serves as a pathway to empowerment, leading to greater acceptance of public health information. Empowerment enhances health-seeking behavior through changes in attitudes, traditions, and beliefs, increases autonomy and decision-making capacity, and helps build social networks that provide information about healthy behaviors and available health services (Mamuti et al., 2022; Zenbaba et al., 2021). Among the identified determinants, maternal education emerged as the most dominant factor influencing second-dose measles immunization uptake, as it was reported in eight of the eleven included studies. Mothers with higher educational attainment tend to possess better health literacy, improved access to health information, and greater decision-making capacity regarding their children's healthcare. Therefore, improving maternal education and health literacy may substantially increase second-dose measles immunization coverage.

Knowledge about measles immunization significantly influences immunization uptake. Children whose mothers or caregivers have good knowledge are more likely to receive measles immunization compared to those with limited knowledge. Knowledge fosters awareness and encourages appropriate practices. Informed mothers or caregivers are more likely to understand the recommended schedule, benefits, consequences of delayed or missed doses, and adverse events following immunization (AEFI). They are also better prepared to make appropriate decisions regarding their children's health. Mothers actively seek information, ask questions, and consult healthcare providers. Empowered mothers advocate for their children's needs and overcome barriers that may hinder vaccine uptake. Conversely, failure of healthcare providers to deliver adequate information may reduce healthcare-seeking behavior (Sugishita et al., 2019)

Maternal healthcare visits are among the most influential predictors of measles immunization utilization. Children born to mothers who attend maternal healthcare services—such as antenatal care (ANC), delivery services, and postnatal care (PNC)—are more likely to receive measles immunization compared to those whose mothers do not attend such services. Women who seek maternal healthcare are more likely to seek care for their children as well. Frequent access to healthcare services provides opportunities for communication, counseling, and health education from healthcare providers regarding the importance of measles immunization (Kantner et al., 2021) Healthcare visits also involve scheduling follow-up appointments for both mother and child, serving as reminders for measles immunization. This highlights the important role of healthcare workers in integrating maternal healthcare services (ANC, delivery, and PNC) with health education to improve adherence to immunization schedules (Taffie et al., 2024).

Accessibility to healthcare services is a key indicator of health system efficiency and equity. It reflects an individual's ability to obtain appropriate healthcare services effectively, efficiently, and in a timely manner (Zahidi et al., 2024). Healthcare accessibility influences measles immunization uptake among children. It refers to the distance between a household and an immunization facility, commonly categorized as walking time <30 minutes or  $\geq 30$  minutes. Mothers who require more than 30 minutes to reach an immunization site are less likely to vaccinate their children against measles compared to those who live within 30 minutes. This may occur because previous long waiting times discourage children and reduce motivation to complete the second dose. Accessibility challenges extend beyond distance and include travel time, inability to afford transportation, lack of available transport, poor road conditions, limited health infrastructure, travel anxiety, and motion sickness, all of which may hinder access to routine immunization services. Therefore, strengthening strategies to improve healthcare accessibility is essential to increase measles immunization coverage (Adugna et al., 2024; Chilot et al., 2022; Hermawan et al., 2025; Ibrahim et al., 2024; Kanyiru et al., 2019; Taffie et al., 2024).

In addition, waiting times exceeding 30 minutes for immunization services are significantly associated with dropout from the second dose of measles immunization (Adugna et al., 2024; Tadesse et al., 2022). Long waiting times may disrupt service utilization and contribute to immunization dropout. These findings highlight an important dimension of healthcare access, where health services fail to respond effectively and promptly to patients' needs. Healthcare providers and facilities should reassess service delivery processes to reduce waiting times and improve second-dose measles immunization coverage (Levesque et al., 2013).

This study contributes to the global understanding of determinants shaping measles immunization coverage and provides a foundation for more targeted interventions in maternal and child health services. Strengthening maternal education and expanding access to postnatal care services, particularly in underserved and remote areas, should be prioritized as part of policy efforts aimed at improving routine childhood immunization coverage.

This review has several limitations. First, most included studies used cross-sectional designs, limiting the ability to establish causal relationships. Second, variations in study settings, sample sizes, and measurement methods may have contributed to heterogeneity among the findings. Finally, the literature search was limited to three databases, which may have resulted in the omission of relevant studies published elsewhere.

## CONCLUSION

Coverage of the second dose of measles immunization among children is influenced by maternal age, education, knowledge, women's empowerment, utilization of maternal health services, and the accessibility of health facilities. Maternal education was identified as the most dominant determinant of second-dose measles immunization coverage, followed by maternal knowledge, utilization of maternal healthcare services, and accessibility to health facilities. Efforts to improve coverage can be achieved by strengthening maternal education and empowerment, integrating maternal health services with immunization programs, expanding access to remote and underserved areas, and promoting cross-sector collaboration to address geographic and sociocultural barriers. Through these strategies, the measles elimination target

can be achieved more equitably across populations.

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# APPLICATION OF THE HIRARC METHOD TO ASSESS HOME ENVIRONMENTAL HAZARDS AMONG ELDERLY: THE ROLE OF FUNCTIONAL INDEPENDENCE AND NUTRITIONAL STATUS

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## ABSTRACT

**Background:** The increasing elderly population is associated with an increased risk of injury due to declining physical function and hazards within the home environment. Home safety is influenced by both environmental and individual factors, including independence level and nutritional status. The Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method can be used to identify and assess home environmental hazards systematically

**Purpose:** This study aimed to analyze the relationship between independence level and nutritional status with home environmental hazard levels among older adults based on the HIRARC method.

**Methods:** A cross-sectional analytical study was conducted among 30 alderly selected through total sampling. Independence level was measured using the Barthel Index, nutritional status was assessed using Body Mass Index (BMI), and home environmental hazards were evaluated using the HIRARC method. Data were analyzed using descriptive statistics and Spearman rank correlation tests with a significance level of 0.05.

**Results:** Most respondents were female (56.7%) and aged 60–69 years (66.7%). Nearly half had normal nutritional status (46.7%) and were categorized as independent (46.7%). Home hazard assessment indicated that 53.3% of homes were at moderate risk. The most common hazards were slippery bathroom floors (60.0%), inadequate lighting (46.7%), and the absence of handrails (40.0%). Significant relationships were found between independence level and home environmental hazards ( $p=0.004$ ), between nutritional status and home environmental hazards ( $p=0.028$ )

**Conclusion:** Independence level and nutritional status are significantly associated with home environmental hazard levels among elderly. Improving home safety, maintaining functional independence, and promoting optimal nutritional status are important strategies to prevent injuries and support healthy aging.

**Keywords:** Elderly, HIRARC, Nutrision Status, Barthel Index, Nutritional Status, Home Environmental Hazards

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## **BACKGROUND**

Rising life expectancy has led to a sustained increase in the number of elderly people (seniors) year after year. The Central Statistics Agency (BPS) reports that the number of elderly people in Indonesia will reach approximately 33.94 million by 2025, or 11.93% of the total population, indicating that Indonesia has entered an aging society (BPS, 2025). The increasing number of elderly presents challenges because the aging process is accompanied by various physiological changes, such as decreased muscle strength, balance, mobility, and sensory function, which can increase susceptibility to injury and reduce the ability to perform daily activities (Mauk, 2018).

Level of independence and nutritional status are two important factors influencing the quality of life of elderly. Independence reflects the ability of elderly to independently perform daily activities, such as moving, transferring, eating, and bathing. This is generally measured using the Barthel Index (Mahoney & Barthel, 1965). On the other hand, poor nutritional status can lead to decreased muscle mass, physical weakness, and impaired balance, while being overweight can limit mobility and increase the burden on the musculoskeletal system. These conditions can potentially reduce the ability of elderly to adapt to various risks in their living environment (WHO, 2021).

From an occupational health and safety (OHS) perspective, accidents are influenced by the interaction between human and environmental factors (ILO, 2022). This concept applies not only to the workplace but is also relevant to the home environment of elderly. Various conditions such as slippery floors, inadequate lighting, stairs without handrails, cluttered electrical cords, and unsafe furniture layout can be sources of hazards that increase the risk of injury. To identify and control these risks, the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method can be used as a systematic approach to assess the risk level of the home environment.

The condition of the home environment contributes to the safety of elderly. Research by Mackenzie, Byles, and Higginbotham (2000) found that slippery floors, obstructions in walkways, inadequate lighting, and a lack of handrails are factors associated with an increased risk of injury in elderly. Furthermore, research by Ziebart et al. (2021) also showed that most senior homes still have various potential hazards that have not been optimally identified. However, most studies have focused on fall risk factors or health conditions of elderly, while research combining nutritional status, level of independence, and level of home environmental risk using the HIRARC approach is relatively limited.

Based on this description, nutritional status and independence level are suspected to be associated with the level of home environmental risk faced by elderly. Elderly individuals with poor nutritional status and low independence levels are potentially more vulnerable to hazards in their living environment than elderly with good nutritional status and the ability to function independently. Therefore, this study was conducted to analyze the relationship between independence level, nutritional status, and home environmental risk levels in elderly using the HIRARC method. The results of this study are expected to provide a basis for developing health promotion programs, injury prevention programs, and developing a safe and friendly home environment for the elderly.

## **OBJECTIVE**

The Objective from this research is to analyze the relationship between the level of independence and nutritional status with the level of environmental hazards in the home in the elderly based on the Hazard Identification, Risk Assessment and Risk Control (HIRARC) method. In addition, this study also aims to identify potential hazards in the elderly's home environment and assess the level of risk as an effort to prevent injuries and improve the safety of the elderly in their residential environment.

## **METHODS**

This research is a quantitative study with an analytical observational design using a cross-sectional approach. The research was conducted in January 2025 at one of the Elderly Posts in Bluru Kidul District, Sidoarjo Regency. The research population was all elderly people registered at the Elderly Posyandu, a total of 30 people. Considering the relatively small population, the sampling technique used was total sampling, the entire population was used as research respondents. Inclusion criteria included elderly aged  $\geq 60$  years, able to communicate well, and willing to participate in this research. While elderly with severe cognitive impairment or not at home at the time of observation were excluded from the research.

The independent variables in this study were the level of independence and nutritional status of the elderly, while the dependent variable was the level of risk in the home environment. Independence was measured using the Barthel Index, which consists of 10 components of Activities of Daily Living (ADL), including eating, bathing, dressing, moving, using the toilet, and transferring. Nutritional status was measured using Body Mass Index (BMI), obtained from respondents' weight and height measurements, then categorized based on the Asian BMI classification. The level of risk in the home environment was assessed using the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method through direct observation of the home, including the yard, living room, bedroom, bathroom, kitchen, and stairs. Observed potential hazards included slippery floors, inadequate lighting, lack of handrails, cluttered electrical wiring, obstructed walkways, and uneven floors. Each identified potential hazard was then rated based on its likelihood and severity to determine the level of risk.

Data were collected through structured interviews, anthropometric measurements, and observations of the home environment. Univariate analyses were conducted to describe respondent characteristics, nutritional status, level of independence, and level of risk in the home environment, using frequency distributions, percentages, means, and standard deviations. Bivariate analyses were conducted using Spearman's rank sum test to determine the relationship between level of independence and nutritional status and level of risk in the home environment at a 95% confidence level ( $\alpha = 0.05$ ).

## **RESULTS**

### **Respondent Characteristics**

This study involved 30 elderly people registered as participants of the Elderly Posyandu in Village X. Based on gender, most of the respondents were female, namely 17 people (56.7%), while 13 respondents were male (43.3%). Based on age group, the majority of

respondents were in the age range of 60–69 years, namely 20 people (66.7%), followed by the age group of 70–79 years, namely 7 people (23.3%) and  $\geq 80$  years, namely 3 people (10.0%).

Table 1. Respondent Characteristics Based on Gender and Age

Gender	n	%
Male	13	43.3
Female	17	56.7
Total	30	100
Age group (Year)		
60-69	20	66.7
70-79	7	23.3
$\geq 80$	3	10.0
Total	30	100

### Nutritional Status of the Elderly

Based on Body Mass Index (BMI) measurements, the majority of respondents (14) had normal nutritional status. Eight (26.7%) were overweight, four (13.3%), and four (13.3%) were obese. These findings indicate that the majority of elderly individuals had a nutritional status within the normal range, although some respondents were found to be underweight or overweight.

Table 2. Distribution of Nutritional Status of the Elderly Based on BMI

Nutritional status (IMT)	n	%
Underweight	4	13.3
Normal	14	46.7
Overweight	8	26.7
Obesitas	4	13.3
Total	30	100

### Elderly Independence Level

Based on the Barthel Index, the majority of respondents (14) were classified as independent. Nine (30.0%) experienced mild dependence, four (13.3%), and three (10.0%) experienced moderate dependence. No respondents were completely dependent. These results indicate that most elderly individuals are still able to perform daily activities independently, although some require assistance with certain activities.

Table 3. Distribution of Elderly Independence Levels Based on the Barthel Index

Independence Level	n	%
Independent	14	46.7
Light Dependence	9	30.0
Moderate Dependence	4	13.3
Heavy Dependence	3	10.0
Total	30	100

### Home Environmental Risk Level Based

The results of hazard identification and risk assessment using the HIRARC method for each house showed that the majority of respondents' houses were in the medium risk category (15 houses (50.0%)). Eight houses (26.7%) were in the low risk category, and seven houses

(23.3%) were in the high risk category. The most commonly identified potential hazards were slippery bathroom floors (18 houses (60.0%), inadequate lighting (14 houses (46.7%), lack of handrails in bathrooms or stairs (12 houses). (40.0%), electrical cables crossing footpaths (8 houses (26.7%), and furniture layout that hinders the mobility of the elderly (7 houses (23.3%).

Table 4. Distribution Table of Home Environmental Hazard Levels

Risk Level	n	%
Low	8	26.7
Medium	15	50.0
High	7	23.3
Total	30	100

### The relationship between Independence Level and Home Environmental Risk Level

Based on the Spearman Rank Test, the p-value was 0.004 ( $p < 0.05$ ) with a correlation coefficient (r) of -0.512. These results indicate a significant relationship between the elderly's independence level and the level of home environmental risk. The negative correlation coefficient indicates that the higher the elderly's independence level, the lower the level of home environmental risk they face.

Table 6. Relationship between Level of Independence and Level of Danger in the Home Environment

Variabel	r	p-Value
Level of Independence (Barthel) with Level of Danger of Home Environment	-0.512	0.004

Description: Spearman Rank Test,  $\alpha = 0.05$ .

### The relationship between nutritional status and home environmental risk levels

Based on the Spearman Rank test showed a p-value of 0.028 ( $p < 0.05$ ) with a correlation coefficient (r) of -0.401. These results indicate a significant relationship between nutritional status and the level of home environmental risk. Elderly people with better nutritional status tend to have better physical ability to perform activities and adapt to home environmental conditions, potentially facing lower risks than elderly people with poor nutritional status.

Table 7. Relationship between Nutritional Status and the Level of risk in the Home Environment

Variabel	r	p-Value
Nutritional Status (BMI) with Home Environmental Hazard Level	-0.401	0.028

Description: Spearman Rank Test,  $\alpha = 0.05$ .

## DISCUSSION

### Home Environmental Hazard Levels

During the aging process, the elderly experience a decline in physical function such as reduced muscle strength, body balance, reflexes, and visual acuity. This condition makes the elderly more vulnerable to various hazards in the home environment compared to productive age groups. Based on the results of hazard identification using the Hazard Identification, Risk

Assessment and Risk Control (HIRARC) method, it shows that most elderly homes are in the medium risk category with the most common potential hazards found including slippery bathroom floors, inadequate lighting, and the lack of handrails in the bathroom area and stairs. These findings indicate that the home environment still has various conditions that have the potential to cause injury to the elderly, especially when carrying out daily activities that involve mobility and changing body positions. The findings of this study align with those of Mackenzie et al. (2000) showed that various home environmental conditions, such as slippery floors, obstacles on walking paths, and the lack of handrails, are factors that contribute to the increased risk of injury in the elderly. Research by Ziebart et al. (2021) also found that most elderly homes still have various potential hazards that have not been identified or optimally controlled. These results indicate that modifying the home environment is an important strategy for preventing injuries in the elderly. Hazards that might be considered minor to adults, such as wet floors or poor lighting, can be triggers for injuries in the elderly. Therefore, a safe home environment is an important factor in supporting the quality of life and independence of the elderly.

The application of the HIRARC method in this study provides a more systematic overview of potential hazards in the home environment. Through the hazard identification and risk assessment process, various conditions that have the potential to cause injury can be identified early, allowing for appropriate control measures. This approach aligns with occupational safety and health (OHS) principles, which emphasize the importance of controlling risks before accidents or injuries occur

### **Relationship between Independence Level and Home Environmental Danger Level**

The analysis results show a significant relationship between the level of independence of the elderly and the level of danger in the home environment. Elderly people with higher levels of independence tend to live in homes with lower levels of risk than elderly people with moderate to severe dependency. These findings show that the ability of the elderly to carry out daily activities is related to the safety conditions of their residential environment.

A good level of independence allows the elderly to mobilize more safely, be able to adapt to environmental conditions, and be able to recognize various potential hazards that can cause injury. Conversely, elderly with limitations in daily activities tend to be more vulnerable to hazards in their home environment due to their limited ability to avoid or cope with risky situations. The results of the study show that limitations in daily living activities (ADL) play an important role in increasing the vulnerability of the elderly to falls and injuries in their living environment. An unsafe home environment can exacerbate the impact of functional limitations, increasing the risk of accidents in elderly.

These findings align with those of Das Gupta et al. (2024) stated that unsafe home environmental conditions are associated with an increased incidence of falls in the elderly, and this relationship is partly mediated by limitations in daily activities (ADL/IADL). In other words, elderly people who have lower functional abilities tend to be more vulnerable to the negative impacts of various hazards in the home environment. In addition to individual factors, the characteristics of the home environment also play a role in maintaining the independence of elderly. Research conducted by Lee (2021) showed that exposure to environmental hazards

in the home is associated with an increased risk of falls in community-dwelling elderly. Hazards such as slippery floors, inadequate lighting, obstructions in walkways, and the lack of handrails can reduce the ability of elderly to safely perform daily activities.

These research findings are further supported by a systematic review by Kim et al. (2023), who concluded that the home environment is an important factor in preventing injuries and maintaining the functional abilities of elderly community-dwelling. A safe home environment allows elderly to perform activities independently, while an environment with numerous hazards can accelerate functional decline and dependence. Therefore, efforts to prevent injuries in the elderly need to be carried out not only through modifying the home environment, but also through interventions aimed at maintaining the functional abilities and independence of the elderly (Mahoney & Barthel, 1965, In Rani *et al.*, 2025).

The study results showed a significant relationship between nutritional status and the level of hazards in the home environment. Elderly individuals with normal nutritional status tended to have lower levels of home environmental risks than those with malnutrition or obesity. This finding suggests that nutritional status also plays an important role in supporting the physical ability of elderly to perform activities and adapt to their living environment. Good nutritional status contributes to maintaining physical function, balance, and mobility, necessary for safely performing daily activities (Dent et al., 2021).

### **The Relationship Between Nutritional Status and the Level of Hazard in the Home Environment**

This finding aligns with the findings of Wang et al. (2022) which showed that poor nutritional status is associated with decreased functional ability and increased risk of falls in the elderly. Another study by Yeung et al. (2023) also found that malnutrition and the risk of malnutrition are associated with decreased physical performance, impaired balance, and increased dependence in daily activities. This condition makes it more difficult for the elderly to adapt to various potential dangers in the home environment. This finding is reinforced by the recent findings of Wang et al. (2024) which showed that sarcopenia and suboptimal nutritional status are factors that contribute to the increased incidence of falls in elderly people living in the community. Decreased muscle strength and mobility make the elderly more susceptible to injury when faced with various environmental hazards such as slippery floors, stairs without handrails, or inadequate lighting. Poor nutritional status can lead to decreased muscle mass and strength, reduced balance, and increased fatigue during daily activities. These conditions can increase the elderly's vulnerability to various hazards in the home environment. Conversely, being overweight and obese can also impair physical function by increasing the load on the musculoskeletal system, reducing mobility, and limiting mobility, potentially increasing the risk of injury if the elderly are exposed to unsafe environmental conditions (Cruz-Jentoft & Sayer, 2023).

The results of this study also support the concept of healthy aging developed by the World Health Organization (WHO), which places intrinsic capacity and functional ability as the main components in maintaining the quality of life of the elderly. Good nutritional status plays an important role in maintaining muscle strength, balance, and mobility, enabling elderly to perform activities more safely and independently (WHO, 2022). Therefore, efforts to

improve the safety of elderly should not only be carried out through improving the home environment and controlling hazards using the HIRARC approach, but also through ongoing nutritional monitoring and interventions to maintain functional capacity.

## CONCLUSION

Based on the research results, it shows that most elderly people have normal nutritional status, an independent level of independence, and live in a home environment with a moderate level of hazard risk based on the Hazard Identification, Risk Assessment and Risk Control (HIRARC) method. The most frequently encountered hazards include slippery bathroom floors, inadequate lighting, and the lack of handrails in risky areas. The analysis shows a significant relationship between the level of independence and nutritional status and the level of hazards in the home environment, where elderly people who are more independent and have better nutritional status tend to live in a home environment with a lower risk level. These findings indicate that the safety of the elderly is not only influenced by physical environmental conditions, but also by individual factors related to functional ability and nutritional status. Therefore, efforts to prevent injuries in the elderly need to be carried out comprehensively through controlling home environmental hazards, increasing independence, and maintaining optimal nutritional status to support the creation of a safe, healthy, and elderly-friendly home environment.

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## CONFLICTS OF INTEREST

There were no obstacles in implementing the research

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## THE ASSOCIATION BETWEEN LEVEL OF KNOWLEDGE AND CONSUMPTION OF IFA SUPPLEMENTATION IN ADOLESCENT GIRLS: A CASE STUDY IN SIDOARJO REGENCY

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### ABSTRACT

**Background:** Anemia in adolescent girls remains a significant health problem, primarily due to iron deficiency. One preventative measure is the administration of Iron Folic Acid supplements. However, compliance with Iron Folic Acid supplements among adolescent girls remains suboptimal. Knowledge is suspected to be a factor influencing consumption behavior.

**Purpose:** This study aims to determine the association between the level of knowledge about iron supplements and the consumption of iron supplements in adolescent girls.

**Methods:** This research method used a quantitative design with a cross-sectional approach. The population are adolescent girls in Sidoarjo. A sample of 106 respondents was drawn using a probability sampling technique with a multistage sampling method. Data were collected using a questionnaire and analyzed using the Chi-Square test with a significance level of 0.05.

**Results:** The results showed that most respondents had a good level of knowledge (41.5%) and were compliant in taking IFA supplementation (54.7%). The Chi-square test showed a p-value of  $<0.01$  ( $<\alpha=0.05$ ), indicating a significant association between knowledge level and Iron Folic Acid supplementation.

**Conclusion:** This study concluded that there was an associate between knowledge and Iron Folic Acid supplementation among adolescent girls in Sidoarjo Regency. Increasing knowledge can be an important strategy for improving adherence to Iron Folic Acid supplementation.

**Keywords:** Adolescent Girls, Anemia, Iron Deficiency, Knowledge, Non-Communicable Disease

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## BACKGROUND

Globally, anemia in adolescent girls remains a major public health concern. Recent reports indicate that the prevalence of anemia among women of reproductive age remains high and tends to stagnate in many developing countries (WHO, 2021). Indonesia, a developing country with a relatively high prevalence of anemia among adolescent girls, is a health problem that requires serious attention (Ministry of Health of the Republic of Indonesia, 2018; Ministry of Health of the Republic of Indonesia, 2023). The impact of anemia is not limited to physical conditions such as fatigue and decreased immunity, but also affects concentration, academic achievement, and productivity in adolescents.

Anemia remains a global public health problem faced by all countries. The global prevalence of anemia is 30.5% among women aged 15-49 years worldwide (World Health Organization, 2025). Meanwhile, in Indonesia, the prevalence of anemia among adolescent girls is 15.5% (Kementerian Kesehatan Republik Indonesia, 2023). Anemia is a condition where hemoglobin levels in the blood are below normal, generally caused by iron deficiency (Turner, Parsi, and Badireddy, 2023). Adolescent girls are a vulnerable group due to their monthly menstruation, which causes regular iron loss, and increased iron needs during growth. (WHO, 2021)

As an effort to prevent anemia, the government has implemented a program to routinely provide Iron Folic Acid (IFA) supplementation to adolescent girls. This program aims to meet iron needs and prevent anemia from an early age. IFA supplementation has been proven effective in increasing hemoglobin levels and reducing the risk of anemia when consumed regularly (Pasricha et al., 2014; De-Regil et al., 2011).

However, the implementation of IFA supplementation programs still faces various obstacles, particularly related to low consumption rates among adolescent girls. This is despite optimal IFA supplement distribution. This suggests that factors influence IFA supplement consumption behavior, one of which is knowledge level (Woldeyohannes et al., 2019).

Knowledge is a predisposing factor that plays a role in shaping individual health behaviors (Dewanti et al., 2024). Adolescents with a good level of knowledge about iron supplements tend to have a higher level of awareness about regularly consuming IFA supplementation. Conversely, a lack of knowledge can lead to misunderstandings regarding the benefits and side effects of IFA supplementation, which can lead to decreased compliance (Angraini and Sari, 2022; Rahmawati & Utami, 2021). Furthermore, several studies have shown that knowledge is significantly related to IFA supplement consumption among adolescent girls (Putri and Lestari, 2023). This suggests that increasing knowledge can be an effective strategy in increasing the success of anemia prevention programs.

Based on this description, it can be concluded that anemia in adolescent girls remains a health problem that requires serious attention. Although IFA supplementation programs have been implemented, their success is significantly influenced by behavioral factors, particularly knowledge levels. Therefore, research is crucial to examine the association between knowledge levels about IFA supplementation consumption and IFA supplementation consumption among adolescent girls.

## **OBJECTIVE**

The aim of this study is that the researcher wants to know the association between the level of knowledge about IFA supplements and the consumption of IFA supplements among adolescent girls in the Sidoarjo.

## **METHODS**

### **Research Design**

This study is a quantitative, observational analytical design using a cross-sectional approach. The independent variable is knowledge level about IFA **supplementation** and the dependent variable is consumption of IFA **supplementation** were measured simultaneously.

### **Research Location and Time**

The research was conducted in Sidoarjo Regency from October to December 2025.

### **Population and Sample**

The population in this study was all adolescent girls in Sidoarjo Regency. Samples of this study are each adolescent girls who met the inclusion criteria. The sample size of 106 respondents was determined using a probability sampling technique with a multistage sampling method (Cluster Sampling and Simple Random Sampling). The sampling steps consist of sample size calculation, calculation of the average of adolescent girls in each villages, randomize the number of villages in Sidoarjo to meet the minimum sample size, and samples were taken at each integrated service post (posyandu) for adolescents using simple random sampling.

The sample size was calculated using the Lemeshow formula with a 95% confidence level ( $Z=1.96$ ), a proportion of 0.5, and a precision of 10%. This resulted in a minimum sample size of 96 respondents. An additional 10% was added to account for dropouts, resulting in a total sample size of 106 respondents.

### **Sample Criteria**

Inclusion criteria included adolescent girls aged 12-18, do not have congenital diseases related to iron deficiency, residing in the Sidoarjo, willing to participate, and completing the questionnaire completely. Exclusion criteria included respondents who did not complete the questionnaire completely or were currently ill.

### **Research Variables**

The independent variable was the level of knowledge about IFA supplements, while the dependent variable was IFA supplement consumption.

### **Research Instrument**

The instrument used was a structured questionnaire consisting of knowledge and IFA supplement consumption. This questionnaire was compiled using references obtained. The questionnaire did not use a standard from any source. Knowledge was measured using the

Gutman scale (True = 1, False = 0) and categorized as good, sufficient, and poor. IFA supplement consumption was categorized as compliant and non-compliant.

### Validity and Reliability

Validity testing was conducted using Product Moment correlation, and reliability testing using Cronbach's Alpha with a value of  $\geq 0.70$ .

### Data Collection Procedure

Data collection was conducted after obtaining permission from the relevant agencies. Respondents were explained the research objectives and signed informed consent. Next, respondents completed the questionnaire independently, and the researcher checked the data for completeness.

### Data Analysis

Data analysis was conducted using univariate and bivariate methods. Univariate analysis was used to describe the frequency distribution of variables. Bivariate analysis used the Chi-Square test with a significance level of 0.05 (95% CI).

### Research Ethics

This research has obtained ethical approval. Respondents' identities were kept confidential, and all respondents provided informed consent.

## RESULTS

Table 1. Level of Knowledge about IFA Supplements

Knowledge's Categories	n	%
Good	44	41.5
Enough	36	34.0
Lack	26	24.5

Based on Table 1, half of respondents had a good level of knowledge (44 respondents (41.5%).

Table 2. Consumption of IFA Supplementation

IFA Consumption	n	%
Obedient	58	54.7
Diobedient	48	45.3

Based on table 2, most of the respondents classified as comply with taking IFA supplementation that is as many as 58 respondents (54.7%)

Table 3. Association between Knowledge Level and Consumption of IFA Supplementation

Knowledge	Consumption of IFA Supplementation		p-value of Chi Square Test
	Obedient (%)	Diobedient (%)	
Good	36 (81.8%)	8 (18.2%)	<0.01*

Enough	18 (50.0%)	18 (50.0%)
Not enough	4 (15.4%)	22 (84.6%)

\*lower than  $\alpha(0.05)$

The Chi-square test results showed a p-value of  $<0.01$  ( $<\alpha$  (0.05)), indicating a significant association between knowledge level and IFA supplement consumption among adolescent girls.

