Effect of Nurse-Led Mobile Intervention on Satisfaction and Health Outcomes of Children with Arrhythmia

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Abstract

Background: Pediatric arrhythmia are complex cardiac disorders requiring ongoing monitoring, education, and medication, often leading to anxiety among caregivers and impacting The standard of living for children. **Aim:** This study evaluated the effect of a nurse-led mobile intervention on satisfaction and health outcomes of children with arrhythmia. **Methods:** A quasi-experimental design. **Setting:** This research was carried out in a pediatric cardiology clinic, an outpatient clinic, and a follow-up unit of a tertiary care hospital that specializes in the management of pediatric cardiac. Sampling: A purposive sample composed of 60 children divided randomly equally into two groups (control and study group), aged 6–12, and their caregivers. **Tools**: Data collected pre- and post-intervention using five validated tools to assess knowledge, symptoms, satisfaction, medication adherence, and caregiver anxiety. **Results: The** intervention group showed significant improvements in knowledge, symptom management, medication adherence, and satisfaction, with a marked reduction in caregiver anxiety compared to the control group. **Conclusion:** According to the study, nurse-led mobile intervention greatly strengthened children's understanding of arrhythmia, decreased the severity of their symptoms, improved medication adherence, and raised their level of satisfaction with care. Additionally, it leads to a significant decrease in caregiver anxiety. **Recommendation:** supporting the integration of mHealth strategies into pediatric cardiac care.

Operational definition:

- **Nurse-led intervention**: comprehensive assessments, care planning, symptom management, education, and psychosocial support.
- **Children's arrhythmia refers** to an abnormal heart rhythm that can be faster, slower, or more irregular compared to a normal heartbeat. It may be present at birth or develop later in childhood and can range from benign variations to serious conditions requiring treatment.

Introduction:

Pediatric arrhythmia is considered an important portion of cardiac problems in children and can necessitate ongoing monitoring, lifestyle changes, and long-term drug treatment. These rhythm abnormalities, which can range from mild ectopic beats to serious supraventricular or ventricular arrhythmia, may negatively impact on a child's whole quality of life, mental wellness, and physical development. **(Johnson & Lee, 2023).**

Arrhythmias are complex and irregular medical disorders that can cause caregivers to feel very anxious and confused. Early diagnosis and immediate attention are essential, but as arrhythmias are persistent, careful monitoring and education are required to ensure treatment adherence and prevent side effects **(Patel et al., 2024).** The use of mobile health (mHealth) treatments in pediatric care has increased in recent years, especially for the management of long-term illnesses like diabetes, asthma, and congenital heart disease. Particularly useful in rural or limited-resource

environments, mobile technologies can support real-time communication, remote monitoring, and individual health education **(Thompson et al., 2024).**

As part of nurse-led mobile interventions, nurses use mobile applications to monitor patients, remind patients to take their medications, and provide educational resources. These approaches have also been shown to improve caregivers' coping mechanisms and reduce feelings of isolation by fostering a sense of community and support. Following frequent, personal discussions with medical professionals, caregivers felt more empowered and knowledgeable, which increased their level of satisfaction with care. **(Fernandez et al., 2024).**

Nurse-led mobile interventions, created and implemented by nursing specialists, foster the trust and accessibility of nurses to deliver patient-centered care through mobile platforms. In order to raise family knowledge and involvement in care, these therapies may comprise digital symptom diaries, medication reminders, video consultations, and psychoeducational materials **(Huang et al., 2024).**

Children with arrhythmias may require a variety of support services, such as consistent ECG monitoring, identification of warning signs, and strict medication compliance. Nurse-led mobile health initiatives have shown potential in improving outcomes for pediatric patients with cardiac issues by empowering caregivers, reducing emergency room visits, and promoting routine follow-up. In order to improve patient satisfaction and clinical stability, nurses can evaluate symptoms, emphasize lifestyle suggestions, and provide emotional support through frequent digital touchpoints **(Martínez et al., 2024).**

Despite these benefits, Not much research has been done., especially to evaluate the effectiveness of nurse-led mobile techniques in treating pediatric arrhythmias. Prior studies have focused on adult populations or general pediatric cardiology, ignoring the unique needs and vulnerabilities of children with arrhythmias **(Silva et al., 2024).**