## DISCUSSION

Bivariate analysis results showed a significant association between knowledge level and IFA supplementation consumption. Respondents with a good level of knowledge tended to be more compliant with IFA supplementation compared to those with moderate and poor knowledge. This suggests that knowledge plays a significant role in shaping individual health behaviors.

Theoretically, knowledge is a predisposing factor that can influence a person's behavior. Individuals with good knowledge will more easily understand the benefits of a health intervention and are therefore more likely to implement it. Conversely, a lack of knowledge can lead to misunderstandings and negative perceptions of a health intervention, including IFA supplementation (Usman, Maria, and Widiatrilupi, 2025).

The results of the study showed that most respondents had a good level of knowledge about IFA supplementation. In addition to good knowledge, there was also variation between levels of adequate and inadequate knowledge. This variation reflects differences in access to information, understanding, and individual experiences regarding the importance of IFA supplementation in preventing anemia. Respondents with a good level of knowledge generally understood the function of IFA supplementation as a source of iron, which plays a role in hemoglobin formation. Theoretically, according to Seokidjo Notoatmodjo (2014), knowledge is a cognitive domain that forms the basis for a person's actions.

These study results align with research by Angraini and Sari (2022), which demonstrated a association between knowledge level and IFA supplementation compliance. Research by Putri and Lestari (2023) also stated that knowledge is a crucial factor influencing IFA supplementation behavior in adolescent girls.

Individuals with good knowledge tend to have more positive health awareness and behaviors, including adherence to iron supplementation. Respondents with adequate knowledge generally understood the general benefits of iron supplements but did not yet have a comprehensive understanding of the dosage, frequency of consumption, and long-term impacts of anemia. According to health promotion and health behavior, incomplete knowledge will affect an individual's ability to make appropriate health decisions. This indicates that the education provided is not optimal and still needs to be improved in terms of both quality and frequency. Meanwhile, respondents with inadequate knowledge tended to have erroneous or limited understanding of iron supplements, such as the assumption that iron supplements are only necessary when sick or fear of side effects. This condition can impact low iron supplement consumption. This difference in knowledge levels can be explained by Lawrence Green's

health behavior theory, which states that knowledge is a predisposing factor in shaping health behavior (Huong et al., 2022).

Most respondents in this study were considered compliant with iron supplementation. However, a significant proportion of respondents were non-compliant, indicating that iron supplementation compliance is suboptimal. IFA supplementation is a key intervention in the prevention and management of anemia, particularly iron deficiency anemia, which remains a global public health problem. Iron supplements generally contain iron (Fe) and folic acid, which play a crucial role in the formation of hemoglobin and red blood cells. Physiologically, iron is needed for the synthesis of hemoglobin, a protein in erythrocytes responsible for transporting oxygen throughout the body. Iron deficiency inhibits erythropoiesis, leading to anemia (Hall & Guyton, 2021). A study by Nuryanto et al. (2021) showed that adolescent girls who regularly consumed iron supplementation experienced significant increases in hemoglobin levels compared to those who were non-compliant.

However, in practice, iron supplementation remains a challenge. Several factors influence compliance, including knowledge, attitudes, family support, side effects, and perceptions of the benefits of iron supplementation. Side effects such as nausea, constipation, and stomach discomfort are often the main reasons for non-compliance (Gibson, 2005). Therefore, appropriate health education is essential to increase adolescents' understanding and awareness of the importance of iron supplementation. Behavioral factors also play a crucial role in the success of IFA supplementation programs. According to Lawrence Green's health behavior theory, health behavior is influenced by predisposing factors (knowledge and attitudes), supporting factors (availability of facilities), and reinforcing factors (social support). These three factors must be considered for optimal intervention (Hidayanty et al., 2025).

Thus, these study results confirm that increasing knowledge is a crucial strategy for improving IFA supplementation. Therefore, ongoing health education efforts across various sectors are needed to increase adolescent girls' understanding of the importance of IFA supplementation. Limitations of this study is that it was conducted only in Sidoarjo Regency and involved only one independent variable. Further research is recommended to add variations to this independent variable and expand the scope of the study.

## **CONCLUSION**

This study shows that the majority of adolescent girls have a good level of knowledge about IFA supplementation and generally compliant with their IFA supplementation. This study concluded that knowledge and IFA supplementation among adolescent girls in Sidoarjo Regency was associated. Therefore, better of adolescent girl's knowledge in line with the higher IFA supplementation. Improving knowledge can be an important strategy for increasing IFA supplementation as a preventative measure for anemia in adolescent girls.

## **ACKNOWLEDGMENTS**

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## CONFLICTS OF INTEREST

The authors declare there was no conflict of interest in this study.

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## THE EFFECT OF *MINDFULNESS* INTERVENTION ON *BURNOUT* IN NURSES

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### ABSTRACT

**Background:** Burnout among nurses is a major issue caused by high workloads, emotional demands, and limited hospital resources, including at Bhakti Rahayu Tabanan Hospital. Burnout is characterized by emotional exhaustion, depersonalization, and decreased personal accomplishment, affecting the quality of nursing care. Previous studies have shown that mindfulness interventions can reduce stress and burnout in healthcare workers by helping individuals recognize and accept present experiences without judgment.

**Purpose:** This study aimed to analyze the effect of mindfulness interventions on nurse burnout levels at Bhakti Rahayu Tabanan Hospital.

**Methods:** This study used a quasi-experimental design with intervention and control groups. Burnout levels were measured using the Maslach Burnout Inventory before and after the intervention. The mindfulness program was conducted for four weeks through structured sessions focusing on breathing awareness, bodily sensations, emotional acceptance, and independent practice at home.

**Results:** Mann-Whitney test results showed significant differences between intervention and control groups in emotional exhaustion ( $p=0.011$ ), depersonalization ( $p=0.005$ ), and decreased achievement ( $p=0.018$ ). Wilcoxon test results also showed significant changes before and after intervention in emotional exhaustion ( $p=0.000$ ), depersonalization ( $p=0.044$ ), and self-achievement ( $p=0.005$ ), indicating that mindfulness interventions reduced nurse burnout.

**Conclusion:** Mindfulness interventions effectively reduced burnout levels, improved emotional regulation, increased self-awareness, and enhanced nurses' sense of accomplishment in the workplace. These findings suggest that mindfulness can become a strategy for hospitals to support nurses' mental health, strengthen coping abilities, maintain patient care quality, and create healthier work environments. Regular mindfulness practice may also improve performance and well-being among nurses.

**Keywords:** Burnout; Mindfulness; Nurses.

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## BACKGROUND

A hospital is a type of healthcare facility that provides healthcare services. Nurses carry out responsibilities related to the survival of their patients. Furthermore, they must also maintain their emotional well-being. This can lead to stress and increase the risk of *burnout*. (Marpaung, 2021)

Research conducted by (Sultana et al., 2020), *burnout* is a major problem for healthcare workers, because nurses frequently interact with patients, so nurses are at greater risk of infection and face greater physical and mental burdens (Guixia, L., & Hui, 2020).

A study conducted by a research team from the Master of Occupational Medicine Study Program, Faculty of Medicine, University of Indonesia (MKK FKUI) found that as many as 83% of healthcare workers in Indonesia have experienced moderate to severe *burnout*, which has the potential to psychologically disrupt their quality of life and work productivity in healthcare. (FKUI Public Relations, 2020). A study conducted by (Wood et al., 2023) found that nurse *burnout* can lead to poor service delivery. There is a correlation between *burnout* and the quality of care provided to patients (Smythe et al., 2020).

The causes of burnout can be classified into personal and/or environmental factors (Yeter DEMİR, 2010). In addition to these factors, there are several other factors that cause *burnout*, namely marital status, length of employment, social support, family structure, responsibility, clarity of emotional stability, and exhaustion (Nursalam, 2016). According to Maslach, *burnout* is characterized by three dimensions, namely emotional exhaustion, depersonalization, and decreased self-efficacy.

A nurse needs proper self-management to deal with the emotions caused by *burnout*. Nurses need to practice meditation to improve moral, emotional, and interpersonal processes, thereby restoring empathy when caring for patients. One form of meditation that nurses can practice is *mindfulness*. *Mindfulness* is a form of self-regulation strategy that involves focusing attention and responding to thoughts, sensations, and emotions with an attitude of acceptance, non-judgment, and awareness of current situations and events. (Azzam et al., 2023).

One systematic review of ICU nurses concluded that *mindfulness interventions*, including meditation exercises, breathing techniques, and cognitive relaxation, can reduce *burnout* when implemented in a structured manner over several weeks. Similar results were found in healthcare workers across various settings, where 6–8 weeks of *mindfulness programs* correlated with significant reductions in stress, anxiety, and *burnout*. Despite growing evidence of effectiveness, specific data on the implementation of *mindfulness interventions*

among nurses in private hospitals in Indonesia, particularly at Bhakti Rahayu Hospital in Tabanan, remains limited.

Bhakti Rahayu Hospital, Tabanan, as a referral healthcare facility in the Tabanan region, requires nurses to provide prompt and high-quality services, potentially increasing work pressure. This situation, if not balanced with adequate stress management strategies, can increase the risk of *burnout*, which ultimately affects the quality of care and nurses' work comfort. Given the scientific evidence that mindfulness programs can be a relatively simple, inexpensive form of psychological intervention that can be integrated into human resource development programs, research is important to examine the extent to which mindfulness interventions affect nurse *burnout levels* at Bhakti Rahayu Hospital, Tabanan.

## **OBJECTIVE**

This study aims to analyzing the effect of providing *mindfulness interventions* on *burnout* levels in nurses

## **METHODS**

### **Research design**

This study used a *quasi-experimental design with an intervention group and a control group, with pre -test–posttest -measurements with control group*. The intervention group received a structured *mindfulness program, while the control group received routine services without mindfulness* intervention during the study period.

### **Location and Time of Research**

This research was conducted at Bhakti Rahayu Tabanan Hospital. The research implementation time is planned for March-April 2026, including the preparation, data collection, analysis, and report preparation stages.

### **Population**

The population in this study was all inpatient nurses working at Bhakti Rahayu Tabanan Hospital.

### **Sample**

Samples will be taken using *non- -probability techniques. (consecutive sampling)* with inclusion criteria: implementing nurses who have worked for at least six months, are willing to follow the entire series of interventions, and are not currently undergoing another intensive

psychotherapy program. Exclusion criteria: nurses on maternity leave, and nurses who are carrying out study assignments. Based on the inclusion and exclusion criteria determined by the researcher, the sample size in this study was 26 respondents (2 people in the isolation room, 8 people in the rose room, 8 people in the jasmine room, 4 people in the PICU and lotus rooms, and 4 people in the ICU room) which were divided into 13 respondents in the treatment group and 13 respondents in the control group.

## RESULTS

**Table 1. Mann-Whitney test**

### Post test KE

Ranks				
	Group	N	Mean Rank	Sum of Ranks
Post_Emoional Exhaustion	Intervention	13	9.69	126.00
	Control	13	17.31	225.00
	Total	26		

### Test Statistics <sup>a</sup>

Post_Emoional Exhaustion	
Mann-Whitney University	35,000
Wilcoxon W	126,000
Z	-2,542
Asymp. Sig. (2-tailed)	.011
Exact Sig. [2*(1-tailed Sig.)]	.010 <sup>b</sup>

a. Grouping Variable: Group

b. Not corrected for ties.

- **Mann-Whitney Objective: To compare total burnout scores (EE, DP, PA) between the intervention and control groups AFTER treatment (post-test).**

Interpretation: From the results of the Mann-Whitney test conducted on the results of the post-test on emotional exhaustion between the control and intervention groups, a significance value of  $0.011 < 0.05$  was obtained, which means that **there is a significant difference between the intervention group and the control group.**

**Post Test DP**

**Ranks**

	Group	N	Mean Rank	Sum of Ranks
Post_Depersonalization	Intervention	13	9.27	120.50
	Control	13	17.73	230.50
	Total	26		

**Test Statistics <sup>a</sup>**

	Post_Depersonalization
Mann-Whitney University	29,500
Wilcoxon W	120,500
Z	-2,830
Asymp. Sig. (2-tailed)	.005
Exact Sig. [2*(1-tailed Sig.)]	.003 <sup>b</sup>

**a. Grouping Variable: Group**

**b. Not corrected for ties.**

Interpretation: From the results of the Mann-Whitney test conducted on the results of the Depersonalization post-test between the control and intervention groups, a significance value of  $0.005 < 0.05$  was obtained, which means that **there is a significant difference between the intervention group and the control group.**

**Post-test PP**

**Ranks**

	Group	N	Mean Rank	Sum of Ranks
Post_Self Achievement	Intervention	13	17.04	221.50
	Control	13	9.96	129.50
	Total	26		

**Test Statistics <sup>a</sup>**

	Post_Self Achievement
--	-----------------------

<b>Mann-Whitney University</b>	<b>38,500</b>
<b>Wilcoxon W</b>	<b>129,500</b>
<b>Z</b>	<b>-2,375</b>
<b>Asymp. Sig. (2-tailed)</b>	<b>.018</b>
<b>Exact Sig. [2*(1-tailed Sig.)]</b>	<b>.016<sup>b</sup></b>

**a. Grouping Variable: Group**

**b. Not corrected for ties.**

Interpretation: From the results of the Mann-Whitney test conducted on the results of the post-test for the decline in achievement between the control and intervention groups, a significance value of  $0.018 < 0.05$  was obtained, which means that **there is a significant difference between the intervention and control groups**.

**Table 2. Wilcoxon Test**

**Pre-Post KE**

**Ranks**

	<b>N</b>	<b>Mean Rank</b>	<b>Sum of Ranks</b>
<b>Negative Ranks</b>	<b>20<sup>a</sup></b>	<b>15.68</b>	<b>313.50</b>
<b>Post_Emo Emotional Exhaustion Positive Ranks</b>	<b>6<sup>b</sup></b>	<b>6.25</b>	<b>37.50</b>
<b>Pre_Emo Emotional Exhaustion Ties</b>	<b>0<sup>c</sup></b>		
<b>Total</b>	<b>26</b>		

**a. Post\_Emo Emotional Exhaustion < Pre\_Emo Emotional Exhaustion**

**b. Post\_Emo Emotional Exhaustion > Pre\_Emo Emotional Exhaustion**

**c. Post\_Emo Emotional Exhaustion = Pre\_Emo Emotional Exhaustion**

**Test Statistics<sup>a</sup>**

	<b>Post_Emo Emotional Exhaustion - Pre_Emo Emotional Exhaustion</b>
<b>Z</b>	<b>-3.507<sup>b</sup></b>
<b>Asymp. Sig. (2-tailed)</b>	<b>.000</b>

**a. Wilcoxon Signed Ranks Test**

**b. Based on positive ranks.**

Wilcoxon Objective: To compare *burnout scores* before and after intervention in the intervention group (pre vs post).

**Interpretation:** From the results of the Wilcoxon test conducted on the comparison of the results of the Pre vs Post test of the emotional exhaustion sample, a significance value of  $0.000 < 0.05$  was obtained, which means that **there was a significant change between the intervention group and the control group**, which means that the mindfulness intervention for nurses had an impact on reducing the emotional exhaustion of nurses

**Pre-Post DP**

**Ranks**

		N	Mean Rank	Sum of Ranks
Post_Depersonalization	Negative Ranks	16 <sup>a</sup>	15.91	254.50
	-Positive Ranks	10 <sup>b</sup>	9.65	96.50
Pre_Depersonalization	Ties	0 <sup>c</sup>		
	Total	26		

a. Post\_Depersonalization < Pre\_Depersonalization

b. Post\_Depersonalization > Pre\_Depersonalization

c. Post\_Depersonalization = Pre\_Depersonalization

**Test Statistics<sup>a</sup>**

	Post_Depersonalization - Pre_Depersonalization
Z	-2.016 <sup>b</sup>
Asymp. Sig. (2-tailed)	.044

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

**Interpretation:** From the results of the Wilcoxon test conducted on the comparison of the results of the Pre vs Post test of the Depersonalization sample, a significance value of  $0.044 < 0.05$  was obtained, which means that **there was a significant change between the**

**intervention group and the control group**, which means that the mindfulness intervention for nurses had an impact on reducing the attitude of depersonalization in nurses.

### Pre-Post PP

#### Ranks

		N	Mean Rank	Sum of Ranks
	Negative Ranks	9 <sup>a</sup>	7.28	65.50
Post_Self_Achievement	-Positive Ranks	17 <sup>b</sup>	16.79	285.50
Pre_Self_Achievement	Ties	0 <sup>c</sup>		
	Total	26		

a. Post\_Self-Achievement < Pre\_Self-Achievement

b. Post\_Self\_Achievement > Pre\_Self\_Achievement

c. Post\_Self\_Achievement = Pre\_Self\_Achievement

#### Test Statistics<sup>a</sup>

	Post_Self_Achievement
	-
	Pre_Self_Achievement
Z	-2.802 <sup>b</sup>
Asymp. Sig. (2-tailed)	.005

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

**Interpretation:** From the results of the Wilcoxon test conducted on the comparison of the results of the Pre vs Post test of the Self-Achievement sample, a significance value of  $0.005 < 0.05$  was obtained, which means that **there was a significant change between the intervention group and the control group**, which means that the mindfulness intervention for nurses had an impact on increasing the self-achievement of each nurse.

## DISCUSSION

The results showed a significant effect of mindfulness intervention on the three dimensions of burnout in nurses at Bhakti Rahayu Tabanan Hospital, with a Wilcoxon

significance value of  $<0.05$  in the pretest-posttest of the intervention group and a Mann-Whitney significance value of  $<0.05$  between the intervention and control groups. The 4-week mindfulness intervention (60 minutes/session, including body scan, meditation, and yoga) reduced emotional exhaustion ( $p=0.000$ ), depersonalization ( $p=0.044$ ), and increased personal accomplishment ( $p=0.005$ ). These findings align with recent studies that confirm *mindfulness* as an effective strategy for managing *burnout* in healthcare workers.

### ***The effect of mindfulness on the dimension of emotional exhaustion***

The mindfulness intervention significantly reduced emotional exhaustion scores in the intervention group (Wilcoxon  $p=0.000$ ; Mann-Whitney posttest  $p=0.011$ ), from moderate/low to low. This is because mindfulness increases self-awareness and emotional regulation, enabling nurses to recognize and reduce emotional exhaustion due to high workloads at Bhakti Rahayu Hospital, Tabanan.

These findings are supported by a 2026 review that concluded mindfulness programs (such as MBSR) were effective in reducing *emotional exhaustion* in healthcare students and service workers, through reduced stress reactivity. A 2025 study of nurses also showed a decrease in *emotional exhaustion scores* after a *mindfulness intervention*, similar to the results in this report (Lutfiana Putri Febriyanti, Prita Adisty Handayani, Siti Juwariyah, 2025).

### ***The effect of mindfulness on the depersonalization dimension***

Mindfulness significantly reduced depersonalization (Wilcoxon  $p=0.044$ ; Mann-Whitney posttest  $p=0.005$ ), shifting cynical attitudes and emotional distance toward greater empathy toward patients. This mechanism occurs because mindful practices (body scans and breath meditation) break the cycle of negative rumination, allowing nurses to maintain interpersonal connections amidst the demands of the hospital.

A 2024 study of service workers found that job mindfulness reduced depersonalization through the mediation of psychological distress, consistent with the intervention's effects in this study. A 2025 review confirmed mindfulness as an emotion regulation strategy that suppresses coldness and cynicism in high-stress populations. (Periana et al., 2025)

### ***The influence of mindfulness on the diminished dimension of personal accomplishment***

The intervention resulted in an increase in personal accomplishment (Wilcoxon  $p=0.005$ ; Mann-Whitney posttest  $p=0.018$ ), from low/moderate to high, increasing nurses' self-

confidence and sense of accomplishment. Mindfulness yoga and daily self-practice strengthened self-efficacy, offsetting feelings of helplessness resulting from chronic emotional burden.

A 2026 study reported that mindfulness improved self-accomplishment in a group at risk for burnout through increased self-compassion. A 2024 study also demonstrated an indirect effect of mindfulness on accomplishment through reduced workplace bullying, relevant to the context of a private hospital. (Setiawan et al., 2026)

### ***The effect of mindfulness on burnout in nurses***

The phenomenon of *burnout* among nurses is a condition in which a person experiences physical, mental, and emotional symptoms caused by persistently high levels of stress (Febriyanti et al., 2025) . Theoretically, *burnout* is understood as a psychological syndrome consisting of three main dimensions: emotional exhaustion, depersonalization, and a decreased sense of personal accomplishment (Sulistianingsih et al., 2025) . This condition often occurs because nurses must always provide comprehensive services to patients and their families in a complex work environment (Sukmayanti, 2023) .

As a countermeasure, research evidence shows that *mindfulness interventions* are very effective in reducing *burnout levels*. (Uminah et al., 2025) . *Mindfulness* itself is a form of self-regulation strategy that involves focusing attention and responding to emotions with an attitude of acceptance without judgment (Sukmayanti et al., 2024) . Based on empirical data at PMC Hospital, the application of *mindfulness* meditation techniques was able to reduce the rate of emotional exhaustion from 70% to 0% and depersonalization from 40% to 0% in nurses who were given treatment (Ezdha et al., 2024) .

The most common and proven effective method is *Mindfulness-Based Stress Reduction* (MBSR), which works by increasing an individual's full awareness of the current situation (Rizkana, 2023) . In addition to reducing negative aspects such as stress, this intervention also significantly improves *self-compassion* and workplace *well-being scores* for nurses (Othman et al., 2023) . This is important because individuals with good emotional intelligence tend to be better able to manage anxiety and avoid the risk of severe *burnout* (Sukmayanti, 2023) .

Based on these findings, researchers strongly believe that nurses need proper self-management to cope with emotions caused by heavy workloads (Sukmayanti et al., 2024) . Given its effectiveness, it is highly recommended for healthcare institutions to implement

*mindfulness interventions* as part of staff development programs to maintain service quality and the mental well-being of healthcare workers (Uminah et al., 2025)

## CONCLUSION

Based on research results, mindfulness interventions have been shown to significantly reduce burnout levels in nurses. The application of mindfulness helps nurses increase self-awareness, manage work stress, and improve emotional regulation, thereby reducing emotional exhaustion, depersonalization, and increasing a sense of accomplishment. Therefore, mindfulness can be used as an effective intervention strategy to maintain mental health and improve nurse performance in the workplace.

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## CONFLICTS OF INTEREST

There's no problem with the research

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# THE EFFECT OF HEALTH EDUCATION USING ANIMATED VIDEO ON KNOWLEDGE OF DIABETES MELLITUS PREVENTION IN SCHOOL-AGE CHILDREN

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## ABSTRACT

**Background:** Diabetes mellitus (DM) among school-age children demonstrates a concerning upward trend in Indonesia. The limited understanding of adolescents regarding DM prevention necessitates effective educational strategies tailored to their developmental characteristics.

**Purpose:** This study aims to evaluate the effectiveness of animated video-based education on school students' knowledge of diabetes mellitus.

**Methods:** A quasi-experimental design with a pretest-posttest control group approach was employed at SMPN 10, Gorontalo City. A total of 58 students were recruited through purposive sampling (intervention group n = 29; control group n = 29). The intervention group received health education consisting of a lecture combined with a ± 15-minute animated video, while the control group received only a conventional lecture. Knowledge was assessed using a validated 15-item multiple-choice questionnaire. Data were analyzed using the Wilcoxon signed-rank test, and the Mann Whitney test.

**Results:** A statistically significant difference in knowledge gain was observed between the intervention group ( $5.10 \pm 1.398$ ) and the control group ( $0.52 \pm 0.509$ ) ( $p < 0.001$ ).

**Conclusion:** Health education delivered via animated video was more effective than conventional lectures in improving knowledge of DM prevention among school-age adolescents.

**Keywords:** Animated Video, Diabetes Mellitus, Health Education, Knowledge, School-Age Children

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## **BACKGROUND**

Diabetes mellitus is a chronic disease characterized by persistent hyperglycemia resulting from impaired insulin production, insulin resistance, or a combination of both. This condition is no longer a health concern exclusive to adults; it has increasingly become a serious threat to younger age groups, including school-age children. The Indonesian Endocrinology Association (2021) projects that the global prevalence of DM will triple by 2030, reaching 21.3 million cases, while the International Diabetes Federation (IDF, 2022) estimates that the figure will reach 16.7 million by 2045.

Indonesia currently ranks fifth worldwide in the total number of individuals living with diabetes. Data from the Indonesian Ministry of Health (2024) reveal that the incidence of Type 1 DM in children has risen dramatically, from 0.0038 per 100,000 in 2000 to 2 per 100,000 in 2023, a seventy-fold increase over two decades. At present, more than 1,400 children have been identified with Type 1 DM, with 13,311 patients younger than 20 years of age (IDF, 2022). This situation places early-onset diabetes prevention at the forefront of the national public health agenda.

At the regional level, data from the Gorontalo Provincial Health Office (2024) recorded a DM prevalence of 4% (10,735 individuals). Blood glucose screening conducted among children aged 6–17 years in Gorontalo Province in 2024 identified 62 children (0.3% of screening participants) with blood glucose levels exceeding normal reference values; an additional 6 comparable cases were identified in the first half of 2025. These findings indicate that DM among school-age children in Gorontalo is not merely a theoretical concern but a tangible and pressing public health issue requiring immediate intervention.

School-age children, particularly junior high school students, constitute a strategically important target group for health educational interventions. During this developmental period, lifestyle habits, dietary behaviors, and physical activity patterns are actively being shaped. Effective health education at this stage can establish health-promoting behaviors as a foundation for preventing chronic diseases in later life. Preventive and promotive efforts through evidence-based school education are among the most widely recommended strategies for this purpose (Marpaung et al., 2022).

A growing body of research has documented the advantages of audiovisual media over conventional educational methods. Hasanica et al. (2021) demonstrated that although leaflets and posters can improve knowledge, their effectiveness depends heavily on audience literacy levels and visual appeal. By contrast, animated video offers a multimodal approach that simultaneously engages both visual and auditory channels, thereby facilitating attention, cognitive processing, and information retention in a manner consistent with the principles of multimedia learning. Riadi et al. (2024) confirmed that a lecture combined with an animated video was statistically superior to a non-animated video in enhancing adolescents' knowledge and attitudes toward non-communicable diseases.

Against this backdrop, the present study aimed to analyze the effect of health education using animated video on adolescents' knowledge of DM prevention, while simultaneously comparing its effectiveness with that of conventional lecture. The findings are intended to

provide an empirical basis for developing more innovative, evidence-based school health promotion programs in the region.

## **OBJECTIVE**

This study aims to evaluate the effectiveness of animated video-based education on school students' knowledge of diabetes mellitus.

## **METHODS**

### ***Study Design***

This study employed a quasi-experimental design with a pretest–posttest control group approach. This design was selected to compare the effectiveness of two educational methods, animated video and conventional lecture, under conditions that simultaneously controlled for baseline characteristics through pretest measurement.

### ***Setting and Participants***

The study was conducted at SMPN 10 in Gorontalo City in January 2026. The sample size was calculated using the Slovin formula with a 10% margin of error, yielding 58 respondents. Participants were recruited through purposive sampling with proportional allocation across class levels, resulting in 29 respondents in the intervention group and 29 in the control group. Class-level matching was applied to ensure proportional balance between groups. Inclusion criteria comprised students in grades VII and VIII who were willing to participate. Exclusion criteria included students who had previously attended a formal DM educational session, students who were absent during the intervention, and students who had not obtained written parental or guardian consent. Students who did not complete the full research process were excluded from data analysis.

### ***Intervention***

The intervention group received health education consisting of a lecture combined with a ± 15-minute animated video covering the following content areas: (1) definition and classification of DM, (2) risk factors, clinical signs and symptoms, (3) complications of DM in children, and (4) steps for preventing DM through a healthy lifestyle. The control group received only a conventional lecture for an equivalent duration, without any animated video component. Both groups participated in the intervention simultaneously in separate, spatially distant rooms to prevent cross-group information contamination. Participants were not permitted to leave the room before completing the posttest, and no smartphones were allowed during the session.

### ***Instrument***

Data were collected using a sociodemographic questionnaire and a validated DM knowledge questionnaire developed by Teslatu (2022). It consisted of 15 multiple-choice items, each with three response options. Respondents were instructed to select the answer that best reflected their knowledge. The questionnaire included both positively worded (favorable) and negatively worded (unfavorable) items. Each item was scored dichotomously, with a score of 1 assigned for a correct answer and a score of 0 assigned for an incorrect answer.

## Data Analysis

Data were analyzed using SPSS version 22. Univariate analysis was conducted to describe the frequency distribution and percentage of each variable. Data normality was tested using the Shapiro–Wilk test. Within-group comparisons were performed using the Wilcoxon signed-rank test. Between-group comparison of effectiveness was assessed using an Mann Whitney test on gain scores (posttest minus pretest). A significance level of  $p < 0.05$  was adopted for all analyses.

## RESULTS

Of the 58 enrolled respondents, the age distribution showed that the majority in both groups were aged 10–13 years (79.3% intervention; 82.8% control), with the remainder aged 14–16 years (20.7% intervention; 17.2% control). In terms of sex, the intervention group comprised 51.7% males and 48.3% females, while the control group comprised 48.3% males and 51.7% females. Regarding grade level, the intervention group was predominantly drawn from Grade VII (58.6%), whereas the control group was primarily from Grade VIII (55.2%). A detailed summary is presented in Table 1.

**Table 1. Respondent Characteristics**

Characteristics	Intervention (n=29)		Control (n=29)	
	n	%	n	%
Age (years)				
10 – 13	23	79.3	24	82.8
14 – 16	6	20,7	5	17.2
Sex				
Male	15	51.7	14	48.3
Female	14	48.3	15	51.7
Grade				
VII	17	58.6	13	44.8
VIII	12	41.4	16	55.2

Table 2 shows statistically significant improvements in knowledge scores in both groups from pretest to posttest ( $p < 0.001$ ). Comparison using the Mann Whitney test revealed a statistically significant difference between the two groups, with the mean knowledge score gain markedly higher in the intervention group  $5.10 \pm 1.398$  than in the control group  $0.52 \pm 0.509$  ( $p < 0.001$ ).

**Table 2. Between-Group Differences in Knowledge Scores**

Knowledge	Intervention	Control	p-value
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Pretest	7.45 ± 1.021	7.72 ± 1.192	<0.001 <sup>a</sup>
Posttest	12.48 ± 0.911	8.48 ± 1.526	<0.001 <sup>a</sup>
Gain score (between-group comparison)	5.10 ± 1.398	0.52 ± 0.509	<0.001 <sup>b</sup>

<sup>a</sup>Wilcoxon signed-rank test; <sup>b</sup>Mann Whitney test

## DISCUSSION

### *Effect of Animated Video–Based Health Education on Knowledge of Diabetes Mellitus Prevention*

The findings of this study indicate that health education delivered through animated video significantly improves students' knowledge of diabetes mellitus (DM) prevention, as evidenced by the increase in the mean knowledge score from 7.45 to 12.48. This effect may be explained by Paivio's Dual Coding Theory (1991) and Mayer's Cognitive Theory of Multimedia Learning (2014), which suggest that learning is enhanced when verbal and visual information are presented together. By integrating narration and visual animation, animated videos facilitate information processing and improve knowledge retention. These findings are consistent with those of Utami and Kowiyah (2022), who reported that animated video is more effective than static media in enhancing conceptual understanding.

These findings are consistent with several prior studies. Riadi et al. (2024) reported that a lecture method combined with an animated video was significantly more effective in improving adolescents' knowledge and attitudes toward obesity than a lecture delivered without visual media. Similarly, Azmii & Ruhmawati (2024), conducted at SMAN 15 Bandung, found significant improvements in knowledge among adolescents following animated video–based health education on diabetes prevention and in a comparative study involving three media formats: poster, animated video, and podcast. Sapitri & Kurniasari (2024) also found that animated video yielded the highest knowledge-gain score among the three formats.

Contextual factors also contributed to the observed outcomes. The respondents in this study belonged to Generation Z, a cohort raised within a digital ecosystem and accustomed to processing information rapidly through visual platforms. Animated video is inherently congruent with their cognitive preferences, which in turn elevates their attention, learning motivation, and receptivity to health messages. Setyawan et al. (2024) affirm that digital media, such as video, are highly relevant and effective health promotion tools for adolescents in the context of non-communicable disease prevention.

### *Comparative Effectiveness of Animated Video and Conventional Lecture on Knowledge Improvement*

A direct comparison using the Mann Whitney test applied to the gain scores revealed a highly substantial difference between the two groups: 5.10 ± 1.398 in the intervention group versus 0.52 ± 0.509 in the control group. This difference is not only statistically significant but

also carries meaningful clinical and educational implications. The magnitude of the disparity in mean score gains indicates a consistent and robust superiority of animated video as a health education medium.

This superiority is consistent with the principles of multimodal learning theory, which holds that integrating dynamic visual elements, audio narration, and contextually relevant content synergistically enhances the encoding of information into long-term memory. Hasanica et al. (2021) specifically noted that media capable of simultaneously stimulating multiple sensory channels have been shown to produce significantly higher health information retention than text-based media or a lecture alone. The characteristics of Generation Z as digital natives who are cognitively more responsive to interactive visual formats further reinforce the superiority of this approach for this particular age group (Risnajayanti et al., 2023).

These findings carry important practical implications for the development of school health promotion programs. At a time when DM prevalence among young age groups continues to rise, the selection of an appropriate educational method is not merely a matter of pedagogical preference, but a public health decision with tangible, long-term consequences. The integration of animated video into school-based health programs and community health center outreach activities at schools represents a strategically sound step, now firmly supported by scientific evidence.

## **LIMITATIONS**

This study has several limitations that should be considered when interpreting the findings. These include the relatively small total sample size across both groups (58 students), the inclusion of participants from a single school, the short intervention period, and the absence of a follow-up assessment to evaluate long-term knowledge retention.

## **CONCLUSION**

Health education delivered via an animated video was significantly more effective at improving school students' knowledge of DM prevention than a conventional lecture. These findings underscore the importance of adopting innovative, technology-based educational media within school health promotion programs, particularly when targeting Generation Z adolescents. The study recommends that schools and school health units incorporate animated video into routine health promotion activities, and that primary healthcare providers supplement conventional lecture approaches with more interactive audiovisual media. Furthermore, future research is encouraged to assess long-term knowledge retention and to develop locally contextualized video content to further facilitate changes in attitude, behavior, and educational uptake.

## **ACKNOWLEDGMENTS**

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## **CONFLICTS OF INTEREST**

There are no conflicts of interest in this study.

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## **BARRIERS AND ENABLERS OF A REPORTING CULTURE: A SYSTEMATIC REVIEW OF PATIENT SAFETY INCIDENT REPORTING BY HOSPITAL HEALTHCARE WORKERS**

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### **ABSTRACT**

**Background:** Patient safety incidents remain common in hospitals and directly affect healthcare quality. Incident reporting is a key strategy for improving service quality and promoting safety culture. An effective reporting culture requires reducing barriers and strengthening enabling factors so healthcare workers feel safe to report incidents.

**Purpose:** This systematic review aimed to synthesize current evidence on the barriers and enabling factors influencing patient safety incident reporting culture among healthcare professionals in hospital settings.

**Methods:** A systematic review was conducted through a comprehensive search of ScienceDirect, ProQuest, PubMed, and Google Scholar using the terms: (“patient safety” OR “adverse event”) AND (“incident reporting” OR “error reporting”) AND (“barriers” OR “enablers”) AND (“healthcare workers”) AND (“hospital” OR “healthcare”). Eligible articles were published in English between 2021 and 2026, available as full text, and focused on barriers, facilitators, or determinants of patient safety incident reporting among healthcare workers in hospital settings. Study selection followed the PRISMA guidelines. Methodological quality was critically appraised using the appropriate Joanna Briggs Institute critical appraisal tools according to study design. Each study was scored, categorized by risk of bias, and assessed for inclusion in the final synthesis. A total of 619 records were identified, and 15 studies were included in the final synthesis after duplicate removal, title and abstract screening, full-text assessment, and methodological appraisal.

**Results:** The main barriers to reporting were fear of blame or punitive consequences, limited feedback, low awareness, inadequate training, lack of time, and complex reporting mechanisms. Supportive factors included leadership support, a non-punitive or just culture, simple and anonymous reporting systems, regular training, effective communication, and transparent feedback mechanisms.

**Conclusion:** Patient safety incident reporting culture is influenced by individual, organizational, and system-related factors. Sustainable improvement requires strong leadership, non-punitive policies, simplified reporting processes, continuous education, and structured feedback systems to encourage reporting and support safer care.

**Keywords:** Barriers; Enablers; Healthcare Workers; Incident Reporting; Patient Safety

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## BACKGROUND

Patient safety incidents (PSIs) represent a persistent global challenge. The World Health Organization estimates that approximately 134 million adverse events occur annually in hospitals, resulting in 2.6 million deaths which were a substantial proportion of which are preventable (Dhingra-Kumar et al., 2020; Schwendimann et al., 2018). In high-income countries alone, nearly one in ten hospitalized patients experiences an adverse event, contributing to increased mortality, prolonged hospital stays, and higher healthcare costs.

PSIs are broadly defined as events or circumstances that result in, or risk resulting in, unnecessary harm to patients (Kumah, 2025). Their occurrence is typically driven by failures across multiple levels: flawed healthcare processes, organizational and systemic deficiencies, and human factors such as poor communication, inadequate teamwork, excessive workload, and insufficient training which all compounded by the growing complexity of care environments (Garcia et al., 2019; Jachan et al., 2021; Thibaut et al., 2019). Incident reporting is a cornerstone of patient safety improvement. By enabling organizations to identify risks, analyze contributing factors, and implement corrective actions, reporting systems transform individual incidents into opportunities for system-wide learning (Dhingra-Kumar et al., 2020; Yoon & Lee, 2022). Their effectiveness, however, depends fundamentally on healthcare workers' willingness to report.

Underreporting remains a critical obstacle. Cultural barriers, particularly fear of blame, punishment, legal repercussions, or professional stigma, consistently discourage healthcare workers from reporting incidents and near misses (Dhingra-Kumar et al., 2020; Fekadu et al., 2025; Halperin & Bronshtein, 2019; Yoon & Lee, 2022). Organizations that respond punitively to errors tend to report fewer incidents, as workers perceive reporting as personally risky rather than constructively purposeful (Brown et al., 2026; Kakemam et al., 2021; Murray et al., 2023). Beyond culture, practical barriers also impede reporting: insufficient knowledge of procedures, inadequate training, time constraints, heavy workloads, complex reporting systems, and a lack of meaningful feedback that erodes trust in the reporting process (Abu Alrub et al., 2022; Alhassan et al., 2022; Varallo et al., 2018).

Conversely, several factors promote reporting. A non-punitive organizational culture, leadership commitment, psychological safety, and open communication create an environment where workers can report without fear (Brown et al., 2026; Murray et al., 2023; Sinaga & Kusumaningsih, 2024). User-friendly reporting systems, targeted education, and timely, visible responses to reported incidents further reinforce reporting behavior and strengthen patient safety culture (Abu Alrub et al., 2022; Pramesona et al., 2025; Tlili et al., 2024). Hospitals have implemented various measures to address these barriers, including the introduction of non-punitive reporting policies, simplified electronic reporting systems, and staff training programs aimed at improving safety awareness (Abu Alrub et al., 2022). However, the outcomes of these efforts have not yet been optimal, as underreporting and inconsistent reporting culture continue to be observed across diverse healthcare settings, suggesting that existing interventions have not fully addressed the underlying barriers.

Despite this growing body of evidence, prior systematic reviews on this topic have remained narrow in scope. Existing reviews have largely focused on a single professional group, such as nurses, often drawing on a small number of studies, or have been confined

to specific clinical areas such as maternity care, limiting the generalizability of their findings across the broader hospital workforce (Beecham et al., 2025; Mohamed & Hamed, 2022; Xu et al., 2025). Moreover, several reviews have concentrated primarily on barriers, with comparatively less attention given to enablers that could inform actionable strategies. This review addresses these gaps by synthesizing evidence from 15 studies spanning multiple professional groups including nurses, physicians, surgeons, and allied health professionals across diverse countries and healthcare settings, while explicitly examining both barriers and enablers of patient safety incident reporting. By doing so, this study provides a more comprehensive and current synthesis to inform targeted strategies for strengthening reporting culture in hospital settings.

## **OBJECTIVE**

This systematic review aimed to synthesize current evidence on the barriers and enabling factors influencing patient safety incident reporting culture among healthcare professionals in hospital settings.

## **METHODS**

### *Design and Review Framework*

This study adopted a systematic review design to identify and synthesize evidence on the barriers and enabling factors influencing patient safety incident reporting culture among healthcare workers in hospital settings. The review was conducted in accordance with the PRISMA guidelines to ensure transparent reporting of the search, screening, eligibility assessment, critical appraisal, and synthesis processes. The review protocol was not prospectively registered in PROSPERO; therefore, this limitation is acknowledged in the Methods section.

The review question was developed using the Population-Exposure-Outcome (PEO) framework. The population was healthcare workers working in hospital settings, including nurses, physicians, surgeons, allied health professionals, pharmacists, and other hospital staff. The exposure or phenomenon of interest was patient safety incident reporting culture, including incident reporting systems, reporting behavior, and organizational conditions related to reporting. The outcomes were barriers and enabling factors influencing incident reporting. Based on this framework, the review question was: “What are the barriers and enabling factors influencing patient safety incident reporting culture among healthcare workers in hospital settings?”

The review involved the following stages: formulation of the review question using the PEO framework, development of database-specific search strategies, systematic literature searching, duplicate removal, title and abstract screening, full-text eligibility assessment, methodological quality appraisal using Joanna Briggs Institute critical appraisal tools, data extraction, and narrative synthesis of findings.

Table 1. Review Framework Based on the PICO Approach

<b>PICO component</b>	<b>Description</b>
Population	Healthcare workers in hospital settings, including nurses, physicians, surgeons, pharmacists, allied health professionals, and other hospital staff
Intervention / Interest	Patient safety incident reporting culture, including incident reporting behavior, incident reporting systems, and organizational conditions that influence reporting
Comparator	Not applicable, because this review did not compare interventions or exposure groups, but synthesized evidence on barriers and enabling factors related to reporting culture
Outcome	Barriers and enabling factors influencing patient safety incident reporting among healthcare workers in hospital settings

### *Search Methods*

The literature search was conducted in January 2026 using ScienceDirect, PubMed, ProQuest, and Google Scholar. The search was restricted to studies published from 2021 to 2026, written in English, and accessible in full-text form.

The search strategy used combinations of keywords and Boolean operators as follows: ("patient safety" OR "adverse event") AND ("incident reporting" OR "error reporting") AND ("barriers" OR "enablers") AND ("healthcare workers") AND ("hospital" OR "healthcare").

The inclusion criteria comprised: (i) original research articles; and (ii) studies published between 2021 and 2026; (iii) English-language publications; (iv) full-text availability; and (v) studies addressing barriers, facilitators, or determinants influencing patient safety incident reporting among healthcare professionals working in hospitals.

The exclusion criteria were: (i) studies without analyzable data related to reporting barriers or facilitators; (ii) studies reporting only incident frequencies without examining reporting behavior; (iii) studies focusing on unrelated patient safety issues; and (iv) studies conducted outside hospital settings or not involving healthcare workers.

### *Search Outcome*

The initial search identified 619 records: ScienceDirect (n = 61), PubMed (n = 1), ProQuest (n = 287), and Google Scholar (n = 270). After removal of 38 duplicate records, the remaining articles were subjected to title and abstract screening. At this stage, 108 records were excluded because they were not aligned with the objectives of the review. Full-text assessment was then performed on 87 articles. Following application of the eligibility criteria, 72 articles were excluded, resulting in 15 studies for inclusion in the final review. The study selection procedure is illustrated in Figure 1 through the PRISMA flow diagram.

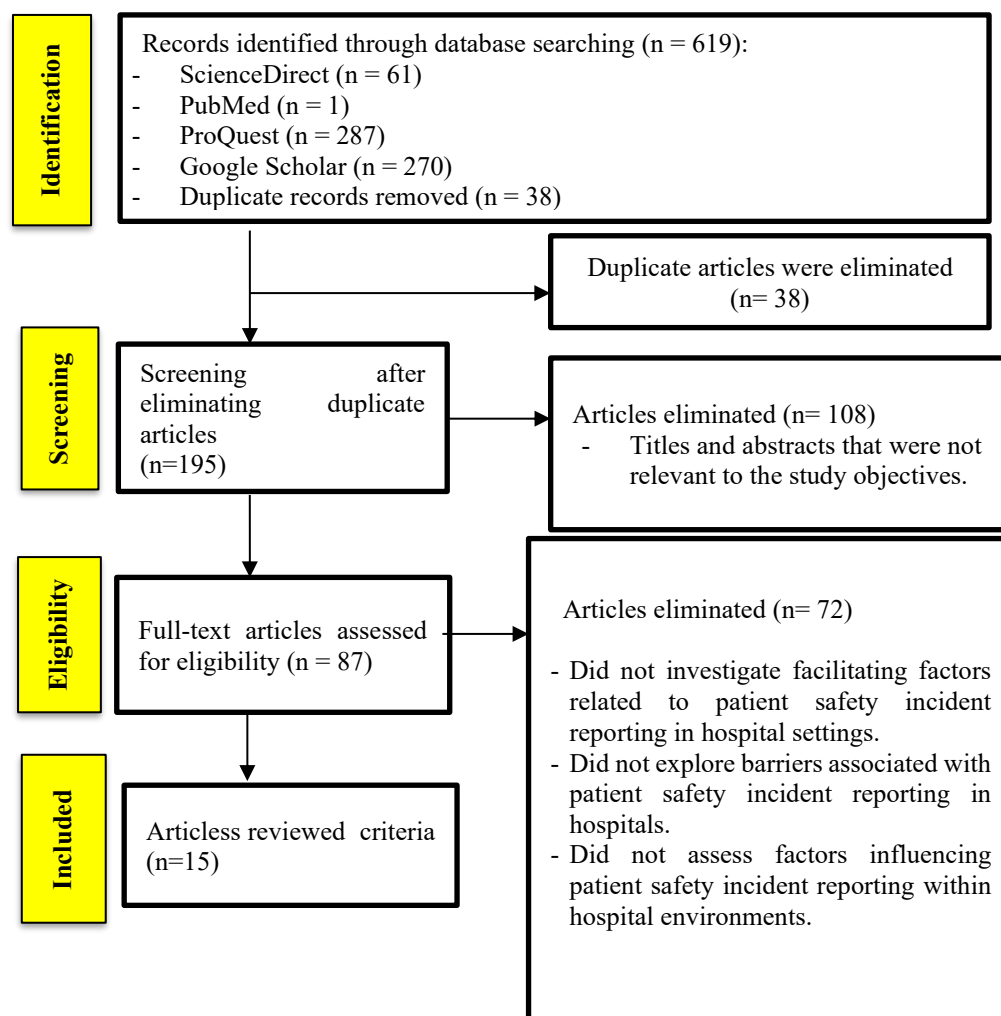


Figure 1. Study Selection Diagram

### Quality Appraisal

The methodological quality of the included studies was assessed using the Joanna Briggs Institute critical appraisal tools appropriate to each study design, including checklists for analytical cross-sectional studies, qualitative studies, and case series or retrospective descriptive studies. Each article was assessed based on methodological relevance, clarity of objectives, appropriateness of study design, sampling strategy, data collection methods, validity of measurement, clarity of analysis, and consistency between findings and conclusions.

Each appraisal item was rated as “Yes,” “No,” “Unclear,” or “Not applicable.” Items rated “Yes” were assigned a score of 1, while items rated “No” or “Unclear” were assigned a score of 0. Items rated “Not applicable” were excluded from the denominator. The total score for each study was converted into a percentage and categorized as follows: low risk of bias/high methodological quality ( $\geq 70\%$ ), moderate risk of bias/moderate methodological quality (50–69%), and high risk of bias/low methodological quality ( $< 50\%$ ).

Studies categorized as high risk of bias were considered for exclusion if their methodological limitations were likely to compromise the validity of the findings. The quality appraisal results, including the checklist used, JBI score, percentage score, risk-of-bias category, and inclusion decision, are presented in Table 2.

#### *Data Abstraction*

Data were collected using a standardized data extraction form. The information obtained included author(s), year of publication, country, study setting, and sample characteristics, research design, and principal findings related to barriers and enabling factors in incident reporting culture.

#### *Data Analysis/ Synthesis*

A narrative synthesis approach was applied to summarize findings across heterogeneous study designs. Extracted results were grouped into recurrent themes, including organizational factors, individual factors, leadership influences, reporting system characteristics, and educational factors. These themes were then synthesized to identify common barriers and enabling factors affecting patient safety incident reporting culture in hospitals.

## **RESULTS**

The article search was conducted using the keywords (“patient safety” OR “adverse event”) AND (“incident reporting” OR “error reporting”) AND (“barriers” OR “enablers”) AND (“healthcare workers”) AND (“hospital” OR “healthcare”). A total of 619 relevant articles were identified from four databases: ScienceDirect (n=61), PubMed (n=1), ProQuest (n=287), and Google Scholar (n=270). Subsequently, the articles were reviewed following the guidelines illustrated in the flow diagram above, resulting in 15 relevant articles. Table 1 provides a summary of the findings from the studies included in this review.

Table 2. Study Characteristics (n=15)

<b>No</b>	<b>Author &amp; Year</b>	<b>Sample</b>	<b>Research Design</b>	<b>Data Analysis Method</b>	<b>Findings</b>
1.	(Shemsu et al., 2024)	345 healthcare workers in general hospitals in the Hadiya zone (August 1–30, 2021)	Quantitative cross-sectional	Descriptive statistics; logistic regression	Factors related to patient safety incident reporting include open communication, team feedback, and management support.

No	Author & Year	Sample	Research Design	Data Analysis Method	Findings
2.	(Yoon & Lee, 2022)	303 nurses in eight military hospitals under the Armed Forces Medical Command	Descriptive correlational cross-sectional	Correlation analysis; structural equation modeling	Factors influencing reporting include organizational culture, safety climate, and knowledge of patient safety.
3.	(Kaya et al., 2023)	Incident data	Quantitative study	Supervised machine learning analysis	A compassionate workplace culture, experiences of violence and harassment, and workload pressure were identified as significant predictors of incident reporting.
4.	(Gluschkoff et al., 2021)	Incident reporting survey data	Logistic regression model	Logistic regression analysis	The most common reason for not reporting incidents is the perception that no harm was caused. Reporting is associated with organizational justice.
5.	(Pedersen et al., 2024)	Healthcare workers	Prospective qualitative study	Thematic analysis	Barriers include perceived risk of identification, negative attitudes toward errors, lack of feedback, and lack of change following reports.
6.	(Almansour, 2023)	Surgeons, physicians, nurses, allied health professionals, pharmacists, and quality staff	Qualitative semi-structured interviews	Thematic analysis	Barriers include fear, lack of knowledge, lack of leadership support, workload, reporting systems, and lack of motivation.
7.	(Olagundoye et al., 2022)	10 staff members (consultants, registrars, midwives) involved in incidents	Qualitative study	Thematic analysis	Factors reducing incidents include timely investigation feedback, strong leadership visibility, and structured staff support.

No	Author & Year	Sample	Research Design	Data Analysis Method	Findings
8.	(Sheikht aheri et al., 2024)	249 nurses from 14 hospitals	Cross-sectional study	Descriptive and inferential statistics	Nurses showed positive attitudes toward PSRS; key factors include management support and performance expectancy.
9.	(Gqaleni & Mkhize, 2024)	Healthcare professionals in specialized care units	Descriptive exploratory qualitative study	Content analysis (Tesch's method)	Barriers include ineffective reporting systems, lack of support, inadequate training, and poor human resources.
10.	(Pramesona et al., 2023)	15 clinical nurses selected using purposive sampling	Qualitative case study	Thematic analysis	Low reporting is caused by lack of understanding, a culture of blame, fear of legal repercussions, insufficient training, inadequate facilities, and limited feedback, and absence of reward/punishment systems.
11.	(Gradišnik et al., 2024)	Nursing students	Retrospective descriptive qualitative study	Qualitative content analysis	Contributing factors include communication failure, fast-paced environments, supervision, and personal factors.
12.	(Hyvämäki et al., 2023)	Inter-organizational health information	Descriptive qualitative study	Qualitative content analysis	Poor documentation and information use are caused by healthcare worker and organizational factors, including technical issues.
13.	(Suuronen et al., 2023)	HaiPro data search using dental-related keywords	Retrospective study	Descriptive statistical analysis	Main reasons for not reporting incidents include lack of communication and lack of information.
14.	(El-Sayed et al., 2025)	240 critical care nurses	Cross-sectional study	Correlation and regression analysis	Supporting factors for a reporting culture include leadership development to promote an open and supportive reporting

No	Author & Year	Sample	Research Design	Data Analysis Method	Findings
15.	(Tolobisa et al., 2026)	Nurses	Qualitative exploratory descriptive design	Thematic analysis	culture while increasing transparency and accountability. Reporting is influenced by fear of punishment, insufficient training and education, as well as fear of litigation.

### Quality Appraisal Results

Based on the JBI critical appraisal, all 15 included studies met the minimum methodological quality threshold for narrative synthesis. The appraisal scores ranged from 70.0% to 90.0%, indicating that all included studies were categorized as having low risk of bias. No study was excluded solely on the basis of methodological quality. However, several methodological limitations were identified, particularly incomplete reporting of strategies to address confounding factors in cross-sectional studies and limited reflexivity reporting in qualitative studies. Therefore, the appraisal results were used to support cautious interpretation of the synthesized findings.

Table 3. Summary of JBI Critical Appraisal Results of Included Studies

No.	Author & Year	Study Design	JBI Checklist Used	Score	Quality	Risk of Bias
1.	(Shemsuet al., 2024)	Cross-sectional study	JBI Analytical Cross-Sectional Checklist	7/8	87.5	Low
2.	(Yoon & Lee, 2022)	Descriptive correlational cross-sectional study	JBI Analytical Cross-Sectional Checklist	7/8	87.5	Low
3.	(Kaya et al., 2023)	Quantitative observational study	JBI Analytical Cross-Sectional Checklist	7/8	87.5	Low
4.	(Gluschoff et al., 2021)	Observational study with logistic regression analysis	JBI Analytical Cross-Sectional Checklist	7/8	87.5	Low
5.	(Pedersen et al., 2024)	Qualitative study	JBI Analytical Cross-Sectional Checklist	9/10	90.0	Low

No.	Author & Year	Study Design	JBI Checklist Used	Score	Quality	Risk of Bias
6.	(Almansour, 2023)	Qualitative semi-structured interview study	JBI Analytical Cross-Sectional Checklist	8/10	80.0	Low
7.	(Olagundoye et al., 2022)	Qualitative study	JBI Analytical Cross-Sectional Checklist	9/10	90.0	Low
8.	(Sheikhtaheri et al., 2024)	Cross-sectional study	JBI Analytical Cross-Sectional Checklist	7/8	87.5	Low
9.	(Gqaleni & Mkhize, 2024)	Descriptive exploratory qualitative study	JBI Analytical Cross-Sectional Checklist	9/10	90.0	Low
10.	(Pramesona et al., 2023)	Qualitative case study	JBI Analytical Cross-Sectional Checklist	9/10	90.0	Low
11.	(Gradišnik et al., 2024)	Retrospective descriptive qualitative study	JBI Analytical Cross-Sectional Checklist	8/10	80.0	Low
12.	(Hyvämäki et al., 2023)	Descriptive register-based qualitative study	JBI Analytical Cross-Sectional Checklist	7/10	70.0	Low
13.	(Suuronen et al., 2023)	Retrospective descriptive study	JBI Analytical Cross-Sectional Checklist	7/10	70.0	Low
14.	(El-Sayed et al., 2025)	Cross-sectional study	JBI Analytical Cross-Sectional Checklist	7/8	87.5	Low
15.	(Tolobisa et al., 2026)	Qualitative exploratory descriptive study	JBI Analytical Cross-Sectional Checklist	8/10	80.0	Low

**Note.** JBI = Joanna Briggs Institute. Scores were calculated by assigning 1 point for each item rated “Yes” and 0 points for items rated “No” or “Unclear.” Items rated “Not applicable” were excluded from the denominator. Studies with scores  $\geq 70\%$ , 50–69%, and  $< 50\%$  were categorized as low, moderate, and high risk of bias, respectively.

## DISCUSSION

The findings of this review suggest that the culture of patient safety incident reporting is influenced by both enabling and inhibiting factors, which can be categorized into internal and external factors. Internal factors refer to individual characteristics such as knowledge, attitudes, perceptions, and experiences, whereas external factors relate to organizational culture, leadership, management support, and reporting systems.

The included studies were conducted across diverse country and healthcare contexts, including Ethiopia, South Korea, England, Finland, Iran, South Africa, Indonesia, Slovenia, and other hospital or healthcare settings. This geographical variation suggests that patient safety incident reporting culture may be influenced not only by individual and organizational factors, but also by broader institutional and health-system contexts. For example, studies from England and Finland emphasized organizational justice, compassionate workplace culture, workload pressure, communication problems, feedback mechanisms, and whether reporting resulted in visible system improvement (Gluschkoff et al., 2021; Kaya et al., 2023; Suuronen et al., 2023). In contrast, studies from Ethiopia, Indonesia, Iran, and South Africa more frequently highlighted barriers related to limited knowledge of reporting procedures, inadequate training, fear of blame or punishment, weak management support, ineffective reporting systems, insufficient feedback, limited facilities, and human resource constraints (Gqaleni & Mkhize, 2024; Pramesona et al., 2023; Sheikhtaheri et al., 2024; Shemsu et al., 2024). A study from South Korea also showed that organizational culture, safety climate, and knowledge of patient safety were important determinants of reporting behavior, suggesting that structured or hierarchical healthcare environments may require strong organizational support to promote reporting (Yoon & Lee, 2022). These findings indicate that strategies to improve reporting culture should be adapted to the local organizational and country context. In settings where reporting systems are relatively established, interventions may focus on strengthening trust, feedback loops, psychological safety, and organizational learning. In settings where reporting barriers are related to limited resources, training, or unclear procedures, priority should be given to strengthening reporting infrastructure, staff education, non-punitive policies, leadership commitment, and accessible reporting mechanisms.

Among the enabling factors, several internal factors were identified. Healthcare professionals who possess adequate knowledge of patient safety, positive attitudes toward reporting systems, and a strong understanding of the importance of incident reporting are more likely to engage in reporting activities (Sheikhtaheri et al., 2024; Yoon & Lee, 2022). Reporting behavior is also influenced by individual factors and perceptions of organizational fairness, as healthcare professionals who perceive reporting systems as fair and beneficial are more likely to report incidents (Gluschkoff et al., 2021; Gradišnik et al.,

2024). These findings emphasize the importance of staff understanding and positive workplace experiences in promoting reporting behaviors.

External enabling factors were more frequently reported across the reviewed studies. Open communication, team feedback, management support, and a positive safety climate were consistently associated with stronger reporting cultures (Shemsu et al., 2024; Yoon & Lee, 2022). A strong patient safety incident reporting culture is supported by open, supportive, and non-punitive leadership. El-Sayed et al. (2025) found that leadership coaching behaviors are strongly associated with reporting culture, particularly through effective communication, learning from errors, and providing constructive feedback to nurses. Similarly, healthcare professionals require management support in the form of training, resource availability, a positive work environment, and recognition for reporting incidents to sustain reporting practices (El-Sayed et al., 2025; Tolobisa et al., 2026). A compassionate workplace culture and visible leadership have also been shown to encourage reporting by creating psychological safety among healthcare workers (Kaya et al., 2023; Olagundoye et al., 2022).