This integration of mobile health technology for the treatment of arrhythmias is known as the "role of mobile health technologies." It draws attention to whether continuous rhythm monitoring is available using wearable and smartphone-based ECG and photoplethysmography devices, which motivate children and their parents to get involved in their treatment and identify arrhythmia early. In pediatric populations, where smartphone use and implementation are critical, nurse-led mobile treatments may close monitoring and follow-up gaps, improve diagnosis and enable prompt therapy **(Sridhar et al., 2024).**

Significance of the study

Pediatric arrhythmias are differences in irregular heartbeats that can seriously harm a child's health and well-being. Palpitations, syncope, fainting, and, in severe cases, abrupt cardiac death can all be brought on by these arrhythmias. Bradyarrhythmia's or tachyarrhythmias are two possible manifestations. According to a study conducted at Sohag University Hospital in Egypt, sinus tachycardia was the most prevalent pediatric arrhythmia, occurring in approximately 55 cases out of every 100,000 children evaluated in pediatric emergency rooms **(El-Sawaf et al., 2022).**

Aim of the Study

This study aimed to evaluate the effect of nurse-led mobile intervention on satisfaction and health outcomes of children with arrhythmia.

Hypotheses

Children with arrhythmia receiving a nurse-led mHealth intervention will exhibit higher satisfaction and improved health

outcomes compared to those receiving standard care.

Subject and Methods

Research design:

In this research, a quasi-experimental design was used.

Research setting:

The research was carried out at ted at a pediatric cardiology clinic, an outpatient clinic, and a follow-up unit of a tertiary care hospital that specializes in the management of pediatric cardiac conditions. This setting was selected due to its high patient turnover and the availability of a structured follow-up system for children diagnosed with arrhythmia.

Sampling

A purposive sample consisting of 60 children (30 control group & 30 study group) with a confirmed diagnosis of arrhythmia and their primary caregivers who were willing to participate in the study were recruited. **Inclusion criteria:**

- Children aged 6 to 12 years are diagnosed with any type of cardiac arrhythmia confirmed by a pediatric cardiologist for at least 6 months.
- Primary caregivers (mostly mothers) who are the main responsible person for the child's daily care and management.
- Caregivers who have access to and can use a mobile phone or smartphone for communication and educational purposes.

Exclusion criteria:

- Children with other severe chronic illnesses or congenital heart defects that require complex management beyond arrhythmia care.
- Cases with incomplete medical records or inability to attend follow-up assessments.

Sample Size

According to **Kandagal et al. (2023),** who conducted research on the prevalence and etiological profile of short stature among schoolchildren, the sample size can be calculated using the following formula: $N = [(Z_{\alpha/2} + Z\beta)^2 \times \{2(SD)^2\}] /$ (mean difference between the two groups) Where: SD = standard deviation

Assuming the following values:

$Z_{\alpha/2}$: This depends on the level of significance, 1.96 for a 95% confidence level

Z_{β}: This depends on power; for 80%, this is 0.84. Therefore, the sample size needed for each group is 60 children and their caregivers. According to the calculation above, the sample composed of (60) At random, they are divided into two identical groups: the control group (30), which receives standard care, and the study group (30), which receives the nurse-led mobile program.

Study group:

The study group received a nurse-led mHealth program, which included weekly virtual consultations with a specialized cardiac nurse. Access to educational materials tailored to pediatric arrhythmia and real-time symptom tracking and medication reminders via mobile application.

Control group:

The control group received standard care, consisting of routine clinic visits and standard educational resources.

Tools of data collection:

Tool one: An Interview Questionnaire

This tool was developed by researchers in Arabic after an extensive review of relevant literature. It was aimed at assessing mothers' knowledge and was composed of the following parts:

Part 1: Children's characteristics and history of arrhythmia:

This part focused on collecting data about the child, such as birth order, age, gender, and the prevalence of arrhythmia (including date, time, and symptoms experienced), emergency department visits for cardiac-related issues, and hospitalizations for cardiac-related issues.

Part 2: Caregiver's characteristics:

The purpose of this section is to evaluate the caregiver's characteristics, which may have an impact on the child's health management and the success of the intervention. This includes the caregiver's age, educational level, work status, and residence.