Another important external enabling factor is the implementation of effective Incident Reporting Systems (IRS). Structured reporting systems facilitate the reporting process and contribute to increased reporting rates, particularly during the early stages of implementation. In addition, prompt communication and responses during investigations, visible leadership involvement, and organized support systems for healthcare professionals help maintain trust in organizational processes and encourage continued engagement in incident reporting (Olagundoye et al., 2022). These organizational supports are particularly important because healthcare professionals who experience positive work environments are more likely to provide high-quality care, report incidents consistently, and actively participate in reporting and investigative processes.

Despite these facilitating factors, several barriers continue to hinder reporting behavior. Internal barriers include poor understanding of incident categories and reporting procedures, negative attitudes toward errors, fear of reporting, and the perception that incidents resulting in no patient harm do not require reporting (Gluschkoff et al., 2021; Pramesona et al., 2023). Additional barriers include perceived risk of identification, fear of legal consequences, and lack of motivation, all of which may reduce healthcare professionals' willingness to report incidents (Almansour, 2024; Pedersen et al., 2024). These findings indicate that inadequate knowledge and unfavorable perceptions remain important obstacles to developing a strong reporting culture.

External barriers were predominantly related to organizational and system-level issues. Studies identified blame culture, lack of leadership support, inadequate training and socialization, ineffective reporting systems, insufficient facilities, absence of feedback mechanisms, poor communication, inadequate human resources, workload pressures, and fear of punishment as major barriers to incident reporting (Almansour, 2024; Gqaleni & Mkhize, 2024; Pramesona et al., 2023; Tolobisa et al., 2026). Communication failures and fast-paced working environments further contribute to underreporting by limiting opportunities for reflection and reporting (Gradišnik et al., 2024). Moreover, incident reporting and investigation processes are often perceived as stressful experiences when

organizations fail to provide structured responses and staff support systems, resulting in reduced trust in leadership and organizational processes (Olagundoye et al., 2022). The absence of feedback and minimal observable changes following incident reports may further discourage future reporting (Pedersen et al., 2024).

The interaction between these internal and external factors has important implications for healthcare organizations. Poorly managed reporting and investigation processes may reduce trust in organizational systems and discourage engagement with reporting mechanisms. This is particularly concerning because incidents can substantially affect the emotional, physical, and psychological well-being of healthcare professionals (Olagundoye et al., 2022). Staff who lack trust in organizational systems are less likely to report incidents, accept investigation findings, or implement recommended actions, thereby limiting opportunities for organizational learning and patient safety improvement (Boamah et al., 2018; Firth-Cozens, 2004; Okello & Gilson, 2015; Winsvold Prang & Jelsness-Jørgensen, 2014). Consequently, strengthening patient safety incident reporting culture requires interventions that address both internal and external factors. Educational initiatives can improve knowledge and attitudes toward reporting, while supportive leadership, effective reporting systems, timely feedback, and structured staff support mechanisms can foster trust, transparency, and continuous learning within healthcare organizations.

## CONCLUSION

Patient safety incidents remain a critical issue in healthcare delivery, as they contribute to increased morbidity, mortality, and financial burden for both hospitals and patients. Findings from a systematic review indicate that underreporting of incidents is influenced by multiple barriers, including limited understanding among healthcare professionals regarding reporting procedures, fear of punishment or legal consequences, lack of feedback, high workload, and insufficient organizational support. These conditions may reduce staff trust in risk management systems and diminish their engagement in incident reporting and investigation processes. Furthermore, adverse incidents can have emotional, physical, and psychological impacts on healthcare professionals. Conversely, a robust culture of patient safety incident reporting is more likely to emerge in settings characterised by open, supportive, and non-punitive leadership. Leadership that fosters effective communication, encourages learning from mistakes, and provides constructive feedback has been associated with a stronger reporting culture. Management support through training, adequate resource provision, a positive work environment, and recognition of staff who report incidents also plays a crucial role in sustaining reporting practices.

For nurses and other healthcare professionals, efforts should focus on improving knowledge and awareness of incident reporting procedures, actively participating in reporting activities, and fostering open communication regarding patient safety issues. Continuous education and training programs may strengthen reporting competencies and encourage learning from incidents. For hospital management and healthcare leaders, strategies should focus on establishing a non-punitive reporting culture, providing timely feedback on reported incidents, ensuring adequate staffing and resources, implementing

accessible and user-friendly reporting systems, and promoting supportive leadership practices. Hospital management should also provide psychological support and recognition for staff involved in reporting and investigation processes to maintain trust in organizational systems. By addressing both individual and organizational factors, healthcare institutions can strengthen patient safety incident reporting culture, promote organizational learning, prevent the recurrence of similar incidents, and ultimately improve the quality and safety of healthcare services.

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#### **CONFLICTS OF INTEREST**

The authors declare that there are no conflicts of interest related to this study.

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**Supplementary Table 1. Item-by-item JBI Critical Appraisal Results**  
**Supplementary Table 1A. JBI Analytical Cross-Sectional Checklist**

Item	Appraisal question
Q1	Were the criteria for inclusion in the sample clearly defined?
Q2	Were the study subjects and setting described in detail?
Q3	Was the exposure measured in a valid and reliable way?
Q4	Were objective, standard criteria used for measurement of the condition?
Q5	Were confounding factors identified?
Q6	Were strategies to deal with confounding factors stated?
Q7	Were the outcomes measured in a valid and reliable way?
Q8	Was appropriate statistical analysis used?

**Note.** Y = Yes; N = No; U = Unclear; NA = Not applicable.

**Supplementary Table 1B. JBI Qualitative Research Checklist**

Item	Appraisal question
Q1	Is there congruity between the stated philosophical perspective and the research methodology?
Q2	Is there congruity between the research methodology and the research question or objectives?
Q3	Is there congruity between the research methodology and the methods used to collect data?
Q4	Is there congruity between the research methodology and the representation and analysis data?
Q5	Is there congruity between the research methodology and the interpretation of results?
Q6	Is there a statement locating the researcher culturally or theoretically?
Q7	Is the influence of the researcher on the research, and vice versa, addressed?
Q8	Are participants and their voices adequately represented?
Q9	Is the research ethical according to current criteria or, for recent studies, is there evidence of ethical approval?
Q10	Do the conclusions drawn in the research report flow from the analysis or interpretation of the data?

**Note.** Y = Yes; N = No; U = Unclear; NA = Not applicable.

**Supplementary Table 1C. JBI Case Series Checklist**

Item	Appraisal question
Q1	Were there clear criteria for inclusion in the case series?
Q2	Was the condition measured in a standard, reliable way for all participants included in the case series?
Q3	Were valid methods used for identification of the condition for all participants included in the case series?
Q4	Did the case series have consecutive inclusion of participants?

- Q5 Did the case series have complete inclusion of participants?
  - Q6 Was there clear reporting of the demographics of the participants in the study?
  - Q7 Was there clear reporting of clinical information of the participants?
  - Q8 Were the outcomes or follow-up results of cases clearly reported?
  - Q9 Was there clear reporting of the presenting site(s) or clinic(s) demographic information?
  - Q10 Was statistical analysis appropriate?
- 

**Note.** Y = Yes; N = No; U = Unclear; NA = Not applicable.

## KNOWLEDGE OF WARNING SIGNS OF HYPERTENSION CRISIS AND EMERGENCY HELP SEEKING BEHAVIOR AMONG PRODUCTIVE AGE ADULTS

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### ABSTRACT

**Background:** Hypertensive crisis is an emergency condition that has the potential to cause damage to target organs and death if not treated quickly and appropriately. The low level of knowledge of the productive age community about the danger signs of a hypertension crisis can contribute to delays in seeking emergency medical attention.

**Purpose** of this study is to determine the level of knowledge of productive age regarding the danger signs of a hypertensive crisis and emergency medical assistance seeking behavior.

**Methods:** This study used a quantitative design with a cross-sectional approach conducted in Kelurahan Pakis, Sawahan, Surabaya, with a sample of 196 respondents selected using a simple random sampling technique. Data was collected using a structured questionnaire that has been tested for validity and reliability. Data analysis was carried out univariate and bivariate using the Chi-square test with a significance level of  $p < 0.05$ .

**Results:** The results showed that most of the respondents had a good level of knowledge (36.7%), followed by the categories of sufficient (34.7%) and insufficient (28.6%). Emergency medical assistance seeking behavior was classified as good in 53.1% of respondents, but there were still 46.9% with inappropriate behavior. The results of the bivariate analysis showed a significant relationship between knowledge level and emergency medical assistance seeking behavior ( $p = 0.001$ ). These findings show that knowledge level has an important role in shaping medical attention seeking behavior in hypertensive emergency conditions.

**Conclusion:** Comprehensive interventions are expected to lower the risk of treatment delays and more severe complications.

**Keywords:** Emergency Care; Help-Seeking Behavior; Hypertensive Crisis; Knowledge; Productive Age.

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## BACKGROUND

Hypertension is still a significant global health problem because it contributes greatly to cardiovascular morbidity and mortality despite the availability of a variety of effective therapies (Burlacu et al., 2025). A hypertensive crisis is a life-threatening emergency condition that requires immediate medical treatment to prevent damage to the target organ (Wondimneh et al., 2025). However, the low level of public knowledge, especially the productive age, related to the danger signs of hypertension crisis is still a major obstacle in early detection and rapid treatment (Wondimneh et al., 2025). This lack of understanding contributes to delays in seeking emergency medical attention thereby increasing the risk of severe complications such as stroke, heart failure, and kidney failure (Kilindimo et al., 2023). On the other hand, productive age groups often ignore early symptoms due to the demands of activity and the perception that they are still in good health. This suggests that the main problem is not only in the incidence of hypertension, but also in low health literacy and help-seeking behavior in emergency situations (Burlacu et al., 2025).

Globally, hypertension affects about 1.13 billion people and about 1–2% of them experience a hypertensive crisis (Gezie et al., 2023). Some recent studies show that the prevalence of hypertensive crises in adult patients can reach 18.9% in certain healthcare facilities (Siame et al., 2025). Hypertensive crises are also reported to be one of the leading causes of emergency department visits with serious clinical implications. In some developing countries, the burden of hypertensive crisis cases continues to increase in line with low blood pressure control in the adult population. In addition, most of the patients who come to the hospital are already in a condition with complications of the target organ due to delayed treatment. This data shows that the hypertension crisis is not only a clinical problem, but also a public health problem related to behavior and access to health services (Calderon-Ocon et al., 2024). The prevalence of hypertension in the adult population in Indonesia reaches 34.11%, which means that about one in three people suffer from high blood pressure according to the latest SKI 2023 data (Tirtasari & Kodim, 2019). The prevalence of hypertension in East Java reaches 32.8% in the population aged 15 years and above, placing it as one of the provinces with the highest cases in Indonesia. Meanwhile, Surabaya as an urban center records the highest number of sufferers in the region with an estimated hundreds of thousands of people due to the high-risk urban lifestyle. Based on the doctor's diagnosis, the age group of 18-24 has a prevalence of hypertension of 0.4% and the age group of 25-34 of 1.8% (Ahmad, 2024).

Hypertensive crises generally occur due to uncontrolled or undiagnosed hypertension over a long period of time (Kilindimo et al., 2023). This process begins with an increase in blood pressure that is not adequately treated and eventually triggers damage to target organs such as the brain, heart, and kidneys. Risk factors such as diabetes mellitus, history of hypertension, and alcohol consumption accelerate the occurrence of a hypertensive crisis in dewas patients (Gezie et al., 2023). In addition to clinical factors, low patient knowledge has been shown to increase the risk of developing a hypertensive crisis by almost double. In many cases, patients come to the emergency department after severe symptoms such as shortness of breath, chest pain, and severe headaches. Delays in making decisions to seek medical attention are key factors that worsen the patient's condition.

Efforts to increase public knowledge about the danger signs of the hypertension crisis are an important strategy in preventing complications (Burlacu et al., 2025). Structured health education can increase individual awareness to recognize early symptoms and seek immediate medical attention. Community-based approaches and health promotion have proven effective in increasing hypertension literacy in productive age groups. In addition, strengthening the emergency service system and access to health services is also needed to accelerate the handling of hypertension crisis cases. The role of health workers, especially emergency nurses,

is very important in providing education and early intervention to at-risk patients (Burlacu et al., 2025). Although various studies have discussed the hypertension crisis from clinical aspects and risk factors, there are still limited studies that specifically explore the level of knowledge of productive age regarding the danger signs and its relationship with emergency medical assistance seeking behavior. In addition, most studies focus more on the patient population in health facilities, so they have not comprehensively described the condition of health literacy in the community. Therefore, this study offers novelty by integrating aspects of knowledge and seeking help seeking behavior in the context of productive age as a risk group that is often overlooked. Thus, research on the level of knowledge and behavior of seeking medical help at productive age is crucial to support comprehensive hypertension crisis prevention strategies. Therefore, this study aims to determine the level of knowledge regarding the warning signs of hypertensive crisis and emergency help seeking behavior among working age adults.

## **METHODS**

This study uses a quantitative design with an analytical descriptive approach and a cross-sectional design, which aims to analyze the relationship between the level of knowledge of productive age regarding the danger signs of a hypertensive crisis and the behavior of seeking emergency medical attention. The research was carried out in Pakis Urban Village, Surabaya City. The population in this study is the entire productive age community 18-59 years who live in Pakis Urban Village, Surabaya City. The research sample was determined using a probability sampling technique with a simple random sampling method, so that each population member has the same chance of being selected. The sample size used the Lemeshow Formula formula with a confidence level of 95% ( $Z = 1.96$ ), a proportion of 0.5, and a margin of error of 7%, a minimum sample size of 196 respondents who met the inclusion and exclusion criteria.

The inclusion criteria include: (1) age 18–59 years, (2) able to read and write, (3) willing to become a respondent by signing an informed consent. Meanwhile, the exclusion criteria are respondents who have cognitive impairments or are unable to complete the questionnaire completely. Data collection was carried out through a structured questionnaire consisting of two parts, namely a questionnaire on the level of knowledge about the danger signs of a hypertensive crisis and a behavioral questionnaire on seeking emergency medical attention.

The knowledge level instrument was developed based on the latest literature related to the hypertension crisis and includes aspects of symptom recognition, risk factors, and initial actions that must be taken. Meanwhile, the help-seeking behavior instrument measures an individual's response in the face of an emergency, such as the decision to seek health care, response time, and the type of facility chosen. The validity test was conducted using Pearson's correlation and the reliability test used Cronbach's alpha with a value of  $\geq 0.7$  indicating that the instrument was feasible to use.

Data analysis was carried out in stages, including univariate analysis to describe the frequency distribution of respondent characteristics, knowledge level, and help-seeking behavior. Furthermore, bivariate analysis was carried out using the Chi-square test to determine the relationship between independent and dependent variables. Before the hypothesis test was carried out, an assumption test was carried out such as the normality and homogeneity test of data. The significance level used was  $p < 0.05$ . This study has received ethical approval from the Health Research Ethics Committee of STIKes William Booth Surabaya, Indonesia (Ethical Approval No. 0028/KEPK-STIKES-WB/2026). All participants provided written informed

consent prior to their participation in the study. Confidentiality, anonymity, and participants' rights were maintained throughout the research process.

## RESULTS

**Table 1. Characteristics of Respondents (n = 196)**

Variable	Categories	n	%
Age	18–25 years old	52	26,5
	26–35 years old	61	31,1
	36–45 years old	45	23,0
	46–59 years old	38	19,4
Gender	Male	88	44,9
	Women	108	55,1
Education	Elementary/Junior High School	34	17,3
	High School	96	49,0
	College	66	33,7
Jobs	Not working	28	14,3
	Private	82	41,8
	Self-employed	54	27,6
	Others	32	16,3
History of Hypertension	Yes	58	29,6
	No	138	70,4

Most of the respondents were in the age group of 26–35 years (31.1%) with the majority being female (55.1%). The level of education was dominated by high school graduates (49.0%), and most worked in the private sector (41.8%). The majority of respondents had no history of hypertension (70.4%).

**Table 2. Distribution of Knowledge Levels about the Danger Signs of Hypertension Crisis**

Knowledge Level	n	%
Good	72	36,7
Enough	68	34,7
Less	56	28,6
<b>Total</b>	<b>196</b>	<b>100</b>

Most of the respondents had a good level of knowledge (36.7%), but there were still respondents with sufficient knowledge (34.7%) and lack (28.6%) which showed a gap in health literacy related to the hypertension crisis.

**Table 3. Distribution of Emergency Medical Attention-Seeking Behavior**

Behavior	n	%
Good	104	53,1
Less good	92	46,9
<b>Total</b>	<b>196</b>	<b>100</b>

More than half of the respondents showed good behavior in seeking medical attention (53.1%), but there were still 46.9% of respondents with inappropriate behavior in dealing with hypertensive emergencies.

**Table 4. The Relationship of Knowledge Level with Emergency Medical Attention-Seeking Behavior**

Knowledge Level	Good Behavior	Lacking Behavior	Total	<i>p-value</i>
Good	52	20	72	<b>0,001</b>
Enough	36	32	68	
Less	16	40	56	
<b>Total</b>	104	92	196	

The results of bivariate analysis using the Chi-square test showed a significant relationship between the level of knowledge and the behavior of seeking emergency medical help ( $p = 0.001$ ). Respondents with a good level of knowledge tended to have more appropriate behaviors to seek help compared to respondents who had sufficient and less knowledge.

## DISCUSSION

### Level of Knowledge about the Danger Signs of a Hypertension Crisis

The results showed that most of the respondents had a good level of knowledge, but there was still a significant proportion with sufficient and insufficient knowledge. This shows that although health information is increasingly accessible, an in-depth understanding of emergency conditions such as hypertension crisis is not evenly distributed. This can be seen from the fact that there are still respondents who are not able to accurately recognize the danger signs of hypertension emergency conditions. This variation in knowledge level is an indicator that public health literacy still needs strengthening. Thus, these results confirm that increasing knowledge does not only depend on the availability of information, but also on the quality of individual understanding.

Research shows that the level of public knowledge about hypertension is still in the moderate to low category, especially in recognizing dangerous symptoms (Wolde et al., 2022). Other research also states that good knowledge is influenced by education level and exposure to health information through digital media (Jihada et al., 2019), (Ssali et al., 2023). The Health behavioral theory also explains that knowledge is a predisposing factor that plays an important role in shaping individual behavior. Individuals with higher levels of education tend to have better abilities in critically understanding health information (Hafni, 2025; Kemenkes, 2023). However, exposure to unstructured or non needs based information can lead to gaps in understanding. Therefore, more targeted and contextual educational interventions are needed to improve the understanding of society as a whole.

According to the researchers, the presence of respondents with a low level of knowledge shows that health education related to the hypertension crisis has not been carried out optimally and evenly at the community level. The information currently available tends to be general and does not specifically emphasize the emergency aspect, so that the public does not understand the urgency of the condition. In addition, the educational approach used may not have taken into account the characteristics of productive age who have high mobility and limited time. The researcher argues that educational interventions need to be developed in a more contextual manner, for example through interactive digital media or community-based approaches. Education should also emphasize on the recognition of critical symptoms and quick actions

that must be taken. Thus, knowledge enhancement is expected to be not only cognitive, but also able to encourage more responsive behavioral changes in emergency situations.

### **Emergency Medical Aid Seeking Behavior**

The results showed that more than half of the respondents had good medical attention-seeking behavior, but there were still almost half of the respondents with inappropriate behavior. This indicates that there is a gap between knowledge and practice in dealing with emergency conditions. The study stated that the behavior of seeking help is greatly influenced by the individual's perception of the severity of symptoms and previous experiences (Wahid, 2021). In addition, the factors of access to health services and social support also play an important role in determining the decision to seek help. Although some respondents showed good behavior, there were still obstacles such as delaying decisions and dependence on independent treatment. In addition, health behavioral theory explains that an individual's decision to seek health services is also influenced by supporting factors such as access to health facilities and social support from the family or surrounding environment (Eriksson et al., 2025). Individuals who have easy access to health services tend to be quicker in making decisions to seek help. Conversely, limited access and lack of social support can be barriers to decision-making. Research also shows that self-medication habits are still quite high in the community, which can slow down the handling of emergencies.

According to the researcher, the presence of respondents with inappropriate help-seeking behavior shows that the existing educational approach has not been fully effective in shaping community preparedness for emergency conditions. The education provided so far tends to focus on improving knowledge, but has not optimally touched on the aspects of attitudes, risk perception, and decision-making skills in emergency situations. The researcher argues that a more applicable approach, such as simulation or emergency response training, is needed so that people are better prepared to face real conditions. In addition, the use of digital media and community-based health campaigns can be an effective strategy to reach the productive age. Family and environmental support also needs to be strengthened as a driving factor in quick decision-making. Thus, comprehensive interventions are expected to improve more responsive and appropriate medical attention-seeking behavior.

### **The Relationship of Knowledge Level to Help-seeking Behavior**

The results of the analysis showed a significant relationship between the level of knowledge and the behavior of seeking emergency medical attention ( $p = 0.001$ ), where respondents with good knowledge tended to have more appropriate behaviors. These findings confirm that knowledge is an important factor in shaping individual health behaviors, especially in emergency situations. Previous research has shown that individuals with a high level of knowledge are more likely to take prompt and appropriate action in the face of emergencies (Kartika & Prajayanti, 2026). Health behavioral theory explains that knowledge is a predisposing factor that affects the formation of individual attitudes and behaviors (Hanifah et al., 2026). In addition, other studies have also found that health education interventions are significantly able to improve better health-seeking behaviors (Lyu et al., 2024). However, the theory also emphasizes that behavior is not only influenced by knowledge, but also by other

factors such as attitudes, beliefs, experiences, and the availability and access to health services. These supporting and reinforcing factors play a role in determining whether knowledge can be translated into real action.

According to the researchers, the significant relationship between knowledge and behavior in this study shows that education-based interventions have great potential in improving community preparedness for hypertension emergencies. However, researchers argue that increasing knowledge alone is not enough if it is not accompanied by strengthening aspects of attitudes, risk perceptions, and ease of access to health services. In practice, individuals often face obstacles such as doubt, limited facilities, or environmental influences in decision-making. Therefore, interventions must be multidimensional, including education, simulation of emergency measures, and increased access to health services. The researcher also emphasizes the importance of a community-based approach to strengthen social support in decision-making. Thus, it is hoped that the knowledge possessed can be truly implemented in fast, precise, and responsive behavior.

This study has several limitations. First, it employed a cross-sectional design; therefore, the relationship observed between knowledge regarding the warning signs of a hypertensive crisis and emergency help-seeking behavior cannot be interpreted as a causal relationship. Second, the study was conducted solely among the working-age population in Pakis Urban Village, Surabaya City, limiting the generalizability of the findings to populations with different social, cultural, and geographical characteristics. Third, data were collected using self-reported questionnaires, raising the possibility of response bias or social desirability bias, which could affect the accuracy of the respondents' answers.

## **CONCLUSION**

This study found a significant relationship between knowledge of the warning signs of a hypertensive crisis and emergency help-seeking behavior among productive-age adults. Individuals with better knowledge tended to demonstrate more appropriate emergency help-seeking behavior, although a considerable proportion of respondents still had inadequate knowledge and inappropriate help-seeking behavior. These findings indicate that improving knowledge is an important step in promoting timely and appropriate responses to hypertensive emergencies.

Based on these findings, healthcare providers, particularly nurses and primary healthcare professionals, should strengthen community-based health education programs focusing on the early recognition of hypertensive crisis warning signs and the importance of seeking immediate medical care. Future research is recommended to develop and evaluate educational or technology-based interventions and to use longitudinal or experimental study designs to better understand the causal relationship between knowledge and emergency help-seeking behavior.

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## CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this study. The research was conducted independently without any financial or commercial relationships that could be construed as a potential conflict of interest.

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# EFFECTIVENESS OF A FAMILY-CENTERED AUDIOVISUAL EDUCATION INTERVENTION ON DELIRIUM KNOWLEDGE AND PREVENTION IN INTENSIVE CARE UNITS: A QUASI-EXPERIMENTAL STUDY

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## ABSTRACT

**Background:** While family involvement is essential for mitigating ICU complications like delirium, limited caregiver knowledge often hinders effective participation. Audiovisual-based health education has emerged as a promising strategy to enhance understanding through engaging and accessible learning modalities.

**Purpose:** This study aimed to examine the effectiveness of audiovisual-based health education in improving knowledge among family caregivers of intensive care unit (ICU) patients.

**Methods:** A quasi-experimental study with a pre-test–post-test control group design was conducted involving 72 participants. Respondents were assigned to either an intervention group receiving audiovisual-based education or a control group receiving standard care. Knowledge levels were measured using a structured questionnaire before and after the intervention. Data were analyzed using the Wilcoxon signed-rank test for within-group comparisons and the Mann–Whitney U test for between-group differences.

**Results:** The intervention group demonstrated a significant increase in knowledge scores from  $7.86 \pm 2.55$  to  $16.19 \pm 3.46$  ( $Z = 4.949$ ,  $p < 0.001$ ), indicating a large effect size ( $r = 0.70$ ). In contrast, the control group showed a non-significant improvement from  $4.56 \pm 1.78$  to  $6.28 \pm 2.19$  ( $Z = 1.732$ ,  $p > 0.05$ ). Between-group analysis revealed a significantly greater improvement in the intervention group ( $\Delta = 8.33$ ) compared to the control group ( $\Delta = 1.72$ ) ( $Z = 7.062$ ,  $p < 0.001$ ;  $r = 0.99$ ).

**Conclusion:** Audiovisual-based health education is highly effective in improving caregiver knowledge and represents a practical, scalable strategy for enhancing family engagement in ICU care.

**Keywords:** Audiovisual Education; Delirium; Family Caregivers; ICU; Knowledge

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## **BACKGROUND**

Delirium is a common and serious neuropsychiatric complication among critically ill patients, particularly in intensive care units (ICUs), and remains a significant global healthcare concern. It is characterized by acute disturbances in attention, awareness, and cognition that develop rapidly and fluctuate over time. The prevalence of delirium in ICU settings is reported to exceed 50% of critically ill patients, and it is strongly associated with adverse clinical outcomes, including prolonged hospitalization, increased mortality, and long-term cognitive impairment (Callahan et al., 2024). Beyond patient-related consequences, delirium also affects family members, contributing to psychological distress and increasing the risk of post-intensive care syndrome–family (PICS-F), thereby emphasizing the importance of a family-centered care approach in critical care settings (Krewulak et al., 2020).

Recent advances in critical care emphasize the integration of family engagement as part of evidence-based delirium management strategies. Current guidelines recommend non-pharmacological interventions, such as reorientation, sleep optimization, and early mobilization, which can be supported by family involvement (Vater et al., 2025). In this context, educational interventions targeting family caregivers have emerged as a promising approach to enhance their participation in delirium prevention and management. Studies over the past five years highlight that structured education particularly using multimedia or audiovisual methods can improve comprehension, retention, and consistency of information delivery, aligning with modern adult learning theories and digital health innovations (Krewulak et al., 2020).

Despite these advancements, empirical evidence indicates that family caregivers often have insufficient knowledge about delirium, limiting their ability to effectively contribute to patient care. Research shows that many caregivers are unable to recognize delirium symptoms or understand appropriate preventive strategies, which reduces their potential role as partners in care (Jung et al., 2021). At the same time, family members are uniquely positioned to detect subtle behavioral and cognitive changes due to their familiarity with the patient. Furthermore, recent studies demonstrate that involving family caregivers in delirium management can improve patient outcomes and reduce caregiver anxiety, reinforcing the clinical significance of enhancing caregiver knowledge (Lange et al., 2022).

However, existing research reveals several gaps. Most studies on delirium education have primarily focused on healthcare professionals, particularly nurses, rather than family caregivers as the main target population. Additionally, while some studies have explored caregiver education, there remains limited use of standardized, validated tools and controlled study designs to rigorously evaluate intervention effectiveness. Moreover, although audiovisual-based education has shown feasibility and potential benefits, evidence regarding its effectiveness in improving family knowledge in ICU settings especially in developing healthcare contexts remains insufficient and underexplored (Wheeler et al., 2023).

Therefore, this study introduces a novel approach by implementing a structured audiovisual health education intervention specifically designed for family caregivers of critically ill patients. Using a quasi-experimental design with a control group and a validated instrument, the Caregiver ICU Delirium Knowledge Questionnaire (CIDKQ). The findings are expected to contribute to the development of evidence-based, family-centered educational strategies in critical care nursing practice and to support the optimization of delirium prevention and management outcomes.

## **OBJECTIVE**

to evaluate the effectiveness of audiovisual education in improving family knowledge of delirium.

## **METHODS**

### **Study Design**

This study employed a quantitative research approach using a quasi-experimental design with a non-equivalent control group. The design involved two groups: an intervention group receiving audiovisual health education and a control group receiving standard care without the intervention. Both groups were assessed using a pre-test and post-test design to evaluate changes in knowledge before and after the intervention. This design is appropriate for evaluating the effectiveness of educational interventions in real clinical settings where randomization is not feasible.

### **Setting and Participants**

The study was conducted in the Intensive Care Unit (ICU) of RSD K.R.M.T Wongsonegoro, Indonesia, in May 2025. The target population consisted of family members of critically ill patients admitted to the ICU. Participants were eligible if they were aged  $\geq 18$  years, able to read and write, had been present in the ICU for at least one day, and had a significant relationship with the patient (e.g., spouse, child, parent, or relative). Exclusion criteria included family members with sensory impairments (hearing or vision problems) or those unwilling to participate

### **Sample Size and Sampling Technique**

Sample size was determined *a priori* using G\*Power (version 3.1.9.7), based on an independent samples *t*-test (two-tailed). Assuming a medium effect size ( $d = 0.5$ ) in accordance with Cohen's (1988) conventions, a significance level of  $\alpha = .05$ , and a desired statistical power of 80% ( $1 - \beta = 0.80$ ), the minimum required sample was calculated at 64 participants (32 per group). To account for potential attrition and non-response, the sample size was inflated by approximately 25%, yielding a final total of 80 participants, equally allocated to the intervention group ( $n = 40$ ) and the control group ( $n = 40$ ).

Participants were recruited using purposive sampling, whereby individuals who met the predetermined eligibility criteria were selected during the designated data collection period. This approach ensured that the sample was theoretically relevant and capable of providing meaningful data pertinent to the study objectives.

### **Intervention**

#### **Intervention Procedure**

This study employed a quasi-experimental design with a non-equivalent control group pre-test/post-test approach. The intervention procedure was carried out in three sequential phases: preparation, implementation, and evaluation.

#### **Phase 1: Preparation**

Prior to data collection, ethical approval was secured from the Research Ethics Committee of RSD K.R.M.T. Wongsonegoro Hospital (Ref. No. 069/Kom.EtikRSWN/III/2025), and institutional research permission was obtained (Ref. No. KH.03.03/F.XXII.10.a/101/2025). Participant eligibility was determined through systematic screening based on predefined inclusion and exclusion criteria. All eligible participants were approached individually, provided with a verbal and written explanation of the study's purpose, procedures, and their rights as participants, including the right to withdraw at any time without consequence. Written informed consent was obtained from each participant prior to enrollment.

#### **Phase 2: Implementation**

Following informed consent, participants were assigned to either the intervention group ( $n = 36$ ) or the control group ( $n = 36$ ). Baseline knowledge was assessed in both groups using the validated Caregiver ICU Delirium Knowledge Questionnaire (CIDKQ), administered digitally via a QR-linked Google Form, prior to any intervention (pre-test).

The intervention group received a structured audiovisual health education program on ICU delirium, lasting approximately 20 minutes, delivered via a purpose-developed video media.

The educational content was developed and validated by ICU clinical experts and nursing faculty, and systematically covered: (1) the operational definition and pathophysiology of delirium, (2) predisposing and precipitating risk factors in critically ill patients, (3) clinical manifestations and subtypes of delirium, (4) evidence-based non-pharmacological prevention strategies, and (5) the role and responsibilities of family members as active partners in delirium prevention and management. The audiovisual format was selected based on its demonstrated superiority in dual-channel information processing, integrating visual and auditory modalities to enhance comprehension, engagement, and knowledge retention in non-clinical populations (Mayer, 2009). Participants in the intervention group were permitted to use their own personal devices to view the educational video under direct researcher supervision, ensuring consistent delivery conditions across sessions.

The control group received no educational intervention and was maintained under standard care conditions throughout the study period. Both groups completed the post-test assessment using the same CIDKQ instrument immediately following the intervention period, ensuring temporal consistency in measurement.

### **Phase 3: Evaluation**

Upon completion of data collection, all questionnaire responses were reviewed for completeness and consistency. Data were entered and coded in SPSS for Windows for subsequent statistical analysis. Confidentiality was maintained throughout all phases of data handling in accordance with the ethical principles of beneficence, non-maleficence, autonomy, and justice.

### **Instruments and Data Collection**

Knowledge of ICU delirium among family caregivers was measured using the Caregiver ICU Delirium Knowledge Questionnaire (CIDKQ), a 21-item multiple-choice instrument (yes/no/don't know) originally developed by Bull et al. (2015) (Karla D. Krewulak et al., 2020) and adapted for ICU settings by (Krewulak et al., 2020). The questionnaire covers three domains risk factors (items 1–10), management actions (items 11–16), and signs and symptoms (items 17–21) with total scores ranging from 0 to 21, categorized as no knowledge (0), low (1–7), moderate (8–14), or good (15–21). Prior to use, the instrument underwent forward and back translation into Bahasa Indonesia, expert content validation by two ICU charge nurses and a critical care nursing faculty member, and pilot testing on 35 caregivers; construct validity was confirmed via Pearson correlation ( $r = 0.336–0.659$ , all items  $p < 0.05$ ,  $r$ -table = 0.334), and internal consistency was acceptable (Cronbach's  $\alpha = 0.778$ ). The original CIDKQ has also demonstrated strong psychometric properties in the literature, with a scale-level content validity index of 0.86 and overall Cronbach's  $\alpha = 0.77$  (Krewulak et al., 2020; Xue et al., 2022). Data were collected digitally via a QR-linked Google Form at two time points immediately before (pre-test) and after (post-test) the intervention in both groups, with the researcher present throughout to ensure standardized administration while maintaining participant confidentiality in accordance with established bioethical principles.

### **Variables**

The independent variable in this study was the audiovisual health education intervention, while the dependent variable was the level of knowledge of family members regarding delirium. Knowledge levels were assessed quantitatively based on questionnaire scores and categorized into levels (e.g., low, moderate, and high) according to predefined criteria.

### **Data Analysis**

Data analysis was performed using statistical software. Descriptive statistics were used to summarize participant characteristics and knowledge scores. Inferential statistics included the Wilcoxon Signed-Rank Test to analyze within-group differences (pre-test vs. post-test) and the Mann–Whitney U Test to compare differences between the intervention and control groups. A  $p$ -value of  $<0.05$  was considered statistically significant.

## Ethical Considerations

This study was conducted in accordance with established ethical standards for human research. Ethical approval was obtained from the Research Ethics Committee of RSD K.R.M.T. Wongsonegoro Hospital (Ref. No. 069/Kom.EtikRSWN/III/2025). All participants were provided with comprehensive information regarding the study objectives, procedures, potential risks, and benefits prior to participation. Written informed consent was obtained from all participants. Confidentiality and anonymity were strictly maintained throughout the study, and participants were assured of their right to withdraw at any time without any consequences to the care received.

## RESULTS

A total of 72 participants were included in this study. The sample was predominantly middle-aged, with the largest proportion aged 45–59 years (45.8%), followed by 18–44 years (36.1%) and 60–75 years (18.1%). Female participants comprised the majority (66.7%). In terms of educational attainment, most participants had completed tertiary education (38.9%), while the remainder had primary (20.8%), secondary (19.4%), and higher education (20.8%). Regarding employment status, homemakers represented the largest group (36.1%), followed by entrepreneurs (23.6%) and other occupations (25.0%), whereas only a small proportion were unemployed (5.6%). With respect to relationship to the patient, most respondents were children (37.5%), followed by siblings (25.0%) and others (23.6%). Overall, the sample reflects a predominantly female, middle-aged, and relatively well-educated caregiving population with diverse socioeconomic roles that may influence health-related experiences (Table 1).

The effect of audiovisual-based health education on knowledge scores is presented in Table 2. A substantial and statistically significant improvement was observed in the intervention group, where mean knowledge scores increased from  $7.86 \pm 2.55$  at baseline to  $16.19 \pm 3.46$  post-intervention ( $Z = 4.949$ ,  $p < 0.001$ ), corresponding to a large effect size ( $r = 0.70$ ). In contrast, the control group demonstrated only a modest and non-significant increase from  $4.56 \pm 1.78$  to  $6.28 \pm 2.19$  ( $Z = 1.732$ ,  $p > 0.05$ ), with a small effect size ( $r = 0.24$ ).

Between-group analysis further confirmed the superiority of the intervention. The mean improvement in knowledge scores was markedly greater in the intervention group ( $\Delta = 8.33$ ) compared to the control group ( $\Delta = 1.72$ ), with a statistically significant difference ( $Z = 7.062$ ,  $p < 0.001$ ) and a large effect size ( $r = 0.99$ ).

Taken together, these findings demonstrate that audiovisual-based health education yields both statistically significant and clinically meaningful improvements in knowledge. The magnitude and consistency of the effect underscore its potential as an effective educational strategy to enhance family understanding in clinical settings.

**Table 1.** Participant characteristics (n= 72)

Variable	n (%) or mean $\pm$ SD
<b>Age, years</b>	
Age groups, years	1.81 $\pm$ 0.72
18-44	26 (36.1)
45-59	33 (45.8)
60-75	13 (18.1)

Variable	n (%) or mean ± SD
<b>Gender</b>	
Male	24 (33.3)
Female	48 (66.7)
<b>Educational attainment</b>	
Primary	15 (20.8)
Secondary	14 (19.4)
Tertiary	28 (38.9)
Higher	15 (20.8)
<b>Relationship to the patient</b>	
Spouse	3 (4.2)
Parents	7 (9.7)
Sibling	18 (25)
Child	27 (37.5)
Other	17 (23.6)
<b>Employment status</b>	
Unemployed	4 (5.6)
Merchant	6 (8.3)
Entrepreneur	17 (23.6)
Homemaker	26 (36.1)
Healthcare profesional	1 (1.4)
Other	18 (25)

*Note.* Values are n (%) unless otherwise stated. Continuous variables are presented as mean±SD, SD, standard deviation

Table 2. Effect of Audiovisual Health Education on Knowledge Scores

Variable	Group	Pre test	Post test	Mean Difference	Z value	p-value
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		Mean ±SD	Mean ±SD			
Knowledge score	Intervention	7.86 ±2.55	16.19 ±3.46	8.13	4.95	<0.001
Knowledge score	Control	4.56 ±1.78	6.28 ±2.19	1.72	1.73	>0.05
Comparison between group	Intervention vs control	-	-	8.33 vs 1.72	7.06	<0.001

*Note* : Data are presented as mean ± standard deviation (SD). Within-group comparisons (pre-test vs post-test) were analyzed using the Wilcoxon signed-rank test, while between-group differences were assessed using the Mann–Whitney U test. A p-value of <0.05 was considered statistically significant. The intervention group demonstrated a substantially greater improvement in knowledge scores compared to the control group, indicating the effectiveness of audiovisual-based health education.

## DISCUSSION

This study demonstrates that audiovisual-based health education is highly effective in improving knowledge among family caregivers, with both statistically significant and clinically meaningful effects. The substantial increase in knowledge scores observed in the intervention group, accompanied by a large effect size, indicates that the intervention produced robust and practically relevant outcomes. In contrast, the minimal and non-significant improvement in the control group suggests that conventional educational approaches may be insufficient to facilitate meaningful knowledge acquisition, consistent with prior evidence highlighting the limitations of passive learning strategies (Cook et al., 2011).

The effectiveness of audiovisual media can be explained through the Cognitive Theory of Multimedia Learning, which posits that individuals learn more effectively when information is delivered through both visual and auditory channels (Bali et al., 2026). By integrating narration, images, and structured content, audiovisual interventions enhance cognitive processing, attention, and retention. Previous studies have demonstrated that multimedia-based education significantly improves knowledge and comprehension compared to traditional methods in healthcare settings (Wang et al., 2025). These findings support the present results, where participants exposed to audiovisual materials achieved markedly higher knowledge gains.

Furthermore, this study aligns with Social Cognitive Theory, particularly the concept of self-efficacy (Bandura, 1991). Although self-efficacy was not directly measured, improved knowledge may contribute to increased confidence in managing health-related situations. Evidence suggests that educational interventions can enhance caregiver competence and engagement by strengthening knowledge and perceived control (Li et al., 2025). In the context of delirium care, improved understanding may enable caregivers to recognize early symptoms, respond appropriately, and participate actively in patient management.

Sociodemographic characteristics may also have influenced the outcomes. The predominance of middle-aged, female, and relatively well-educated participants reflects a caregiving population that is actively engaged and potentially more receptive to educational interventions. Previous studies have shown that higher educational attainment is associated with better health

literacy and information processing, which may enhance the effectiveness of structured education programs (Alliston et al., 2024). However, variability in employment and family roles suggests the need for flexible and accessible educational approaches, such as audiovisual media, that can accommodate diverse caregiving contexts.

From a clinical perspective, the findings underscore the importance of integrating technology-based education into routine care. Audiovisual interventions provide a scalable and standardized approach that ensures consistent information delivery while allowing repeated access for reinforcement (Verville et al., 2021). This is particularly relevant in busy clinical environments where time constraints may limit direct education by healthcare professionals.

Nevertheless, several limitations should be acknowledged. The quasi-experimental design limits causal inference, and the relatively small sample size may reduce generalisability. In addition, the study focused on knowledge outcomes without assessing behavioural changes or patient-related outcomes. Future studies should adopt longitudinal and interventional designs to examine whether improved knowledge translates into better caregiving practices and patient outcomes. Incorporating psychosocial variables such as self-efficacy, caregiver burden, and anxiety would also provide a more comprehensive understanding of intervention mechanisms (Guo et al., 2025; Kocabaş et al., 2025).

## CONCLUSION

Audiovisual-based health education is an effective intervention for improving knowledge among family caregivers of ICU patients. The findings demonstrate significant and clinically meaningful improvements in knowledge scores, with a large effect size compared to standard care. This highlights the potential of audiovisual education as a practical, scalable, and engaging strategy to enhance family involvement in delirium prevention and management. Integrating such interventions into routine clinical practice may contribute to improved caregiving quality and patient outcomes in critical care settings. Furthermore, the intervention was delivered only once, preventing evaluation of long-term knowledge retention and sustainability. The use of self-report questionnaires with closed-ended items may not fully capture deeper understanding or cognitive processing. Finally, potential confounding factors, such as prior exposure to health information and informal support systems, were not controlled. Future studies should employ randomized designs, larger samples, and longitudinal approaches to strengthen evidence and assess long-term impact.

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## CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest related to this study. This research was conducted independently without any financial or commercial relationships that could be construed as a potential conflict of interest.

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## ENDORPHINE MASSAGE INTERVENTION ON MOTHERS POST-SECTION CAESAREAN PAIN LEVEL CHANGES

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### ABSTRACT

**Background:** Cesarean delivery is a surgical intervention frequently associated with postoperative discomfort stemming from abdominal and uterine incisions. Inadequately managed pain following this procedure may hinder early mobilization, interfere with lactation, delay overall recovery, and elevate the probability of adverse outcomes such as thromboembolism and compromised maternal-infant attachment. Endorphin massage serves as a viable therapeutic modality, utilizing gentle, rhythmic tactile stimulation designed to prompt the secretion of endogenous analgesic peptides known as endorphins. This technique functions by fostering relaxation, decreasing muscular rigidity, enhancing hemodynamics, and mitigating pain perception via specific neurophysiological pathways.

**Purpose:** The objective of this investigation was to evaluate the efficacy of endorphin massage in diminishing pain severity among postpartum women who have undergone a Cesarean section.

**Methods:** This inquiry utilized a case study framework grounded in the examination of clinical nursing practice. The intervention comprised a 15-minute endorphin massage session administered once daily over a consecutive three-day period. Data acquisition involved patient history taking, direct observation, and clinical documentation, with post-surgical pain assessments conducted utilizing the Numeric Rating Scale (NRS), the Visual Analogue Scale (VAS), and the Indonesian Nursing Outcome Standards (SLKI) criteria.

**Results:** The findings demonstrated that the application of endorphin massage effectively lowered pain intensity in patients recovering from Cesarean deliveries. Consequently, this technique represents a practical, non-pharmacological nursing strategy for managing post-cesarean pain.

**Conclusion:** Administering a 15-minute endorphin massage daily for three days successfully alleviated pain intensity in post-Cesarean section individuals. Pain metrics, as evaluated by the NRS and VAS, dropped from a baseline score of 5 on the initial day to a score of 1 following the final session on day three. Additionally, nonverbal pain indicators, including facial grimacing and guarding of the abdomen post-coughing, were notably diminished. Thus, endorphin massage is recommended as an adjunctive, non-pharmacological therapy for alleviating postoperative discomfort in post-Cesarean mothers.

**Keywords:** Cesarean Pain Management; Endorphin Massage Therapy; Post-Cesarean Section.

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## BACKGROUND

The Indonesian Nursing Standards bifurcate pain into acute and chronic classifications. Acute pain is characterized as a sensory or emotional response linked to actual or potential tissue trauma, emerging suddenly or progressively with intensities ranging from mild to severe, and typically resolving within three months; conversely, chronic pain involves a similar experience but persists beyond the three-month threshold (Tim Pokja SDKI DPP PPNI, 2018). A Cesarean section (CS) is a surgical method employed to extract a fetus via incisions in both the abdominal wall and the uterus (Putri et al., 2022). The discomfort following a CS generally originates from tissue injury caused by the surgery, subsequent inflammatory reactions, peripheral and central neural sensitization, and the risk of acute pain progressing into a chronic condition (Michalska et al., 2025). Therefore, post-CS pain is characterized as the physical distress stemming from these surgical incisions, which can last for less than three months or potentially become protracted.

Recent epidemiological data provided by Demilew et al. (2024) highlights a substantial global incidence over the last ten years, projecting that roughly 58% of women experience acute discomfort following a CS. Moreover, the 2023 Indonesian Health Survey reported a national CS rate of 25.9%, with East Kalimantan province observing a rate of 22.1% ; in correlation with these statistics, the most prominent complication noted among postpartum patients is the emergence of pain within the initial 24 hours following the operation (Kementrian Kesehatan Republik Indonesia, 2023). Such post-surgical discomfort can severely obstruct maternal-infant bonding, restrict milk production, and interrupt early breastfeeding, ultimately threatening neonatal well-being (Sales & Astuti, 2025).

To manage this discomfort, a combination of pharmacological and non-pharmacological strategies can be strategically implemented. Pharmacological options frequently encompass non-opioid pain relievers, NSAIDs, and localized or regional opioid agents (Hidayatullah & Noviard, 2025), while non-pharmacological alternatives involve therapeutic touch, acupressure, massage therapies, distraction techniques, hypnotherapy, thermal applications, Transcutaneous Electrical Nerve Stimulation (TENS), and Benson relaxation exercises (Morita et al., 2020). One specific technique utilized in this study to mitigate post-CS pain is endorphin massage. Endorphin massage is a non-invasive therapeutic intervention that uses light physical contact to mitigate pain by suppressing signal transmission through small C fibers and A-delta fibers, thereby obstructing the neural pathways to pain stimuli. This physiological mechanism induces pain relief and instills a profound feeling of relaxation (Karuniawati, 2020).

Prior investigations, such as the study by Lestari et al. (2024), have validated its clinical utility ; in their research, two participants exhibited moderate initial pain (scoring 5 and 6), which subsequently dropped by two points following the massage, shifting their pain into the mild bracket. These outcomes are corroborated by Emilia et al. (2024), who observed a notable decrease in the mean pain score—from 6.95 to 3.40—when endorphin massage was paired with pharmacological treatments. Consequently, evidence strongly supports the significant efficacy of endorphin massage in alleviating post-CS pain (p-value = 0.000).

An initial observational study performed at the Karang Mumus Ward of RSUD Inche Abdoel Moeis from December 22 to December 28, 2025, recorded five post-cesarean cases where all patients reported incisional pain, yet notably, none had received endorphin massage as a part of their pain management protocol. Motivated by these clinical observations, the authors aim to explore the therapeutic effects of endorphin massage on the fluctuation of pain levels among post-CS mothers at the Karang Mumus Ward of RSUD Inche Abdoel Moeis.

## **OBJECTIVE**

The central aim of this investigation was to assess the clinical effectiveness of endorphin massage in modifying pain intensities among postpartum women recovering from Cesarean deliveries at RSUD Inche Abdoel Moeis, Samarinda.

## **METHODS**

### *Study Design*

This inquiry utilized a case study methodology, explicitly adopting an analytical framework focused on clinical nursing practice.

### *Setting*

The clinical intervention took place in the Karang Mumus Ward at RSUD Inche Abdoel Moeis, Samarinda, during January 2026.

### *Research Subject*

The study involved a single postpartum patient recovering from a Cesarean section who fulfilled all predefined inclusion criteria. These prerequisites mandated that the participant be fully alert, actively experiencing post-surgical discomfort, consenting to take part, and presenting no medical barriers to receiving endorphin massage. Before commencing, the participant received a comprehensive briefing on the study's aims, advantages, and procedures, which culminated in the execution of an informed consent document as a formal agreement.

### *Instrument*

Data compilation was executed via observational checklists alongside validated pain measurement instruments, specifically the Numeric Rating Scale (NRS) and the Visual Analogue Scale (VAS), to quantify pain severity pre- and post-intervention. Furthermore, standard nursing care logs were employed to track the patient's clinical trajectory comprehensively.

### *Intervention*

The therapeutic massage protocol was performed once daily for 15 minutes, spanning three consecutive days. The inaugural treatment session was initiated exactly six hours post-surgery.

### *Data analysis*

The gathered data underwent descriptive analysis by contrasting the shifts in pain metrics documented before and after the therapeutic sessions throughout the monitoring phase. The results are delineated using both tabular formats and narrative summaries to demonstrate the effectiveness of endorphin massage for post-Cesarean section patients.

### *Ethical Consideration*

Institutional approval was secured from the hospital administration, and informed consent was formally obtained from the subject prior to any intervention. The investigating team strictly upheld patient privacy and executed the procedures in accordance with fundamental nursing ethics.

## **RESULTS**

In this clinical evaluation, the endorphin massage was delivered once per day for 15 minutes across a three-day timeline. Before initiating each massage, the subject's baseline

pain was meticulously evaluated utilizing two standardized instruments: the Numeric Rating Scale (NRS) and the Visual Analogue Scale (VAS). The corresponding clinical findings generated from these assessments are detailed below.

*Tabel 1 Pre- and post-intervention pain level observations over three days utilizing the Numeric Rating Scale (NRS)*

Day/Date	Pre-intervention	Post-intervention	Score Changes
Tuesday, 06/01/2026	5	3	2
Wednesday, 07/01/2026	4	2	2
Thursday, 07/01/2026	2	1	1
Average			1,6

The presented data illustrates that the systematic application of endorphin massage led to a steady reduction in pain severity. On the first day, the preliminary NRS score was 5; following the intervention, this metric decreased to 3, representing a 2-point alleviation in discomfort. On day two, the pre-treatment score stood at 4, which dropped to 2 post-massage, again showing a 2-point improvement. By the final day, the initial pain rating of 2 was further diminished to 1 following the therapy, achieving an additional 1-point reduction.

*Tabel 2 Pre- and post-intervention pain level observations over three days utilizing the Visual Analogue Scale (VAS)*

Day/Date	Pre-intervention	Post-intervention	Score Changes
Tuesday, 06/01/2026	5	3	2
Wednesday, 07/01/2026	4	2	2
Thursday, 07/01/2026	2	1	1
Average			1,6

Observation metrics gathered via the VAS strongly supported these favorable results. Before the initial therapy session, the subject's facial pain indicator was at a 5, which improved to a 3 post-intervention, marking a 2-point decline. During the second day, a pre-intervention VAS rating of 4 was effectively reduced to 2, indicating another 2-point drop. On the concluding day, the starting VAS scale of 2 fell to 1 post-treatment, confirming a final 1-point alleviation in pain intensity.

## DISCUSSION

Following the preliminary clinical evaluation on day one, it was noted that the patient, Mrs. M, suffered from acute pain linked to her Cesarean delivery, which occurred between 09:48 and 10:50 on January 6, 2026. At six hours post-operation, clear indications of pain were evident, particularly localized discomfort at the surgical wound exacerbated by coughing or laughing. She characterized the sensation as a non-radiating, throbbing pain, assigning it an initial severity of 5 on both the NRS and VAS instruments. The inaugural endorphin massage was implemented exactly six hours post-delivery. Before this session, her pain was sporadic and paired with nonverbal behaviors, including facial grimacing and clutching the incisional area after a cough. Post-intervention evaluations revealed a decrease in both pain scores to 3, reflecting a two-point reduction. Moreover, defensive nonverbal actions, such as grimacing and guarding the abdomen, were completely eliminated following the treatment.

During the second day of monitoring, initial assessments recorded a pain score of 4 across both scales. From a clinical standpoint, the patient exhibited brief speech interruptions and defensive abdominal clutching post-cough. Upon completion of the massage, her pain ratings fell to 2, and the previously noted grimacing and guarding behaviors ceased. On the third and final day, pre-intervention pain levels were registered at 2, with no observable nonverbal pain indicators present. After the concluding massage, the scores dropped further to 1 on both the NRS and VAS, maintaining a relaxed state free from nonverbal pain cues.

Throughout the three-day study, a marked transformation in the patient's pain profile was documented. Overall, the comprehensive assessment highlighted a total four-point decrease in pain severity, transitioning from a baseline of 5 on day one to a minimal score of 1 by day three. This significant amelioration strongly implies that endorphin massage is a highly efficacious technique for relieving post-CS pain. The formal intervention concluded at this juncture due to the patient's discharge. Nonetheless, comprehensive instruction was provided to both the patient and her spouse, empowering them to self-administer the massage therapy at home for any residual discomfort.

Endorphin massage acts as a crucial adjunctive therapy for managing postoperative pain in postpartum women. Its primary objective is to trigger endorphin release, enhancing maternal comfort, mitigating psychological distress, and decreasing surgically induced nociception (Lestari et al., 2024). Physiologically, the deliberate, rhythmic strokes generate swift neural impulses from peripheral receptors that bypass slower pain signals, reaching the neural gate first. Consequently, the central nervous system processes these comforting somatic inputs rather than the painful stimuli. Endorphins themselves are composed of 30 distinct amino acid sequences, encompassing cortisol, corticotrophin, and catecholamines, all synthesized endogenously to mitigate both stress and pain (Aprilia, 2024). By employing light tactile engagement, the massage disrupts nociceptive signal transmission along A-delta and small-diameter C nerve fibers, effectively shutting the neural gate to pain (Karuniawati, 2020).

The fundamental analgesic mechanism of this technique is rooted in the stimulation of the body's natural pain-relieving systems. The rhythmic physical contact activates the limbic system and hypothalamus within the central nervous system. This activation promotes the secretion of endorphins, which function as intrinsic painkillers by thwarting the release of nociceptive neurotransmitters, thereby lowering overall pain sensitivity (Fitrianingsih & Yulis, 2025). Additionally, the massage facilitates profound relaxation, reducing muscular tension and substantially elevating the patient's sense of well-being. This relaxation response is intrinsically connected to parasympathetic nervous system arousal, which helps to further dampen conscious pain perception.

The findings from this single-case analysis align robustly with existing scholarly literature. For example, a study by Lestari et al. (2024) highlighted that individuals suffering from moderate pain (scoring 5 and 6) experienced a two-point drop after receiving endorphin massage, shifting them into a state of mild pain. Similarly, research conducted by Emilia et al. (2024) verified that combining pharmacological agents with endorphin massage dramatically reduced mean pain scores from 6.95 to 3.40. These aggregated studies solidify the premise that endorphin massage yields a statistically significant reduction in postoperative pain for women following a Cesarean section ( $p$ -value = 0.000). Lastly, it is imperative to recognize that external variables, such as past obstetrical history and proactive family involvement, can simultaneously shape an individual's subjective experience of pain.

## **CONCLUSION**

The results of this clinical investigation involving a postpartum patient grappling with acute pain post-Cesarean section reveal that a 15-minute daily administration of endorphin massage over three consecutive days is highly effective in mitigating pain severity. Quantitative measurements derived from the Numeric Rating Scale (NRS) and Visual Analogue Scale (VAS) demonstrated a substantial drop in pain levels, decreasing from a pre-intervention peak of 5 on day one to an optimal score of 1 post-treatment on day three. Simultaneously, observable manifestations of distress, such as abdominal guarding and facial grimacing induced by coughing, were successfully eradicated. From a physiological perspective, this therapeutic massage cultivates profound relaxation and stimulates the endogenous release of endorphins, which act as natural pain suppressants to lower the subjective pain threshold in postpartum individuals. As a result, endorphin massage emerges as a highly practical and effective non-pharmacological adjunct for holistic postoperative pain care in women recuperating from Cesarean surgeries.

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### CONFLICTS OF INTEREST

The author affirms that there are no prospective conflicts of interest concerning the execution, authorship, or dissemination of this scholarly work.

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## THE EFFECT OF COMBINATION THERAPY OF STRAIGHT LEG RAISING EXERCISE AND RESISTED ACTIVE MOVEMENT ON PAIN RELIEF IN OSTEOARTHRITIS PATIENTS

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### ABSTRACT

**Background:** Osteoarthritis is a degenerative joint disease that frequently causes chronic pain, decreased mobility, and reduced quality of life. Non-pharmacological management through exercise therapy is recommended to reduce pain and improve joint function.

**Purpose:** To determine the effect of a combination of Straight Leg Raising Exercise and Resisted Active Movement on pain intensity among osteoarthritis patients.

**Methods:** This study used a quasi-experimental design with a pretest-posttest control group approach. A total of 60 respondents were selected using purposive sampling and divided into intervention and control groups, each consisting of 30 respondents. The intervention group received a combination of Straight Leg Raising Exercise and Resisted Active Movement, while the control group received Range of Motion exercises. Pain intensity was measured using the Numeric Rating Scale. Data were analyzed using Wilcoxon and Mann-Whitney tests.

**Results:** The average pain score in the intervention group decreased from 4.57 to 2.83, while in the control group it decreased from 4.43 to 3.23. Wilcoxon test showed significant differences before and after intervention in both groups ( $p=0.000$ ). Mann-Whitney test showed a significant difference in pain reduction between groups ( $p=0.001$ ). The median reduction in pain score was 2.00 in the intervention group and 1.00 in the control group.

**Conclusion:** The combination of Straight Leg Raising Exercise and Resisted Active Movement significantly reduced pain intensity among osteoarthritis patients and was more effective than Range of Motion exercises.

**Keywords:** Osteoarthritis; Pain; Resisted Active Movement; Straight Leg Raising Exercise.

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## BACKGROUND

Osteoarthritis (OA) is a degenerative joint disease characterized by progressive cartilage damage, subchondral bone changes, osteophyte formation, and local inflammation that cause pain and limited joint function. OA is a leading cause of disability and reduced quality of life in adults and the elderly (Raja S et al., 2022). According to a 2023 World Health Organization report, there are approximately 528 million people with osteoarthritis worldwide, and this number continues to rise. In Indonesia, the prevalence of OA has also increased significantly, especially in the age group over 40 (WHO 2023). Osteoarthritis can be managed through pharmacological and non-pharmacological approaches. Non-pharmacological therapy is a primary recommendation because it is relatively safe, easy to perform, and has minimal side effects (Yudiansyah, 2024). One widely used intervention is physical exercise or exercise therapy, which aims to increase muscle strength, joint flexibility, and improve lower extremity function. Regular exercise can help reduce pressure on the joints, thereby alleviating pain (Kitagawa *et al.*, 2025).

Several factors contribute to the development and progression of osteoarthritis, including aging, obesity, previous joint injuries, repetitive mechanical loading, and occupational activities involving prolonged standing, squatting, or heavy lifting (Rahmi, 2023). These factors increase stress on the knee joint, resulting in cartilage degeneration and worsening clinical symptoms. Obesity, in particular, is recognized as one of the most significant modifiable risk factors because excessive body weight increases joint loading and accelerates structural damage in the knee joint (Stearthritis, 2025). Chronic pain experienced by patients with osteoarthritis is not only caused by cartilage degeneration but also by inflammatory processes involving the synovial membrane, subchondral bone, ligaments, and surrounding muscles (Utami & Laksmi, 2024). Persistent pain may lead to decreased physical activity, muscle weakness, reduced functional ability, and a decline in quality of life. Therefore, interventions that target both pain reduction and muscle strengthening are essential to improve functional outcomes and prevent further disability among individuals with osteoarthritis (Mei *et al.*, 2022)

The Straight Leg Raising Exercise (SLR) is a quadriceps strengthening exercise performed by raising the leg straight without bending the knee menurut Silaen & Sudaryanto, (2024) this exercise can increase thigh muscle strength, improve knee joint stability, and reduce mechanical stress on degenerative joints. Meanwhile, Resisted Active Movement (RAM) is an active movement exercise that provides resistance to optimally improve muscle strength, endurance, and neuromuscular control. The combination of these two exercises is thought to have a synergistic effect in reducing osteoarthritis pain compared to either exercise alone (Mien & Ca, 2022). Pain is a major complaint in osteoarthritis patients, disrupting daily activities. OA can be managed pharmacologically or non-pharmacologically. One effective non-pharmacological approach is physical exercise aimed at increasing muscle strength, joint stability, and reducing pain (Thahira *et al.*, 2024) The Straight Leg Raising Exercise (SLR) strengthens the quadriceps without putting excessive pressure on the knee joint, while the Resisted Active Movement (RAM) improves muscle strength and neuromuscular control

through resistance training. The combination of these two exercises is thought to provide a more optimal effect in reducing osteoarthritis pain. (Iqbal *et al.*, 2024).

## **OBJECTIVE**

To determine the effect of combination therapy of Straight Leg Raising Exercise and Resisted Active Movement on pain in osteoarthritis patients in the working area of Sawah Lebar Community Health Center, Bengkulu City in 2026.

## **METHODS**

This study used a quasi-experimental design with a pretest-posttest control group approach. The study was conducted in the Sawah Lebar Community Health Center (Puskesmas) area of Bengkulu City in 2026. The sample size was 60 respondents, divided into two groups: 30 in the intervention group and 30 in the control group. Respondents were selected using a purposive sampling technique based on predetermined inclusion and exclusion criteria. The inclusion criteria were patients diagnosed with osteoarthritis, aged 40 years and above, experiencing knee pain, able to communicate effectively, and willing to participate in the study. Patients with severe physical disabilities, cognitive impairment, or other musculoskeletal disorders that could interfere with the intervention were excluded from the study.

Prior to the intervention, all respondents underwent baseline pain assessment using the Numeric Rating Scale (NRS). Participants in the intervention group performed a combination of Straight Leg Raising Exercise and Resisted Active Movement according to a standardized protocol under researcher supervision. The exercises were conducted regularly for four weeks. Meanwhile, participants in the control group received conventional Range of Motion (ROM) exercises according to standard care procedures. Following the intervention period, pain intensity was reassessed using the same instrument. The Numeric Rating Scale (NRS) was used as the primary instrument for measuring pain intensity. The NRS is a widely accepted and validated tool for assessing pain severity, consisting of a numerical scale ranging from 0 (no pain) to 10 (worst possible pain). Higher scores indicate greater pain intensity.

Ethical approval for this study was obtained from the Health Research Ethics Committee prior to data collection. All participants were informed about the study objectives, procedures, potential benefits, and risks before providing written informed consent. Confidentiality and anonymity of participant information were maintained throughout the research process. Results: The intervention group received a combination of straight leg raises and active range of motion exercises with resistance for four weeks, while the control group received range of motion (ROM) exercises. Pain intensity was measured using a Numeric Rating Scale (NRS). Data were analyzed using the Wilcoxon test to determine differences before and after the intervention, and the Mann-Whitney test to determine between-group effects, with a significance level of  $\alpha = 0.05$ .

Tabel 1. Respondent Characteristics

No	Variables	Group		P Value
		Intervention (n=30)	Control (n=30)	
1	<b>Age</b>			
	Mean	50.23	50.67	
	Median	50.50	52.00	
	Min	40	40	0.683*
	Max	59	59	
	SD	5.67	5.98	
	CI 95%	48.11–52.35	48.43–52.90	
2	<b>Gender</b>			
	Man	14 (46.7%)	14 (46.7%)	1.000**
	Woman	16 (53.3%)	16 (53.3%)	
3	<b>Type of work</b>			
	Manual (Teacher, Housewife)	13 (43.3%)	17 (56.7%)	0.302**
	Using Tools (Farmers, Laborers, Craftsmen)	17 (56.7%)	13 (43.3%)	
4	<b>Body Mass Index</b>			
	18,5–24,9 : Normal	4 (13.3%)	2 (6.7%)	0.667**
	25–29,9 : Overweight	13 (43.3%)	15 (50.0%)	
	>30 : Obesity	13 (43.3%)	13 (43.3%)	

\*Uji Mann Whitney\*\*Uji Chi Square

Most of the respondents were female, engaged in heavy physical work, and were in the overweight to obese category.

Tabel 2. Average Pain Score Before and After Intervention

Variables	Group		P Value
	Intervention	Control	
<b>NRS Score Before Intervention</b>			
Mean	4.57	4.43	
Median	5.00	4.00	
Min	4	4	0.306*
Max	5	5	
SD	0.50	0.50	
CI 95%	4.38–4.75	4.25–4.62	

\*Mann Whitney

NRS Score After Intervention		
Mean	2.83	3.23
Median	3.00	3.00
Min	2	2
Max	4	4
SD	0.64	0.67
CI 95%	2.59–3.08	2.98–3.49

There was a decrease in average pain scores in both groups after the intervention. However, the decrease in the intervention group was greater than in the control group.

Tabel 3. Wilcoxon Test Results

	N	Median (Min-Max)	Z	P value
<b>Intervention Numeric Rating Scale Score</b>				
Before Intervention	30	5.00 (4-5)	-4.901 <sup>b</sup>	0.000****
After Intervention	30	3.00 (2-4)		
<b>Control Numeric Rating Scale Score</b>				
Before Intervention	30	4.00 (4-5)	-5.108 <sup>b</sup>	0.000****
After Intervention	30	3.00 (4-5)		

\*\*\*\**Uji wilcoxon*

There was a significant difference between pain scores before and after the intervention in both groups.

Tabel 4. Mann-Whitney Test Results

Variabel	n	Median (Min-Max)	U	P value
<b>Intervention Numeric Rating Scale Score</b>				
Intervention Group	30	2.00 (1-3)	246.000	0.001*
Control Group	30	1.00 (1-2)		

\**Mann Whitney*

There was a significant effect of combination therapy of SLR and RAM on reducing osteoarthritis pain compared to the control group.

## DISCUSSION

The study results showed that the combination of Straight Leg Raising Exercise and Resisted Active Movement significantly reduced pain intensity in osteoarthritis patients. The reduction in pain scores in the intervention group was greater than in the control group. These results indicate that muscle strengthening and resistance training provide more optimal benefits than conventional ROM exercises (Coaccioli *et al.*, 2022). These findings are consistent with previous studies demonstrating that exercise-based interventions play an important role in reducing pain and improving physical function among patients with knee

osteoarthritis (Daşkapan *et al.*, C.E.). Strengthening exercises contribute to enhanced muscle performance, improved joint stability, and decreased biomechanical stress on affected joints, thereby alleviating pain symptoms and improving mobility. Furthermore, combining strengthening and resistance exercises may produce greater therapeutic effects than a single exercise modality because it simultaneously targets muscle strength, endurance, and neuromuscular control (Yu *et al.*, 2022).

Straight Leg Raising Exercise works by increasing quadriceps muscle strength without placing excessive pressure on the knee joint. This increased muscle strength helps stabilize the joint and reduces mechanical stress on the articular surface, thus reducing pain (Bhatnagar *et al.*, 2022). Furthermore, this exercise increases blood circulation, which aids tissue recovery and reduces joint stiffness (Dell *et al.*, 2025). Resisted Active Movement provides external resistance that stimulates neuromuscular adaptation, increasing muscle strength, joint stability, and movement control (Zeng *et al.*, 2021). The combination of these two exercises produces a synergistic effect in improving joint function and reducing pain in osteoarthritis patients. These study results align with those of Iqbal *et al.*, (2024) and Bartolotti *et al.*, (2021) which demonstrated that physical exercise is effective in significantly reducing osteoarthritis pain.

The findings of this study are consistent with previous research showing that exercise-based interventions are effective in reducing pain and improving physical function in patients with osteoarthritis (Nirwana, 2024). Strengthening exercises targeting the quadriceps muscle have been shown to reduce joint loading, improve knee stability, and thus reduce pain intensity. A systematic review by Lim *et al.*, (2024) reported that therapeutic exercise programs, specifically strengthening and resistance training, significantly reduced pain intensity and improved quality of life among patients with knee osteoarthritis. These findings support the use of a combination of Straight Leg Raise and Active Movement with Resistance as a non-pharmacological intervention for pain management in patients with osteoarthritis (Rafiq *et al.*, 2021).

## **CONCLUSION**

The combination of Straight Leg Raising Exercise and Resisted Active Movement significantly reduced pain in osteoarthritis patients in the Sawah Lebar Community Health Center, Bengkulu City. The average pain score in the intervention group decreased from 4.57 to 2.83, while in the control group, it decreased from 4.43 to 3.23. The Mann-Whitney test showed a p-value of 0.001, proving that the combination of SLR and RAM therapy was more effective than ROM exercises in reducing osteoarthritis pain.

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## **CONFLICTS OF INTEREST**

The author declares that there is no conflict of interest in this research

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## ***EFFECTIVENESS OF BEETROOT EXTRACT (*Beta vulgaris*) ON INCREASING HEMOGLOBIN (Hb) IN THIRD-TRIMESTER PREGNANT WOMEN WITH ANEMIA IN BENGKULU CITY***

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### **ABSTRACT**

**Background:** Anemia in pregnancy occurs due to physiological changes during pregnancy. Pregnant women are advised to take Fe tablets during pregnancy, and to support their absorption, they are recommended to consume vitamin C. Beetroot extract contains vitamin C, iron, and zinc.

**Purpose:** This study aims to determine the effectiveness of administering beetroot extract (*Beta vulgaris*) in increasing hemoglobin (Hb) in third-trimester pregnant women with anemia in Bengkulu City.

**Methods:** The research sample consisted of 20 respondents, with 10 respondents each in the intervention and control groups. The research method used a quasi-experimental design with a two-group pretest-posttest design. Sampling used an accidental sampling technique. Data analysis used the Wilcoxon test and paired sample t-test. Before the intervention was given, the average Hb level was 9,6 gr/dL, and after beetroot extract was administered, the average Hb level increased to 10,3 gr/dL. The average difference between the two groups was 0,82.

**Results:** The results of the bivariate analysis showed that the  $p\text{-value} = 0.041 < \alpha = 0.05$ , so it can be concluded that administering beetroot extract (*Beta vulgaris*) is more effective than the control group in increasing hemoglobin (Hb) in third-trimester pregnant women in Bengkulu City.

**Conclusion:** Therefore, it can be an option for pregnant women in preventing and treating anemia.

**Keywords:** Anemia; Beetroot; Pregnant women.

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## BACKGROUND

The global prevalence of low Hb levels in 2019 was 29,9% (95% uncertainty interval (UI): 27,0%, 32,8%) among women of reproductive age aged 15-49 years. The prevalence of low Hb levels among pregnant women was 36,5%. In Indonesia, cases of pregnant women with Hb levels below the normal limit have increased from year to year, starting with 1.306 cases in 2016 and 1.321 cases in 2019 (WHO, 2019).

According to the Basic Health Research (Riskesdas), the prevalence of low Hb levels among pregnant women in Indonesia was 48,9%, occurring in both urban and rural areas. This has become a concern for the government in developing strategies to reduce maternal mortality rates in Indonesia and globally. Indonesia is also among the countries contributing to the highest maternal mortality rates in the world (Ministry of Health of the Republic of Indonesia, 2018). Based on data from the Bengkulu Provincial Health Office in 2020, the Maternal Mortality Rate (MMR) was still relatively high among women aged 20 to 35 years and above, with causes of maternal death including bleeding 67,34%, hypertension 0%, infection 0%, and anemia 16,8% (Bengkulu City Health Office, 2021).

The causes of maternal death include the triad of bleeding 40-60%, preeclampsia and eclampsia 20-30%, and infection 20-30%; among these three factors, bleeding ranks first. Bleeding during pregnancy can cause anemia because of the loss of red blood cells due to gastrointestinal bleeding injuries, uterine bleeding, or bleeding caused by surgery. Losing a large amount of blood will certainly reduce the amount of blood in the body, resulting in anemia (Astutik & Ertiana, 2018).

Anemia is a problem characterized by low hemoglobin levels in the blood or a decrease in red blood cells, marked by insufficient oxygen-carrying capacity to meet the physiological needs of the human body. Hemoglobin is a blood protein needed by humans that contains a large amount of iron, binds to oxygen, and forms oxyhemoglobin in red blood cells. Through this function, oxygen (O<sub>2</sub>) is transported from the lungs to tissues throughout the body. WHO states that hemoglobin levels <12 gr/dL are classified as anemia (Shubham et al., 2020).

Anemia has side effects that greatly affect the health of both mother and baby. The causes of the high prevalence of anemia among pregnant women include increased iron requirements due to physiological and metabolic changes. Pregnant women with anemia are at risk of miscarriage, prematurity, low birth weight, increased frequency of pregnancy complications, maternal mortality risk, increased perinatal mortality, and bleeding before, during, and after childbirth (Winarni, Lestari & Wibisono, 2020).

Anemia in third-trimester pregnant women tends to occur more frequently because the need for iron increases with gestational age, while iron stores in the body are insufficient. As a result, many third-trimester pregnant women experience iron-deficiency anemia unless they are given iron supplements. According to the study by Sikoway, Mewo & Assa (2020), the average hemoglobin level of third-trimester pregnant women was below normal because of increased iron needs during pregnancy. Iron functions in hemoglobin formation, and low hemoglobin levels during pregnancy can have negative effects on the mother and fetus. Therefore, hemoglobin levels during pregnancy must be continuously maintained and monitored to prevent undesirable outcomes by regularly consuming iron preparations and other food sources that contain iron (Sikoway, Mewo & Assa, 2020).

Anemia in pregnant women can be managed through pharmacological and non-pharmacological treatment. Pharmacological treatment that can increase hemoglobin in pregnant women involves consuming at least one Fe tablet daily up to 90 tablets. This method is often disliked because it causes nausea and vomiting due to the smell of iron. Therefore, a healthy and safe breakthrough through non-pharmacological therapy is needed, one of which is consuming beetroot extract, a fruit high in folic acid, calcium, phosphorus, vitamin C, magnesium, carbohydrates, and iron. Beetroot contains copper and folic acid, which are very beneficial in supporting fetal brain development and addressing anemia problems (Setyianingsih, Widayati & Kritiningrum, 2020).

A study by Stephana (2018) found that the intervention of administering 30 grams of beetroot extract brewed with 200 ml of hot water and consumed once daily for 7 days could increase hemoglobin levels. Another method is to prepare 250 ml/day of beetroot juice for 7 days, which can increase hemoglobin levels in pregnant women with anemia. The average hemoglobin level of pregnant women before receiving beetroot was 9.50 gr/dL in the experimental group and 9.18 gr/dL in the control group; after receiving beetroot for 7 days, it became 11.27 gr/dL in the experimental group and 9.22 gr/dL in the control group that did not receive the beetroot intervention. Based on these averages, there was an increase of 1.77 gr/dL.

Based on research findings regarding the effect of administering beetroot extract on hemoglobin levels in pregnant women, the average hemoglobin level before beetroot extract administration was 9.50 gr/dL, and after beetroot extract administration it was 11.27 gr/dL. Thus, the average difference in Hb levels before and after beetroot extract administration was 1,77 gr/dL, and it can be concluded that in this study there was an effect of beetroot extract administration on hemoglobin levels in pregnant women (Putri, Astuti & Puspasari, 2020).

Data from the Bengkulu City Health Office showed that there were 6.865 pregnant women in 2022. There were three public health centers with the highest number of pregnant women among all public health centers in Bengkulu City: Telaga Dewa Public Health Center with 732 people, followed by Jembatan Kecil Public Health Center with 563 people, and Nusa Indah Public Health Center with 491 people (Bengkulu City Health Office, 2022).

Based on the description above, the authors were interested in conducting a study entitled Effectiveness of Administering Beetroot Extract (*Beta vulgaris*) on Increasing Hemoglobin (Hb) in Third-Trimester Pregnant Women with Anemia in Bengkulu City.

## **METHODS**

### *Methodology*

This research used a quasi-experimental design with a two-group pretest-posttest design. The research location was three public health centers in Bengkulu City with the highest number of pregnant women among the 25 public health centers in Bengkulu City, namely Telaga Dewa, Jembatan Kecil, and Nusa Indah Public Health Centers.

### *Sample/ Participants*

The sample used consisted of 20 respondents divided into 2 groups, namely the intervention group and the control group, each with 10 respondents who met the criteria of being third-trimester pregnant women. The sampling technique used was random sampling...

### Instrument

The researchers tested the effectiveness of beetroot extract on increasing hemoglobin in third-trimester pregnant women. The intervention group was then given a combination of beetroot extract and Fe tablets, while the control group consumed only Fe tablets.

## RESULTS

The results of the study showed the characteristics of pregnant women, namely maternal age, gestational age, occupation, and pretest and posttest Hb levels.

**Table 1. Frequency distribution of characteristics based on respondent age and gestational age**

No	Variable	N	Min	Max	Mean
1.	Respondent Age				
	Intervention	10	16	32	25,93
	Control	10	19	32	26,8
2.	Gestational Age				
	Intervention	10	28	35	30,9
	Control	10	28	35	33,2

Based on Table 1 above, the average age of respondents in the intervention group was 25,93 years, and the average age in the control group was 26,8 years. The average gestational age in the intervention group was 31 weeks, and in the control group it was 33 weeks.

**Table 2. Frequency distribution of characteristics based on occupation**

No	Group	N	Not Working	%	Working	%	Total
	Intervention	10	8	80	2	20	100
	Control	10	9	90	1	10	100

Based on Table 2 above, almost all respondents in the intervention and control groups (80% and 90%) were housewives or not working.

**Table 3. Frequency distribution of pretest and posttest Hb levels**

Group	N	Min	Max	Mean
Intervention				
Pre	10	8,6	10,9	9,65
Post	10	9,3	11,7	10,3
Control				
Pre	10	8,6	10,8	9,41
Post	10	8,5	11	9,49

Based on Table 3 above, in the intervention group the average pretest Hb level was 9,65 gr/dL and increased to 10,3 gr/dL in the posttest, while in the control group the average pretest Hb level was 9,41 gr/dL and increased to 9,49 gr/dL in the posttest.

**Table 4. Data normality test**

	Group	p-value
Hb Pre	Intervention	0,29
	Control	0,368
Hb Post	Intervention	0,71
	Control	0,689

Based on Table 4.4 above, it can be seen that in the intervention group, the normality test for pretest Hb data was 0,29, while the normality test for posttest Hb data in the intervention group was 0,71. In the control group, the normality test for pretest Hb data was 0,368, while for posttest Hb data in the control group it was 0,689.

**Table 5. Effect of administering beetroot extract and Fe tablets in the intervention group**

Intervention	Mean Rank	p-value
Pre	0,00	0,005
Post	0,55	

Based on Table 4.5 above, it can be seen that the  $p\text{-value} = 0,000 < \alpha = 0,05$ ; therefore, the research hypothesis ( $H_a$ ) is accepted, so it can be concluded that there is an effect of administering beetroot extract and Fe tablets (TTD) on Hb levels in the intervention group.

**Table 6. Effect of administering Fe tablets in the control group**

Control	Mean	Diff.	t-value	df	p-value
Pre	9,41	0,80	-1,922	9	0,087
Post	9,49				

Based on Table 4.6 above, it can be seen that the  $p\text{-value} = 0,87 > 0,005$ , which means that there was no effect or difference in Hb levels before and after treatment (administration of Fe tablets) in the control group. This can also be seen from the calculated t-value  $(-1.922) < t\text{-table at df } 9 \text{ and a } 95\% \text{ confidence level } (2.262)$ . Nevertheless, when viewed from the average value  $(-0,08)$ , the negative value may indicate a difference of 0,08, where the average posttest value was higher than the pretest value. However, there was no significant difference.

**Table 7. Difference in Hb levels between the two groups after the intervention**

Variable	Group		Mean difference	t	p-value
	Intervention (mean rank)	Control (mean rank)			
Hb Level	10,3	9,49	0,82	2,206	0,041

Based on Table 4.7 above, it can be seen that the  $p\text{-value} = 0,041 < 0,005$ , which means that there was a significant difference between the intervention and control groups. There was an average difference of 0,82 between the two groups, with the average posttest Hb level in the intervention group (10,31) compared with the average Hb level in the control group

(9,49). The results of this statistical test showed that administering beetroot extract was more effective in increasing Hb levels than the control group. When comparing the t-value with the t-table for df 18, it was also found that the calculated t-value (2,206) > the t-table (2,101), meaning that there was a difference in the average posttest results between the intervention and control groups.

## DISCUSSION

### **1. Frequency distribution of age, gestational age, and occupation among third-trimester pregnant women in Bengkulu City.**

The statistical results showed that the average age of respondents in the intervention group was 25,93 years, and the average age in the control group was 26,8 years. The average gestational age in the intervention group was 31 weeks, and in the control group it was 32 weeks.

According to theory, age is viewed as a condition that forms the basis of individual maturity and can be observed subjectively through age periods, so that various processes, experiences, knowledge, skills, and independence develop along with increasing age. The more mature a person is, the better their level of maturity and strength in thinking and working (Dai, 2021). According to Saifuddin (2020), the safest age range for pregnancy is >20 to <35 years. According to the researchers, the respondents in this study were within the safe age range for pregnancy and were in the third trimester, namely 28 to 35 weeks of gestation.

The frequency distribution of characteristics based on occupation showed that almost all respondents in the intervention and control groups (80% and 90%) were housewives or not working. According to theory, work is an activity carried out primarily to support the family economy. Women's work is closely related to health status. Several factors underlie and directly or indirectly cause maternal death, including contextual or distal determinants (women's status in the family, family status in society, and community status). One factor that affects women's status is employment, where mothers working in the formal sector have better access to various types of information, including health information. This empowerment enables women to be more active in determining attitudes and more independent in making the best decisions for themselves, including decisions related to health and pregnancy (Dai, 2021).

### **2. Frequency distribution of hemoglobin levels before the administration of beetroot extract (*Beta vulgaris*) in Bengkulu City.**

The analysis results showed that in the intervention group, the average pretest Hb level was 9,65 gr/dL and increased to 10,3 gr/dL in the posttest, while in the control group, the average pretest Hb level was 9,41 gr/dL and increased to 9,49 gr/dL in the posttest. According to the theory of Saifuddin (2020) and Astutik & Ertiana (2018), Hb levels are used to determine whether pregnant women have anemia. The degree of anemia based on Hb level is as follows: very mild: Hb 10 gr/dL to the normal limit; mild: Hb 8 gr/dL-9,9 gr/dL; moderate: 6 gr/dL-7.9 gr/dL; and severe: Hb <5 gr/dL. According to the researchers' assumption, in this study, respondents in the intervention and control groups were within the categories of mild and very mild anemia.

### **3. Effectiveness of beetroot extract (*Beta vulgaris*) in increasing hemoglobin levels among third-trimester pregnant women in Bengkulu City.**

The analysis results to determine the effect of beetroot extract (*Beta vulgaris*) on increasing hemoglobin levels among third-trimester pregnant women in Bengkulu City

showed that the  $p\text{-value} = 0,000 < \alpha = 0,05$ ; therefore, the research hypothesis ( $H_a$ ) is accepted, and it can be concluded that there is an effect of administering beetroot extract and Fe tablets (TTD) on hemoglobin levels among third-trimester pregnant women in Bengkulu City. In the control group, the  $p\text{-value} = 0,87 > 0,005$ , which means that there was no effect or difference in Hb levels before and after treatment in the control group. There was an average difference of 0,82 between the two groups. The analysis results showed a  $p\text{-value} = 0,041 < 0,005$ , which means that there was a significant difference between the intervention and control groups.

The management and prevention of anemia can be carried out by consuming Fe tablets or blood supplement tablets (TTD), at least 90 tablets during pregnancy, and to support absorption, vitamin C found in fruits can be added. Beetroot (*Beta vulgaris*) is one fruit that is often used as a natural coloring agent for various foods and is rich in folate, which is effective in preventing heart disease and anemia. Beetroot contains relatively high levels of folic acid and iron, both of which are essential for the formation of red blood cells and new hemoglobin in the body. Its high iron content reactivates and regenerates red blood cells and supplies oxygen that is useful for the health of red blood cells. Beetroot also contains vitamin C, which helps the body absorb iron, meaning that if iron can be absorbed properly, the formation of new red blood cells will also occur properly and smoothly (Novita & Joseph, 2018).

Beetroot (*Beta vulgaris*) also contains vitamins A, B, and C, carbohydrates, protein, fat, and minerals such as iron, calcium, and phosphorus. Beetroot has a high folic acid content compared with other fruits. This fruit can help the iron absorption process and help reduce anemia problems. *Beta vulgaris* is an alternative treatment that contains iron and can increase Hb levels in the blood (Utaminingsyas, 2017).

Beetroot extract contains folic acid and iron, which can increase hemoglobin levels in pregnant women; red blood cells increase after beetroot extract is administered. The nutritional content of red beetroot per 100 g is vitamin A 20 IU, thiamine 0,02 mg, riboflavin 0,05 mg, niacin 0,4 mg, vitamin C 10 mg, calcium 27 mg, iron 1,0 mg, phosphorus 43 mg, fiber 87,4 g, fat 1 g, carbohydrates 9,6 g, protein 1,6 g, and calories 42 kcal per 100 g. In addition, red beet leaves are not inferior to red beetroot because they also have nutritional value, although the leaves are rarely consumed (Babarykin et al., 2019).

Red beetroot extract has been proven to increase hemoglobin levels. The data obtained showed that in the treatment group given red beetroot extract, the average hemoglobin level at pre-test was 10,033 gr/dL and at post-test was 11,507, with a difference of 1,474. This means that hemoglobin levels increased by 1,474 gr/dL after the red beetroot intervention. After testing using the paired t-test, a significant value of 0,000 ( $<0,05$ ) was obtained, indicating an effect of red beetroot administration on hemoglobin in anemic mothers (Dewita & Henniwati, 2020).

This is also supported by the findings of Zuiatna et al. (2023), which showed that before being given beetroot juice, the average Hb level of pregnant women was 10,0, and after being given beetroot, it increased to 11,5. The analysis results showed a  $p\text{-value} = 0,000 < 0,05$ , which means that there was an effect of beetroot juice administration on increasing Hb levels among pregnant women with anemia in Sipaku Area Village, Simpang Empat District, North Sumatra Province.

Similar findings were also reported by Liananar et al. (2019), who proved that before beetroot juice was given, Hb levels were 10,1-11,00 gr/dL, and after beetroot juice was given, they increased to an average of 12 gr/dL. The study by Liesmayani et al. (2022) showed that the analysis results had a  $p\text{-value} = 0,000 < 0,05$ , meaning that there was an effect of beetroot

juice administration on increasing Hb levels among pregnant women with anemia in the UPTD Peulumat Public Health Center area.

## CONCLUSION

Based on the research results and discussion described in the previous chapter, it can be concluded that:

1. The results from 20 respondents showed that the average age in the intervention group was 25,93 years, and the average age in the control group was 26,8 years. The average gestational age in the intervention group was 31 weeks, and in the control group it was 32 weeks. Almost all respondents in the intervention and control groups (80% and 90%) were housewives or not working.
2. The results from 20 respondents showed that in the intervention group, the average pretest Hb level was 9,65 gr/dL and increased to 10,3 gr/dL in the posttest, while in the control group, the average pretest Hb level was 9,41 gr/dL and increased to 9,49 gr/dL in the posttest.

There was an effect of administering beetroot extract (*Beta vulgaris*) on hemoglobin levels among third-trimester pregnant women in Bengkulu City, with a p-value of  $0,000 < \alpha = 0,05$ .

## ACKNOWLEDGMENT

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## DECLARATION OF CONFLICTING INTEREST

The limitation of this study was the difficulty of obtaining the research material (beetroot) directly, as it had to be ordered in advance. Future researchers are expected to use a larger sample and different methods.

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# TRENDS IN THE USE OF NATURAL AGENTS FOR CHRONIC WOUND CARE IN DEVELOPING COUNTRIES: A SCOPING REVIEW

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## ABSTRACT

**Background:** Chronic wounds remain a major healthcare challenge in developing countries due to limited access to advanced wound care technologies and the high cost of treatment. These limitations have encouraged the use of natural agents as affordable alternatives for chronic wound management. Natural agents such as honey, *Aloe vera*, propolis, virgin coconut oil, *Centella asiatica*, and herbal extracts have demonstrated antimicrobial, anti-inflammatory, and tissue-regenerative properties.

**Purpose:** This scoping review aimed to map trends in the clinical use of natural agents for chronic wound care in developing countries from 2010 to 2024, including the types of agents used, therapeutic outcomes, safety, cost-effectiveness, and emerging clinical applications.

**Methods:** This review followed the Arksey and O'Malley methodological framework and the PRISMA-ScR guidelines. A systematic search of PubMed, ScienceDirect, Scopus, and Google Scholar identified studies published between January 2010 and October 2024. Eligible studies were screened, selected, and synthesized.

**Results:** Of 2,876 records identified, 15 studies met the inclusion criteria. The findings showed a gradual evolution in the clinical use of natural agents. Honey and *Aloe vera* predominated in earlier studies, while more recent research explored propolis, virgin coconut oil, olive oil–honey combinations, *Centella asiatica*, and plant-based hydrogels. Most studies focused on diabetic foot ulcers. Overall, natural agents accelerated wound healing, enhanced granulation tissue formation, reduced wound size and infection, and provided cost-effective alternatives to conventional wound care.

**Conclusion:** Natural agents have evolved from conventional single-agent therapies to diverse bioactive formulations integrated with modern wound care. Current evidence supports their effectiveness, affordability, and potential role in improving chronic wound management, particularly in developing countries and other resource-limited healthcare settings.

**Keywords:** Chronic Wounds; Natural Agents; Nursing; Wound Healing.

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## **BACKGROUND**

A wound is defined as a break or disruption in the continuity of the skin which serves as the body's first line of defense. When this process of repair is delayed beyond the expected period of healing the condition is known as a chronic wound. Chronic wounds remain a significant global health problem that affects millions of people, causing prolonged suffering, disability, and a financial burden on individuals and healthcare systems. These wounds include diabetic foot ulcers (DFUs), venous leg ulcers, arterial ulcers, and pressure ulcers, which often require long-term management and specialized care (Gonzalez et al., 2021).

The prevalence of chronic wounds is steadily increasing, especially in low- and middle-income countries, due to the rising incidence of diabetes mellitus, peripheral vascular disease, malnutrition, and limited access to modern healthcare. According to the World Health Organization (2022), the global prevalence of diabetic foot ulcers ranges from 4% to 10%, with developing nations contributing to a major proportion of these cases. Chronic wounds are associated with a high risk of infection, amputation, prolonged hospitalization, and decreased quality of life (Abdulrahim et al., 2023). These outcomes highlight the need for effective and accessible wound management strategies, particularly in resource-constrained healthcare systems.

Conventional treatments for chronic wounds, including debridement, antiseptic dressings, and synthetic wound healing agents, often come with limitations such as high cost, antibiotic resistance, and restricted availability in rural settings. These challenges have encouraged researchers and clinicians to explore natural-based alternatives that are more affordable, sustainable, and locally sourced (Sung et al., 2021). Natural agents such as honey, aloe vera, propolis, virgin coconut oil, and *Centella asiatica* have demonstrated promising effects in enhancing wound healing through their antimicrobial, anti-inflammatory, and antioxidant activities (Karadeniz et al., 2023; Witkowska et al., 2024).

Honey, one of the most studied natural substances, promotes autolytic debridement, reduces bacterial colonization, and accelerates granulation tissue formation (Moghazy et al., 2010; Kamaratos et al., 2014). Aloe vera gel contains polysaccharides and glycoproteins that stimulate fibroblast proliferation and collagen synthesis, which are essential for tissue regeneration (Hekmatpou et al., 2019). Similarly, propolis and virgin coconut oil have been recognized for their potent antimicrobial and moisturizing properties that facilitate epithelial repair (Afkhamizadeh et al., 2018; Sya'bani et al., 2020). In recent years, the advancement of nanotechnology and biopolymer hydrogels has further expanded the potential of natural products in chronic wound management, allowing improved stability, delivery, and bioavailability (Lopes et al., 2024).

In developing countries, the use of natural agents is not only a matter of tradition but also a practical response to limited resources and high medical costs. Many of these substances are easily accessible, culturally accepted, and have minimal side effects. Therefore, mapping the research trends and clinical evidence related to their use is

crucial for integrating these therapies into evidence-based nursing and wound care practices.

This scoping review aims to explore the trends and patterns of research on the use of natural agents for chronic wound care in developing countries from 2010 to 2024. The objectives are to identify the types of natural agents used, summarize their therapeutic outcomes, analyze their cost-effectiveness and safety, and highlight emerging innovations in their applications. Understanding these trends will help guide future nursing practices, promote affordable wound care interventions, and support global health equity through the utilization of locally available natural products.

## **OBJECTIVE**

This scoping review aims to identify and map trends in the use of natural agents for chronic wound care in developing countries from 2010 to 2024. Specifically, it aims to identify the types of natural agents used, summarize their therapeutic outcomes, evaluate their safety and cost-effectiveness, and highlight emerging innovations in their clinical applications.

## **METHODS**

### **Design**

This study employed a scoping review design to comprehensively explore and map the trends in the use of natural agents for chronic wound management in developing countries between 2010 and 2024. The scoping review was conducted based on the framework proposed by Arksey and O'Malley (2005), which is a structured and systematic process to summarize the breadth of evidence in a particular research area. The approach begins with the identification of a clear and objective research question, followed by an extensive search for relevant studies, selection of eligible literature, organization, and analysis of the findings. This design was chosen because it enables the exploration of various forms of evidence from multiple study designs, providing an overview of how natural-based therapies have been utilized and investigated for chronic wound healing, particularly in resource-limited settings. The review aims not only to map the existing evidence but also to highlight research gaps and potential directions for future nursing and clinical practice.

### **Search Methods**

The literature search was carried out using the PICO framework to define key concepts and formulate focused research questions on the use of natural agents for chronic wound care in developing countries. Boolean operators “AND” and “OR” were used to refine and connect search terms such as “natural agents,” “chronic wounds,” “developing countries,” “honey,” “aloe vera,” “propolis,” and “virgin coconut oil.” Relevant studies were identified through major databases, including PubMed, ScienceDirect, Scopus, and Google Scholar. The inclusion criteria consisted of full-text articles published between January 2010 and October 2024, written in English, and discussing the application of

natural-based products in wound management. Titles, abstracts, and keywords were screened to ensure alignment with the study's objectives.

**Table 1. PICO Search Strategy**

<b>P</b>	<b>I</b>	<b>C</b>	<b>O</b>
Patients with chronic wounds (diabetic foot ulcers, pressure ulcers, non-healing wounds) in developing countries	Application of natural agents (honey, aloe vera, propolis, virgin coconut oil, Centella asiatica, plant-based hydrogel)	Compared with conventional or synthetic wound dressings	Outcomes related to wound healing rate, granulation tissue formation, infection control, and cost-effectiveness

### Search Outcome

A total of 2,876 articles were identified from databases including Google Scholar, PubMed, ScienceDirect, and Scopus, as well as manual searches. Fifteen articles underwent extraction after screening and eligibility assessment. Several articles were excluded because they were only abstracts, not full text, focused on animal studies, or were unrelated to the use of natural agents in chronic wound care. Articles were limited to English and Indonesian publications from 2010 to 2024.

The results of article filtering obtained ten randomized controlled trials (RCTs), two systematic reviews, two narrative reviews, and one pilot clinical trial. Of the 15 studies reviewed (Table 2), research originated from several countries including Egypt, Greece, Vietnam, Belgium, Pakistan, Hong Kong, Iran, Indonesia, Poland, the Czech Republic, Turkey, and Portugal.

These studies focused on the application of natural agents such as honey, aloe vera, propolis, virgin coconut oil, Centella asiatica, and plant-based hydrogels in the management of chronic wounds, particularly diabetic foot ulcers and pressure ulcers. Most studies reported that natural-based dressings accelerated wound healing, improved granulation tissue formation, and reduced infection compared to conventional dressings.

Overall, the findings demonstrate a growing trend toward the use of evidence-based natural products that are effective, biocompatible, and affordable, making them suitable for implementation in developing countries and resource-limited healthcare settings.

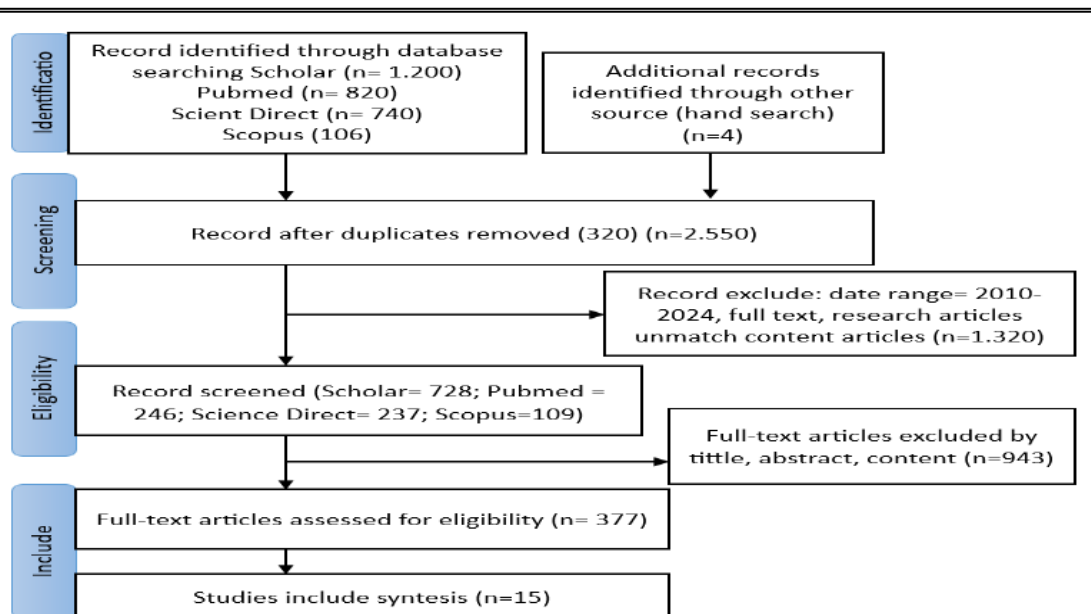


Figure 1: Prism Flow Diagram (Moher, 2009)

## Data Abstraction

Data abstraction was carried out for all articles that met the inclusion criteria. Each selected study was thoroughly reviewed, and essential information was extracted and organized in a structured matrix using Microsoft Word. The extracted data covered details such as the author's name, publication year, country of origin, article title, and methodological components. In addition, the main outcomes and key findings of each study were identified to capture similarities, variations, and overall trends in the use of natural agents for chronic

## RESULTS

A total of 2,876 records were initially identified through database and manual searches. Following screening and eligibility assessment, 15 studies met the inclusion criteria and were included in this scoping review (Figure 1). The characteristics and main findings of the included studies are summarized in Table 2.

The included studies comprised ten randomized controlled trials (RCTs), two systematic reviews, two narrative reviews, and one pilot clinical trial. The studies were conducted across several developing countries, including Egypt, Vietnam, Pakistan, Iran, Indonesia, and Turkey, as well as several developed countries such as Greece, Belgium, Hong Kong, Poland, the Czech Republic, and Portugal.

The findings indicate a clear research trend toward the increasing use of natural agents for chronic wound management. Honey was the most frequently investigated natural product, followed by aloe vera, propolis, virgin coconut oil, *Centella asiatica*, and plant-based hydrogels. The majority of studies focused on diabetic foot ulcers and pressure ulcers, reflecting the growing research interest in chronic wound conditions associated with diabetes and prolonged immobility.

Across the included studies, natural-based wound therapies consistently demonstrated positive clinical outcomes, including accelerated wound healing, enhanced granulation tissue formation, reduced infection, and improved healing compared with conventional dressings. Several studies also reported that these interventions were cost-effective, biocompatible, and feasible for implementation in resource-limited healthcare settings.

Overall, the evidence demonstrates an increasing trend in research on natural agents for chronic wound care, with expanding diversity in the types of natural products investigated and growing evidence supporting their effectiveness, safety, and potential integration into evidence-based wound management practices in developing countries.

**Table 2 Synthesis of Review Articles**

No.	Writer, Year	Title	Findings
1	Moghazy, AM, Shams, ME, Adly, OA, Abbas, AH, El-Badawy, MA, Elsakka, DM, Hassan, SA, Abdelmohsen, WS, Ali, OS, Mohamed, BA (2010)	The clinical and cost effectiveness of bee honey dressing in the treatment of diabetic foot ulcers.	Honey dressing significantly accelerates the healing of infected diabetic foot wounds compared to conventional dressings, reducing wound size, bacterial load, hospitalization time, and treatment costs.
2	Kamaratos, AV, Tzirogiannis, KN, Iraklianos, SA, Panoutsopoulos, GI, Kanellos, IE, Melidonis, A. (2012 / 2014)	Manuka honey-impregnated dressings in the treatment of neuropathic diabetic foot ulcers: a randomized controlled trial.	Manuka honey dressing accelerated healing time and increased the percentage of sterile wounds in patients with neuropathic DFUs; more effective than standard care.
3	Vandamme, L., Heyneman, A., Hoeksema, H., Verbelen, J., Monstrey, S. (2013)	Honey in modern wound care: a systematic review.	Reviews show that honey has broad antibacterial effects, accelerates granulation, epithelialization,

			and reduces inflammation in various types of wounds.
4	Dat, A.D., Poon, F., Pham, K.B., Doust, J. (2012)	Aloe vera for treating acute and chronic wounds.	Evidence for the effectiveness of Aloe vera on acute/chronic wounds is limited and the quality of research is low, although some studies have shown potential to accelerate healing.
5	Imran, M., Hussain, M., Baig, M.A., Mueen, M., Aslam, S., Iqbal, T. (2015)	Give honey-impregnated dressing: an effective treatment for diabetic foot ulcers.	Applying honey dressing accelerates wound shrinkage and shortens healing time compared to saline dressing on DFU.
6	Tsang, KK, Kwong, EWY, To, TS, Chung, JWY, Wong, TKS (2017)	A pilot randomized, controlled study of nanocrystalline silver, manuka honey, and conventional dressings in healing diabetic foot ulcers.	nAg and Manuka honey dressings reduced ulcer size more quickly and reduced infection rates compared to conventional dressings; nAg performed best, followed by honey.
7	Afkhamizadeh, M., Aboutorabi, R., Ravari, H., Yazdani, M., Ramezani, M. (2018)	Propolis as an alternative treatment for diabetic foot ulcers: a randomized controlled clinical trial.	Topical propolis accelerates the healing of diabetic ulcers with a significant reduction in wound area and healing time compared to standard of care.
8	Hekmatpou, D., Mehrabi, F., Rahzani, K., Aminiyan, A. (2019)	The review concluded that Aloe vera is	The review concluded that Aloe vera is effective in

		effective in increasing epithelialization, reducing pain, and accelerating healing in various chronic and acute wounds.	increasing epithelialization, reducing pain, and accelerating healing in various chronic and acute wounds.
9	Karimi, Z., Zare, M., Zarei, M., Heidari, M. (2019)	The effect of olive oil and honey mixture on wound healing in diabetic foot ulcers: a randomized clinical trial.	The combination of olive oil and honey increases the rate of wound healing and granulation tissue formation in DFU patients compared to standard care.
10	Sya'bani, NI, Kusuma, AH, Hartini, S. (2020)	Effect of virgin coconut oil massage on prevention of pressure ulcers in bedridden patients: a quasi-experimental study.	Application and massage with VCO prevents the occurrence of decubitus in bedridden patients by increasing skin moisture and elasticity.
11	Herman, A., Herman, AP (2023)	Herbal products in diabetic wound management: preclinical and clinical evidence and molecular mechanisms.	Various herbal products (honey, propolis, plant extracts) are effective in accelerating wound contraction and tissue regeneration through antioxidant and anti-inflammatory mechanisms.
12	Lopes, AI, Silva, AP, Rodrigues, CF (2024)	Plant-based hydrogels and films for wound healing: current advances and translational potential.	Plant-based hydrogels/films have shown great potential in accelerating cell migration, antibacterial activity, and improving wound moisture in preclinical and translational models.

13	Holubová, A., Bolehovská, R., Cerná, M., Fuchsová, D., Dolečková, M., Černý, J., et al. (2023)	Medical grade honey (L-Mesitran®) in the management of chronic infected diabetic foot ulcers: a prospective case-control study.	The use of L-Mesitran® (medical grade honey) reduces wound size, reduces pain, and reduces the need for systemic antibiotics in cases of chronic infected DFU.
14	Karadeniz, E.Y., Cihan, F.G., Ozturk, O., Uyanikgil, Y. (2023)	Efficacy of honey dressings in diabetic foot ulcers: a systematic review and meta-analysis.	Honey dressing significantly accelerated healing time, increased granulation tissue formation, and reduced pain compared to controls.
15	Witkowska, K., Chmielewska, Kaczmarczyk, M., Duda-Szymańska, J., Olszewska, M., Nowak, G. (2024)	The use of Centella asiatica in the treatment of burns and chronic wounds: a comprehensive review.	Centella asiatica accelerates epithelialization, increases collagen synthesis, and helps repair burns and chronic wounds.

## DISCUSSION

### **Theme 1. Effectiveness of Classic Natural Ingredients (2010–2015): Dominance of Honey and Aloe Vera**

During the 2010–2015 period, the use of natural agents for chronic wound care was predominantly characterized by honey and Aloe vera as the principal therapeutic options. Moghazy et al. (2010) and Kamaratos et al. (2012) reported that both clover honey and Manuka honey effectively accelerated granulation tissue formation, reduced wound size, and inhibited the growth of pathogenic bacteria, including *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Likewise, Dat et al. (2012), through a Cochrane Review, confirmed that Aloe vera promoted epithelialization in both acute and chronic wounds, although the overall quality of evidence remained moderate.

Imran et al. (2015) further demonstrated that combining honey with berry extract produced synergistic effects by accelerating wound contraction and reducing wound exudate. These findings indicate an early trend toward enhancing the therapeutic efficacy of conventional natural agents through combination approaches. Biologically, honey promotes wound healing through its osmotic activity, antioxidant properties, and stimulation of growth factors such as VEGF and TGF- $\beta$ , thereby enhancing angiogenesis. In contrast, Aloe vera functions primarily as a natural moisturizer with anti-inflammatory properties that modulate excessive inflammatory responses and create a favorable environment for tissue repair.

From a nursing perspective, this trend demonstrates that the clinical use of locally available natural agents, particularly honey and Aloe vera, provides an effective and affordable alternative for chronic wound management in developing countries. Their accessibility and relatively low cost make them particularly suitable for resource-limited healthcare settings. However, most of the available evidence originates from studies with relatively small sample sizes and methodological limitations, including inadequate randomization and blinding. Therefore, despite the consistently positive therapeutic outcomes reported by Moghazy et al. (2010), Kamaratos et al. (2012), Dat et al. (2012), and Imran et al. (2015), the broader integration of these natural agents into nursing practice requires standardized clinical protocols to ensure safe, effective, and consistent application across both hospital and community care settings.

### **Theme 2. Herbal Diversification and Combination (2016–2020): Shifting from Monotherapy to Polyformulation**

During the 2016–2020 period, the use of natural agents for chronic wound care evolved from single-agent therapies toward combination formulations and multifunctional bioactive products. This transition reflects an increasing emphasis on enhancing therapeutic effectiveness by integrating natural compounds with complementary antimicrobial and regenerative properties. Tsang et al. (2017) demonstrated that a combination of Manuka honey and nano-silver (nAg) functioned as an effective antimicrobial dressing, significantly reducing

infection and accelerating the healing of diabetic foot ulcers. Similarly, Afkhamizadeh et al. (2018) reported that topical propolis promoted granulation tissue formation and significantly reduced wound size. Karimi et al. (2019) further showed that a combination of olive oil and honey enhanced tissue granulation and accelerated epithelialization in patients with diabetic foot ulcers through antioxidant activity and improved microcirculation.

In addition to combination therapies, the clinical use of established natural agents continued to expand. Hekmatpou et al. (2019), through a systematic review of 25 clinical trials, confirmed that Aloe vera remained a valuable multifunctional therapeutic agent capable of reducing inflammation and promoting tissue regeneration. Likewise, Sya'bani et al. (2020) demonstrated that virgin coconut oil (VCO) effectively prevented pressure ulcers by maintaining skin hydration and inhibiting the growth of Gram-positive bacteria. These findings indicate that the use of natural agents during this period became increasingly diverse, extending beyond traditional wound healing applications to include preventive and supportive wound care strategies.

From a nursing perspective, this trend reflects a shift in clinical practice from conventional wound treatment toward more comprehensive, patient-centered wound management. The increasing diversity of natural agents requires nurses to evaluate the safety, dosage, formulation compatibility, and clinical indications of each intervention before implementation. Furthermore, selecting appropriate natural therapies should be supported by evidence-based clinical decision-making to optimize patient outcomes while minimizing potential risks. Nevertheless, standardized nursing protocols regarding preparation methods, dosage consistency, application techniques, and aseptic procedures remain limited, highlighting the need for the development of evidence-based clinical guidelines to support the safe integration of natural agents into routine wound care practice.

### **Theme 3. Integration of Natural Materials with Innovative Nursing Approaches (2021–2024)**

During the 2021–2024 period, the use of natural agents for chronic wound care advanced through their integration with modern wound management technologies and evidence-based nursing approaches. This phase was characterized by the incorporation of bioactive natural compounds into innovative therapeutic formulations designed to enhance wound healing while improving patient safety and clinical outcomes. Herman and Herman (2023) reported that herbal bioactive compounds, including flavonoids and polyphenols, promote the expression of VEGF, TGF- $\beta$ , and type I collagen genes in diabetic wounds, thereby accelerating the proliferative and remodeling phases of tissue repair. Similarly, Holubová et al. (2023) demonstrated that medical honey (L-Mesitran®) reduced antibiotic requirements and alleviated pain in patients with chronic wounds, highlighting its potential contribution to antimicrobial stewardship and the prevention of antibiotic resistance.

The clinical application of natural agents also expanded toward advanced wound care products. Karadeniz et al. (2023), through a meta-analysis, reported that honey-based dressings reduced wound healing time by up to 30% compared with conventional dressings. Lopes et al.

(2024) described the development of plant-based hydrogels enriched with herbal extracts that provide antimicrobial activity, maintain an optimal moist wound environment, and exhibit high biocompatibility. In addition, Witkowska et al. (2024) demonstrated that *Centella asiatica* enhanced collagen synthesis and epithelialization in chronic wounds and burn injuries. These findings indicate a continuing trend toward integrating natural agents with advanced biomaterials and modern wound dressing technologies to improve therapeutic effectiveness.

From a nursing perspective, this trend reflects the expanding role of nurses in implementing evidence-based natural therapies within contemporary wound management. The increasing use of herbal-infused dressings and bioactive wound care products requires nurses to understand sterilization procedures, appropriate application techniques, contact time, and the potential risk of local adverse reactions. Furthermore, the integration of biologically based wound management into nursing education and clinical training is essential to ensure that natural-agent therapies are applied safely, scientifically, and consistently across diverse healthcare settings.

#### **Theme 4. Local Wisdom, Safety, and Ethics in Using Natural Materials**

The use of natural agents for chronic wound care in developing countries is influenced not only by their demonstrated therapeutic effectiveness but also by their cultural acceptability, local availability, and economic affordability. This trend reflects the integration of traditional knowledge with evidence-based nursing practice to improve access to wound care in resource-limited settings. Putri et al. (2020) reported that the use of Kalimantan forest honey and papaya sap in Sumatra represents the incorporation of local wisdom into community-based wound management. Similarly, Tamba et al. (2021) and Mwangi et al. (2022) emphasized that the utilization of locally available natural agents can strengthen community-based wound care, promote patient self-management, and enhance community participation in maintaining wound health.

Despite these advantages, the expanding use of natural agents also raises important concerns regarding product standardization, safety, and ethical practice. Alam et al. (2018) highlighted that variations in extraction methods, dosage, and formulation contributed to inconsistent therapeutic outcomes across studies. In addition, Roslan et al. (2020) reported that certain natural agents, particularly propolis and essential oils, may induce allergic reactions in susceptible individuals. These findings indicate that although natural agents offer considerable clinical potential, their application should be guided by standardized preparation methods and careful patient assessment.

From a nursing perspective, the increasing use of natural agents requires nurses to balance clinical effectiveness with patient safety and professional accountability. Prior to implementing natural-agent therapies, nurses should conduct appropriate sensitivity assessments, provide patient education regarding proper use, and monitor for potential adverse reactions. Furthermore, ethical principles including informed consent, accurate clinical documentation, and respect for patient preferences should be consistently maintained to ensure that natural-agent interventions are implemented safely, ethically, and in accordance with evidence-based

nursing practice.

## **Theme 5. Implications and Directions for Future Nursing Research**

The synthesis of the 15 included studies demonstrates that the use of natural agents for chronic wound care has evolved into an evidence-based, innovative, and sustainable approach to nursing practice. Across the reviewed studies, natural agents consistently showed therapeutic benefits, including enhanced wound healing, reduced infection, improved tissue regeneration, and cost-effectiveness, making them particularly relevant for resource-limited healthcare settings. Consistent with these findings, WHO (2022) recommends integrating nurse-led wound care interventions that incorporate evidence-based natural agents to improve access to affordable and effective wound management in developing countries.

Despite the promising clinical evidence, the continued integration of natural agents into routine nursing practice requires further strengthening of the evidence base. Future studies should prioritize large-scale randomized controlled trials, standardized formulations, dosage optimization, and comprehensive safety evaluations to improve the quality and consistency of clinical evidence. In addition, interdisciplinary collaboration among nurses, pharmacists, biomedical scientists, and wound care specialists will be essential to facilitate the development, evaluation, and implementation of standardized natural-agent therapies in clinical practice.

From a nursing perspective, the increasing use of natural agents presents opportunities for nurses to lead evidence-based innovations in wound management across primary, secondary, and community healthcare settings. Nurses working in primary healthcare facilities, including community health centers (Puskesmas), are strategically positioned to promote the safe implementation of natural-agent therapies through patient education, clinical assessment, and continuous monitoring of treatment outcomes. Furthermore, strengthening translational nursing research will be crucial to ensure that innovations involving natural agents are effectively translated into clinical practice and contribute to improving patients' quality of life.

Overall, the trends observed between 2010 and 2024 indicate a progressive evolution in the use of natural agents for chronic wound care, from conventional natural remedies toward evidence-based and technologically enhanced therapeutic approaches. These findings highlight the growing role of natural agents as integral components of sustainable, patient-centered, and evidence-based nursing practice, particularly in developing countries where accessible and cost-effective wound care interventions remain a healthcare priority.

## **CONCLUSION**

This scoping review from 15 article demonstrates a clear evolution in the use of natural agents for chronic wound care between 2010 and 2024. During the early period, honey and *Aloe vera* were the predominant natural agents, demonstrating effectiveness in promoting granulation tissue formation, reducing bacterial growth, and accelerating epithelialization. Subsequently, the use of natural agents expanded toward combination therapies incorporating propolis, virgin coconut oil, and olive oil–honey formulations, reflecting a transition from single-agent therapies to synergistic bioactive approaches. More recently, natural agents have

been integrated with advanced wound care technologies, including herbal-infused dressings and plant-based hydrogels, to enhance antimicrobial activity, tissue regeneration, and overall wound healing outcomes. Overall, the findings indicate that natural agents represent effective, affordable, and evidence-based therapeutic options for chronic wound management, with particular relevance for nursing practice in developing countries and other resource-limited healthcare settings.

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#### **CONFLICTS OF INTEREST**

None

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## THE EFFECTIVENESS OF TERA EXERCISE ON BLOOD SUGAR LEVELS IN TYPE 2 DM SUFFERERS

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### ABSTRACT

**Background:** Blood sugar levels in type 2 DM sufferers tend to increase mildly but progressively because they are low self-care management in people with type 2 DM. One non-pharmacological therapy that can help blood sugar levels remain stable is tera exercise.

**Purpose:** This study aimed to analyze the effectiveness of tera exercise on blood sugar levels in type 2 DM sufferers at the Wonokromo Community Health Center.

**Methods:** The design of this study is RCT (Randomized Controlled Trial). The number of samples for each group was 24 in the control group and 24 in the intervention group. The study was conducted at the Wonokromo Community Health Center from July – 4 August times, every Tuesday and Friday for 2 weeks, with a duration of 45 minutes, using the technique of Simple Random Sampling. The independent variable in this study is physical exercise, and the dependent variable is blood sugar levels. The instrument in this study was the tera gymnastics SOP and blood sugar level observation sheet. The statistical test used is paired t-test and independent t-test with a significance level of  $\alpha = 0.05$ .

**Results:** The test result obtained a p-value of 0.000, which means that there is a significant difference in blood sugar levels before and after participating in tera exercise activities. Test results independent t-test A significant value was obtained of 0.034 ( $p < 0.05$ ), which means tera exercise influences the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center

**Conclusion:** Tera exercise effectively reduces blood sugar levels in type 2 DM sufferers at the Wonokromo Community Health Center. The term exercise is hoped to be used as an independent intervention in the elderly posyandu program at the Wonokromo Community Health Center

**Keywords:** Blood sugar; Diabetes mellitus; Tera exercise.

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## BACKGROUND

Diabetes mellitus is one of the main health problems in society due to low levels of health self-care management of diabetes sufferers themselves. There are still many diabetes sufferers who pay little attention to their diet by consuming excessive sugar, rarely doing physical activity, rarely checking their blood sugar levels, not paying attention to caring for their feet, and not following doctor's recommendations for taking medication (Siwi Handayani et al., 2013).

Case diabetes mellitus in 2021, it is estimated that 1 in 10 or 537 million adults will experience diabetes mellitus. This number is projected to increase to 63 million in 2030 and 783 million in 2045 (Webber, 2021). According to (Indonesian Ministry of Health, 2019) there are 10.7 million cases of diabetes mellitus in Indonesia. Meanwhile, in the East Java region there were 875,745 diabetes mellitus sufferers in 2020 (East Java Provincial Health Service, 2020).

Regional Health Research Data (RISKESDAS) shows that the prevalence of diabetes sufferers in East Java province is in the top 10 in Indonesia with a prevalence of 6.8% (Riskasdas Jatim, 2018). Based on the results of initial data collection at the Wonokromo Community Health Center, there were 270 people suffering from diabetes mellitus from January – May 2023. The results of a preliminary study conducted at the Wonokromo Community Health Center through interviews with diabetes sufferers in May 2023 showed that 7 out of 15 diabetes sufferers had almost no do light exercise such as walking or gymnastics to control blood sugar levels and prevent complications of diabetes mellitus.

Complications due to high blood sugar levels in diabetes mellitus sufferers occur in the blood vessels in the body. If they cannot be controlled, they can cause complications in all organs of the body, namely microvascular complications, including those that can affect the nerves, kidney organs, and can cause kidney failure. Meanwhile, macrovascular complications can affect the blood vessels of the brain (stroke) which can also cause disability and even death (Lestari et al., 2021).

Some light physical exercises that DM sufferers can do include diabetes exercise, aerobic exercise, yoga and tera exercise. Tera gymnastics is a type of physical and mental exercise, which combines the movement of body parts with breathing techniques and rhythms through focused thinking which is carried out regularly, harmoniously, correctly and continuously. Tera exercise can directly cause an increase in glucose use by active muscles so that there are more insulin receptors which will have an effect on reducing blood glucose in diabetes sufferers (Umiyah, 2022).

**Objective(s):** This research aims to determine the effectiveness of tera exercise on blood sugar levels in type 2 DM sufferers at the Wonokromo Community Health Center.

## METHODS

### *Study Design*

The study used a quasi-experimental, with plans for pre-test and post-test with the control group. In this design, the treatment group did tera exercises, while the control group did not do tera exercises.

### *Setting*

The sample in this study was type 2 DM sufferers at the Wonokromo Community Health Center..

### *Research Subject*

The sample in this study was type 2 DM sufferers at the Wonokromo Community Health Center. The study criteria are type 2 DM sufferers who are willing to be respondents and do not have accompanying complications. Inclusion criteria in this study were type 2 DM patients willing to be respondents, DM patients aged 40 - 70 years, and patients who had suffered from DM for 2 - 5 years. The exclusion criteria include patients who have had hearing loss since birth, patients who have mental disorders, and DM patients with complications

### *Instruments*

The independent variable in this study is physical exercise, while the dependent variable is blood sugar levels. The researchers collected data using tera exercise SOP and blood sugar level observation sheets. They used a glucometer with a strip test and a needle to measure blood sugar levels and tera exercise procedures to carry out an exercise.

### *Intervention (this heading is only for experimental studies)*

The intervention in this study is tera exercise in the treatment group, which will be carried out for 1 week twice on Tuesdays and Fridays for 45 minutes over 2 weeks by a certified exercise instructor. Meanwhile, in the control group, DM exercises will be carried out with a frequency of 2x per week for 2 weeks on Wednesdays and Saturdays. After 2 weeks of intervention on type 2 DM sufferers, blood sugar levels were measured again in 2 groups, namely the treatment group, whose blood sugar levels were measured after doing tera exercises, while in the control group, blood sugar levels were measured after giving diabetes exercises. The results of measuring blood sugar levels are recorded on the observation sheet

### *Data Analysis*

The data collected is corrected again through observation sheets, and then the effectiveness of tera exercise on blood sugar levels for respondents before (pre) and after (post) performing tera exercises is assessed using a statistically paired t-test and independent t-test with a significance level of  $\alpha < 0.05$ .

### *Ethical Consideration*

This research has been declared ethically appropriate under No.095/010/VII/EC/KEP/LCBL/2025

## **RESULTS**

The results of the research are explained in the information below:

Table 1. Frequency distribution of respondent characteristics based on gender

Category	Treatment Group		Control Group		P value
	f	(%)	f	(%)	
<b>Gender</b>					
Man	4	16.7	9	37.5	0.012
Woman	20	83.3	15	62.5	
<b>Age</b>					
Middle	13	54.2	14	58.3	0.027
Advanced	11	45.8	10	41.7	
Old Age	0	0	0	0	
<b>Education</b>					
					0.034

Elementary	8	33.3	8	33.3
Intermediate	7	29.2	3	12.5
High	9	37.5	13	54.2

Table 1 above shows that almost all of the genders in the treatment group (83.3%) were female with 20 respondents, and in the control group, the majority (62.5%) were female with 15 respondents. The age characteristics of the treatment group were mostly (54.2%) in the middle age category (45 - 59 years) with 13 respondents and in the control group the majority (58.3%) were in the middle age category (45 - 59 years old) as many as 14 respondents. It can be seen that the characteristics of respondents based on education level in the treatment group were almost half (37.5%) in the higher education category (D3/Bachelor's degree), with nine respondents. In the control group, the majority (54.2%) were in the education category. High as many as 13 respondents.

Table 2 Blood sugar levels before doing tera exercise in the treatment group and control group

Blood Sugar Levels	group			
	Mean	SD	Min-Mak	N
Pre-treatment group	258	28	190-426	24
Pre-control group	274.7	22.6	157-498	24

In table 2 it can be seen that the average blood sugar level in the treatment group was 258mg/dL with a minimum value of 190mg/dL and a maximum value of 426mg/dL. The control group had an average blood sugar level of 274.7 mg/dL with a minimum value of 157 mg/dL and a maximum value of 498 mg/dL.

Table 3 Blood sugar levels after doing tera exercise in the treatment group and control group

Blood Sugar Levels	Mean	SD	Min-Mak	N
Post treatment group	122.2	28.6	100 - 152	24
Post control group	139.2	22.5	92 - 200	24

In table 3 it can be seen that the average blood sugar level after tera exercise in the treatment group was 122.2 mg/dL with a minimum value of 100 mg/dL and a maximum value of 152 mg/dL. The control group had an average blood sugar level of 139.2 mg/dL with a minimum value of 92 mg/dL and a maximum value of 200 mg/dL.

Table 4 Test Results Paired t test effectiveness of tera exercise on blood sugar levels in type 2 DM sufferers

Variable	Group	Mean	Mean difference	P value
Pre test	Treatment group	258	16.7	0.000

	Control group	274.7		
<b>Post test</b>	Treatment group	122.2	17.0	0.000
	Control group	139.2		

Bivariate analysis results with test t-paired obtained p-value 0.000, this means that there is a difference in blood sugar levels between before and after participating in tera exercise activities. Likewise, in the control group the results of the paired t-test showed p-value 0.000, this means that there is a significant difference in blood sugar levels between before and after participating in diabetes exercise activities.

Table 5 Differences in blood sugar levels between the treatment group and the control group

	Df	t	Mean delta	Sig. (2 tailed)
Post test treatment	48	3.281	122.2	<b>.034</b>
Post Test Control			139.2	

Based on table 7 test results independent t- test obtained a significance value of 0.034 ( $p < 0.05$ ) where the p value  $< 0.05$  then  $H_0$  is rejected and  $H_1$  accepted, which means that there is an effect of tera exercise on the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center.

## DISCUSSION

The results of the study showed that the average blood sugar level of the treatment group after doing tera exercise 4 times, which was done 2 times a week for 2 weeks, was 122.2 mg/dL with the lowest value being 100 mg/dL and the highest value being 152 mg/dL. The control group had an average value of 139.2 mg/dL, the lowest blood sugar level was 92 mg/dL and the highest blood sugar level was 200 mg/dL. From these results it can be concluded 48 that there was a significant decrease, shown by a decrease of 135.8 mg/dL in the treatment group and 135.5 mg/dL in the control group. From these results it can be seen that there is no significant difference between the treatment group and the control group in terms of the ability to reduce blood sugar levels.

The benefits of exercise for diabetes mellitus sufferers include reducing blood glucose levels, preventing obesity by burning the body's calories so that blood glucose can be used for energy, thereby lowering blood sugar levels. The results of research that support this theory are that diabetes exercise can cause a decrease in blood glucose levels, this is because when doing physical exercise there is an increase in glucose use by the muscles, many capillary beds are open, so that in turn there is an increase in blood flow and more insulin receptors are available and more active in lowering glucose (Lindawati & Wasludin, 2019).

Tera exercise is an aerobic exercise (with oxygen) because this exercise has an element of breathing (Novitasari et al., 2013). Tera exercise is carried out routinely 3x a week with a duration of 60 minutes so that it has an effect on reducing blood glucose levels (Ata et al., 2017). This is not in line with this research because the researchers only did tera exercises 2x a week with a duration of 45 minutes. Even though this exercise is only done 4 times over 2 weeks with a duration of 30 – 45 minutes, this exercise still has an effect on reducing blood glucose levels at any time. An increase in blood sugar levels can occur due to influencing risk factors, such as the respondent's failure to perform exercise movements (Pratiwi et al., 2020)

This research is in line with research conducted by (Pratiwi & Muf seenin, 2021) regarding the effect of tera exercise on blood pressure and sugar levels in elderly people with diabetes mellitus at PSTW Nirwana Puri Samarinda. Where after the tera exercise intervention was carried out routinely twice a week with a duration of 45 minutes for the posttest value, the average sugar level value was 118.38 with the lowest blood sugar level being 79 mmHg and the highest being 394 mmHg.

The results show that there is a change in blood glucose levels after doing exercise, this is due to the use of energy burned by cells that use blood glucose using insulin. A person who does sports activities will have a catalytic effect on insulin so that blood glucose in the body is easily burned by cells. In contrast to the situation of people who experience high insulin resistance, glucose in the body will be stored in the form of fat and will be excreted in the form of urine from the body.

### **Analysis of the Effectiveness of Tera Exercise on Blood Sugar Levels in DM Sufferers Type 2**

The results of the study showed that both the treatment group and the control group experienced a significant reduction in blood sugar levels. This is proven by the results of the paired t-test in the treatment group and the control group, which obtained a p-value of 0.000, this means that there is a significant difference in blood sugar levels between before and after participating in tera exercise activities.

Physical exercise such as tera gymnastics that is done regularly can reduce blood sugar levels, after exercise glucose increases by at least 40%. During tera exercise the need for energy is much greater than during resting conditions so that the use of glucose in the blood also increases. In other words, because glucose in the muscles is burned by physical activity to produce energy, ultimately the glucose 52 in the blood decreases (Novitasari et al., 2013). Apart from that, tera exercise can also control blood pressure, this is because there are breathing movements that make the body more relaxed and dilate the capillaries so that it can increase blood circulation.

This research is in line with research conducted by (Pratiwi & Muf seenin, 2021). Where the results of the Wilcoxon test obtained significance (p) value = 0.000 or  $\leq 0.05$ . The hypothesis decision taken is that  $H_a$  is accepted, which means there is a significant influence on blood glucose levels before and after doing tera exercise.

In this research test results independent t – test obtained a significant value of 0.034 ( $p < 0.05$ ) based on these results because the p-value  $< 0.05$  then  $H_0$  rejected and  $H_1$  accepted, which means that there is effectiveness of Tera exercise on the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center.

In this study, it was found that several respondents experienced a less significant decrease in blood sugar levels. According to researchers, this is because apart from doing physical exercise, patients with DM are also required to maintain their diet. Tera exercise can be used as a non-pharmacological therapy to reduce and control blood glucose levels. Controlling blood glucose levels is important to avoid disease complications. Researchers strongly support that respondents can always control their blood glucose levels by exercising diligently, maintaining their diet and getting enough rest.

The results of research on the application of the 4 pillars of diabetes mellitus control with average blood sugar levels show that education, eating management, exercise and medication compliance have an impact on stabilizing blood glucose and improving quality of life. Exercise or physical exercise is one way for diabetes mellitus sufferers to control blood sugar levels within normal limits, because by exercising, it can increase the use of glucose by muscles, which can directly cause a decrease in blood sugar. The type of exercise

recommended for diabetes mellitus sufferers is aerobic exercise which can improve the function and efficiency of the body's metabolism. Aerobic sports such as jogging, swimming, group exercise and cycling are appropriate for diabetes mellitus sufferers because they use the large muscles in the body and improve the work of the cardiovascular system.

## **CONCLUSION**

Respondents in the treatment group before doing tera exercise had blood sugar levels in the poor category with a mean of 258 mg/dL and after doing tera exercise had blood sugar levels in the good category with a mean of 122.2 mg/dL. Respondents in the control group before doing diabetes exercise had blood sugar levels in the poor category with a mean of 274.7 mg/dL and after doing diabetes exercise had blood sugar levels in the good category with a mean of 139.2 mg/dL. There is effectiveness of tera exercise on the blood sugar levels of type 2 DM patients at the Wonokromo Community Health Center.

To improve the quality of Puskesmas services, especially for DM patients, it is hoped that tera exercise can be used as one of the superior services and become an SOP in the diabetes management program. Future researchers should be able to carry out further research on other factors such as (history of DM, obesity, long suffering from DM and high blood pressure) which are associated with the incidence of type 2 DM.

## **SUGGESTIONS**

The greater a person's beliefs mixed with the relaxation response. the stronger the relaxation effect obtained. Nurses can implement this intervention in meeting psychological needs.

## **ACKNOWLEDGMENT**

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## **DECLARATION OF CONFLICTING INTEREST**

The is no conflict interest in this article.

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## THE EFFECTIVENESS OF TAI CHI ON STRESS LEVELS IN OLDER ADULTS

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### ABSTRACT

**Background:** Stress is one of the most common psychological problems among older adults and contributes to various health disorders, such as hypertension, sleep disturbances, cognitive decline, and an increased risk of mortality. Chronic stress in older adults is also known to be closely associated with a decline in psychological well-being and quality of life. In addition, stress can exacerbate the degenerative diseases commonly experienced by older adults. Research shows that stress contributes to the onset of chronic diseases such as hypertension in older adults, making it a complex and multidimensional health issue

**Purpose:** To analyze the effectiveness of Tai Chi exercises on stress levels in older adults

**Methods:** A pre-experimental, single-group pretest-posttest design was conducted on 28 older adults using the PSS-10. The Tai Chi intervention consisted of 40-minute sessions, three times per week for 21 days. Analysis was performed using a paired t-test based on the study results

**Results:** The mean stress score decreased from  $15.96 \pm 5.71$  to  $12.46 \pm 3.47$ . The paired t-test revealed a statistically significant difference ( $t = 4.274$ ;  $p < 0.001$ ).

**Conclusion:** Tai Chi is effective in reducing stress levels in the elderly and should be considered as a community nursing intervention.

**Keywords:** Elderly; Stress; Tai Chi.

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## BACKGROUND

The natural aging process brings about various changes physical, psychological, and social that increase vulnerability to mental health disorders, particularly stress (Yang et al., 2024). Stress in older adults is often triggered by a decline in physical function, loss of social roles, chronic illness, and social isolation, which, if not properly managed, can significantly reduce quality of life (Wu et al., 2024)

Stress is one of the most common psychological problems among older adults and contributes to various health issues, such as hypertension, sleep disorders, cognitive decline, and an increased risk of mortality (Kemenkes & Cirebon, 2021). Chronic stress in older adults is also known to be closely associated with a decline in psychological well-being and quality of life (Yang et al., 2024). Additionally, stress can exacerbate degenerative diseases commonly experienced by older adults. Research shows that stress contributes to the onset of chronic diseases such as hypertension in older adults, making it a complex and multidimensional health issue (Kemenkes & Cirebon, 2021).

Globally, the prevalence of mental disorders among older adults is quite high and continues to rise in tandem with the growth of the older adult population. The World Health Organization reports that approximately 14% of older adults worldwide experience mental disorders, with depression and anxiety being the most prevalent conditions (World Health Organization, 2023). Furthermore, recent global studies indicate that the prevalence of stress, anxiety, and depression among older adults can reach 30–50%, and is even higher among those living alone, experiencing functional limitations, or living with chronic illnesses (Wu et al., 2024). In Indonesia, the number of older adults continues to rise significantly. Data from the Central Statistics Agency (BPS) indicate that the proportion of older adults reached approximately 10.48% of the total population in 2022 and is projected to continue rising over the coming decades (BPS, 2022). In line with this, results from the Basic Health Research (Riskesdas) indicate that the prevalence of emotional and mental disorders among individuals aged  $\geq 15$  years reached 9.8%, with higher rates observed in the elderly population (Indonesian Ministry of Health, 2018; further confirmed in the latest health report). Studies in several regions of Indonesia also report that approximately 35–55% of older adults experience mild to severe stress, particularly among those with chronic illnesses and limitations in daily activities (Kemenkes & Cirebon, 2021).

If stress is not managed effectively, it can develop into chronic stress, which has farreaching effects on the health of older adults. Physiologically, chronic stress can increase cortisol levels, which contribute to elevated blood pressure, a weakened immune system, and the worsening of chronic conditions such as hypertension and cardiovascular disease (Salini, 2025). In addition, stress also causes sleep disturbances, fatigue, and accelerates the decline in overall health. From a psychological perspective, prolonged stress contributes to the onset of anxiety disorders, depression, and cognitive decline, such as memory and concentration problems. International research indicates that older adults with chronic stress are at higher risk of experiencing cognitive decline and a reduced quality of life (Park et al., 2023). This aligns with research in Indonesia showing that older adults with high stress levels tend to experience a reduced quality of life and increased dependence in daily activities (Munawaroh et al., 2024).

Stress management in older adults requires a comprehensive approach that encompasses promotive, preventive, and rehabilitative aspects, with an emphasis on non-pharmacological interventions that are safe, easy to implement, and evidence based. One intervention that has proven effective is mind-body exercise, such as Tai Chi, which integrates physical movement, breathing techniques, and mental concentration. Physiologically, Tai Chi reduces activation of the sympathetic nervous system and increases parasympathetic activity, thereby helping to lower stress hormones such as cortisol and promote physical relaxation. Experimental studies show that Tai Chi significantly reduces stress levels in older adults, with a meaningful decrease in stress scores following regular practice (Subramanian et al., 2024). Furthermore, Tai Chi also offers long-term benefits, not only in reducing stress but also in improving cognitive function and balance, as well as preventing physical decline in older adults (Iqhrammullah & Yufika, 2024). This demonstrates that Tai Chi is a holistic intervention capable of comprehensively improving the quality of life for older adults.

The urgency of this study stems from the fact that treatment remains dominated by pharmacological therapy, and the limited availability of non-pharmacological interventions in the community indicates a gap in nursing practice. Tai Chi, as a safe and easily implemented mind-body intervention, has the potential to be an effective solution; however, empirical evidence in the Indonesian context remains limited, making this study important. This study is expected to serve as the basis for the development of evidence-based nursing interventions to reduce stress in older adults, particularly through the implementation of Tai Chi at the community level

## **OBJECTIVE**

This study aims to analyze the effectiveness of Tai Chi in reducing stress levels among older adults. Specifically, this study aims to identify differences in stress levels before and after the Tai Chi intervention among older adults.

## **METHODS**

This study was conducted in Balonggarut Village, Krembung Subdistrict, Sidoarjo Regency, East Java, in January 2026. The study employed a quantitative pre-experimental method with a one-group pretest-posttest design, involving 30 older adults selected through simple random sampling. A total of 28 older adults met the inclusion criteria, namely: being over 50 years of age, having no history of heart, muscle, or mental health problems, and having never practiced tai chi before (Dinani et al., 2019).

The intervention, consisting of tai chi exercises, was administered by the researcher for 40 minutes, three times a week, over a period of 21 days. Data collection was conducted in two stages: a pretest before the intervention and a posttest after the intervention was completed. During the pretest stage, data were collected to determine the initial condition of the research subjects before they received the treatment. After the intervention was carried out, the post-test phase was conducted to evaluate the changes or effects resulting from the intervention. Prior to the 21-day intervention, the researcher administered an initial pre-test and a final post-test using the 10-item Perceived Stress Scale (PSS-10) questionnaire developed by Sheldon Cohen in 1983. The scale for each PSS item ranges from 0 to 4, with a score of 0 meaning "Never Feel" and a score of 4 meaning "Very Often Feel." To obtain the total perceived stress score, the scores for each PSS item are summed, taking into account the positive items (items 1, 3, 4, 5, 7, 8, and 9) and the negative items (items 2, 6, and 10). The positive items are summed according to their assigned scale values, while the negative items

are summed by reversing their scale values.  
 Perceived Stress Scale (PSS-10) Measurement tool.

No	Question	0	1	2	3	4
1	Over the past month, how often have you gotten angry over something unexpected?	0	1	2	3	4
2	Over the past month, how often have you felt unable to control the important things in your life?	0	1	2	3	4
3	Over the past month, how often have you felt anxious and stressed?	0	1	2	3	4
4	Over the past month, how often have you felt confident in your ability to handle personal problems?	0	1	2	3	4
5	Over the past month, how often have you felt that everything that happened went according to your expectations?	0	1	2	3	4
6	Over the past month, how often have you felt unable to complete the tasks you needed to do?	0	1	2	3	4
7	Over the past month, how often have you been able to control your irritability in your daily life?	0	1	2	3	4
8	Over the past month, how often have you felt more capable of handling problems compared to others?	0	1	2	3	4
9	Over the past month, how often have you gotten angry because of problems you couldn't control?	0	1	2	3	4
10	Over the past month, how often have you felt overwhelmed by difficulties to the point that you were unable to cope?	0	1	2	3	4
	<b>Score</b>					

Source (Cohen in (Salfia, 2019)

Tai Chi exercises follow standard operating procedures (SOPs). Tai Chi is a form of Chinese martial arts that consists of meditation exercises breathing techniques, and a combination of martial arts movements such as circular motions, gentle stretches, and balanced body postures (Serikali, 2006). The goals of Tai Chi are (1) to reduce anxiety and depression, (2) to improve sleep quality, (3) to improve balance, flexibility, and muscle strength, (4) to reduce the risk of falls, (5) to maintain the highest possible quality of life, (6) Stabilizing blood pressure, (7) Preventing osteoporosis (Faula & Rhosma, 2023). The tai chi sessions are held at the Balonggarut Village Hall in Krembung Subdistrict, Sidoarjo Regency, East Java. Each session lasts approximately 40 minutes, three times a week for 21 days.

## RESULTS

### Univariate Analysis

Table 1 Frequency distribution of respondent data based on age in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, in January 2026

Age	Frequency	Percentage (%)
45 - 59 tahun	3	11%
60 - 69 tahun	11	39%
> 70 tahun	14	50%
<b>Total</b>	<b>28</b>	<b>100%</b>

Based on Table 1 regarding respondent characteristics by age, it was found that the largest group of respondents was those aged over 70 years, consisting of 14 older adults, representing 50% of the total and falling into the high-risk elderly group. Age is a factor that influences stress levels among older adults.

Table 2: Frequency Distribution of Respondent Data by Gender in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, January 2026

Gender	Frequency	Percentage (%)
Male	3	11 %
Female	25	89%
<b>Total</b>	<b>28</b>	<b>100%</b>

Based on Table 2 regarding gender, the results show that the majority of respondents were female, totaling 25 elderly individuals, representing 89%

Table 3 Frequency Distribution of Respondent Data Based on Educational Level in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, January 2026

Educational Level	Frequency	Percentage (%)
Elementary School	22	78%
Junior High School	2	7%
High School	1	4%
No schooling	3	11%
<b>Total</b>	<b>28</b>	<b>100%</b>

### Bivariat Analysis

Table 1: Frequency distribution of respondents' data based on stress levels among the elderly before the Tai Chi exercise intervention in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, in January 2026

Stress Level	Frequency	Percentage (%)
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Low	8	28,6%
Moderate	20	71,4%
High	0	0%
<b>Total</b>	<b>28</b>	<b>100%</b>

Based on Table 1, it was found that the stress levels among the elderly before receiving the Tai Chi exercise intervention were predominantly in the moderate stress category, with 20 elderly individuals (71.4%)

Table 2 Frequency Distribution of Respondent Data Based on Stress Levels Among the Elderly After Receiving Tai Chi Exercise in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, January 2026

Stress Level	Frequency	Percentage (%)
Low	18	64.3%
Moderate	10	35.7%
High	0	0%
<b>Total</b>	<b>28</b>	<b>100%</b>

Based on Table 2, it was found that the stress levels of the elderly after receiving the Tai Chi exercise intervention were predominantly in the low-stress category, with 18 elderly participants (64.3%)

Table 3: Frequency Distribution of the Effectiveness of Tai Chi Exercise on Stress Levels Among the Elderly in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, January 2026

Variable Stress Level Among the Elderly	Pre Test		Post Test		<i>P</i>
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Stres Rendah	8	28.6	18	64.3	
Stres Sedang	20	71.4	10	35.7	0.001
1Stres Tinggi	0	0	0	0	
<b>Total</b>	<b>28</b>	<b>100 %</b>	<b>28</b>	<b>100 %</b>	

Table 3 shows that of the 28 respondents, the majority of older adults—20 older adults (71.4%)—had moderate stress levels before receiving the Tai Chi exercise intervention, and 18 older adults (64.3%) had low stress levels after receiving the Tai Chi exercise intervention. This is consistent with the p-value of the paired t-test (0.001,  $\alpha = 0.05$ ), indicating that Tai Chi

exercise is effective in reducing stress levels among the elderly in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, East Java.

## DISCUSSION

According to the World Health Organization (WHO) in 2023, stress is defined as a state of anxiety or mental tension caused by difficult situations. Stressful situations activate the hypothalamus, which in turn controls two neuroendocrine systems—the sympathetic nervous system and the adrenal cortex system—that stimulate the release of a group of hormones, including cortisol, when the body experiences stress. Stress hormones suppress the immune system; if stress is not managed, it will have an impact on health and quality of life (Panti et al., n.d.). According to Stress Adaptation Model Gail W, Stuart stated that stress is influenced by predisposing and precipitating factors (Faula & Rhosma, 2023). Based on the Stress Adaptation Model theory, Gail W. Stuart states that stress is influenced by predisposing and precipitating factors (Faula & Rhosma, 2023). Predisposing factors include biological factors (genetics, nutritional status, biological sensitivity, general health status, and exposure to toxins), psychological factors (knowledge, verbal ability, past experiences, morale, self-concept, and psychological defenses), and sociocultural factors (age, gender, education, occupation, position, religion, cultural background, and social connections). The findings indicate that stress levels among older adults were in the moderate category prior to the tai chi exercise intervention; this is due to several factors, such as the fact that older adults experience higher stress levels as they age. Stress can be managed through adaptive coping mechanisms, enabling individuals to adapt to stress-inducing factors. Coping mechanisms represent an individual's defensive response to a problem, whether that response is adaptive or maladaptive. To avoid prolonged stress and maintain the psychological and physical well-being of older adults, one way to improve their health is through exercise and physical activity, such as Tai Chi. Physical exercises such as Tai Chi have also been shown to effectively increase stress tolerance and reduce anxiety, although their effects may not be equivalent to pharmacological interventions (Faula & Rhosma, 2023).

The results of this study indicate that the Tai Chi exercise intervention is effective in reducing stress levels among older adults, as evidenced by a significant decrease in scores ( $P = 0.001$ ). Tai Chi exercise has been shown to help reduce stress levels, although it does not have a strong enough effect to significantly lower them. It was found that not all older adults who received the Tai Chi exercise intervention experienced a reduction in stress; some older adults still exhibited moderate stress levels.

## CONCLUSION

Based on the research findings, it was concluded that the stress levels of older adults in Balongagarut Village, Krembung Subdistrict, Sidoarjo Regency, prior to the Tai Chi exercise intervention were mostly in the moderate stress category, involving 20 older adults (71.4%), whereas after the Tai Chi exercise intervention, nearly half of the older adults 18 older adults (64.3%) experienced low stress levels. It can be concluded that the Tai Chi exercise intervention proved effective in reducing stress levels among the elderly in Balunggarut Village, Krembung Subdistrict, Sidoarjo Regency, East Java. This reduction was demonstrated by a significant decrease in stress scores following the Tai Chi exercise intervention. Thus, it can be concluded that Tai Chi can serve as a non-pharmacological intervention option to maintain the mental health of the elderly, particularly in managing stress levels.

These findings are consistent with various previous studies indicating that Tai Chi can have a positive impact on psychological well-being, reduce stress hormones, and improve neurological and cognitive function. The effect of Tai Chi on stress levels among older adults in this study is also consistent with Sister Callista Roy's Adaptation Theory, which posits that the presence of an input or stimulus prompts an individual to develop a coping mechanism or control mechanism. Control mechanisms are divided into regulatory and cognitive subsystems. The end result of the input and process is an output. The output referred to in is behavior that can be observed, measured, or subjectively reported. Roy divides output into two responses: adaptive and maladaptive.

However, this study has limitations, including: a limited number and homogeneous characteristics of respondents, an intervention duration that was too short, the absence of a control group, and the fact that most older adults complained of forgetting the movements of Tai Chi (the majority of whom were over 70 years old).

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#### CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest in this study.

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