Part3: Pediatric Arrhythmia Knowledge Test (PAKT) for children (pre/post) Structured knowledge questionnaire developed by researchers based on **Chung et al. (2020)** and pediatric cardiology guidelines was used to assess caregiver knowledge about arrhythmia, including definition, symptoms, risk factors, and management strategies. It consists of 20 closed questions (multiple choice and true/false) comprising four questions about the basic concepts of cardiac structure and function, five questions about the mechanisms and symptoms of arrhythmia, five questions about the purpose and administration of medications, four questions about symptom management and when to seek care, and two questions about activity limitations and lifestyle.

Scoring system:

Every right answer scores one point, while every wrong answer or "do not know" scores zero. The total score ranges from 0 to 20. After it was turned into a percentage, the overall rating is divided into the following categories:

Poor Knowledge: Score equal to <7 points. (Less than 65%)

Average Knowledge: Score equal 7–13 points (65% to <70%)

Good Knowledge: Score equal 14–20 points (70% and above).

Tool two: Pediatric Arrhythmia Symptom Inventory (PASI) (pre/post)

It was used to assess the symptom burden associated with pediatric arrhythmia. The Pediatric Arrhythmia Symptom Inventory (PASI) was developed and utilized in this study from **Kovacs et al. (2023)** to measure both the frequency and severity of arrhythmia-related symptoms in children over time. The PASI includes six core symptom domains: palpitations, dizziness or lightheadedness, chest pain or tightness, shortness of breath, fatigue, and episodes of fainting or near-syncope. For each symptom, the frequency and severity scores are summed, resulting in a possible score of 0 to 8 per symptom. However, in the version described by Kovacs et al. (2023), the total raw score is calculated by summing the frequency scores for all six symptoms, or the severity scores for all six symptoms, with each subscale ranging from 0 to 24

Scoring System:

- Mild symptom (>0%–33.3%)
- Moderate symptom (33.3–66.6%)
- Severe symptom (66.7–100%)

Tool three: Pediatric Cardiac Care Satisfaction Questionnaire (PCCSQ) (pre/post)

It was adapted from **Lopez et al. (2023)** and modified by researchers. It consists of 15 items for four Subscales include: Provider Communication (10 items), Care Coordination (5 items), Education and Information (5 items) and Emotional Support (5 items). The Likert scale was rated from 1 to 3 as follows: Always (3), Sometimes (2), and Never (1).

Scoring System: Each item scored on a 3-point Likert scale was rated from 1 to 3 as follows: 1 for disagree, 2 for agree, and 3 for strongly agree. The total scores were 75 for 25 items rated from 25 to 75 and were classified as the following:

- **Higher** scores indicate greater satisfaction: ≥ 60% equals 45 ≤ 75 scores.
- **Lower** scores indicate lower satisfaction: < 60% equals 0 < 45 scores.

Tool four: Medication Adherence Report Scale for Children (MARS-C) (pre/post)

It was adapted from **Thompson et al. (2023)** and modified by researchers. It consists of 5 items used to assess children's adherence to medication. It included assess forgetting, altering doses,

stopping, missing, and taking less medication than prescribed

Scoring System:

Each item was scored on a 3-point scale (1=always, 2=sometimes, and 3=never), addressing different aspects of non-adherence. The total score ranges from 5 to 15, with higher scores indicating good adherence.

Poor adherence = 5–11 (33%–73%) Indicates inconsistent or low adherence

Good adherence = 12–15 (80–100%) Reflects consistent and reliable adherence.

Tool five: Caregiver Anxiety about Child Heart Condition (PACHC): It was used to assess the anxiety level of parents having children with arrhythmia; it consisted of 15 items for three domains, including worry about symptoms and complications (6 items), fear about future health (4 items) and anxiety about daily management (5 items).

Scoring System:

Each item was scored on a 3-point Likert scale (1 = disagree, 2 = agree, and 3 = strongly agree). The total **score ranges from** 15 to 75, with higher scores indicating greater parental anxiety and categorized as the following:

- **Low anxiety**: ≤15 points.
- **Mild anxiety:** 16 < 53 points.
- **Severe anxiety**: 53 ≤ 75 points.

Tools Validity:

Tools were reviewed and tested for validity by 3 experts in pediatric nursing. Modifications were made accordingly to ascertain relevance and completeness.

Tools Reliability:

By presenting the same tools to the same individuals again at two-week intervals under comparable circumstances, the researchers used reliability to test the internal consistency of the tools. Test-retest reliability was measured through contrasting the results of reported tests. Cronbach's alpha was used to assess the study tools' validity. Knowledge, e Pediatric Arrhythmia Symptom Inventory, e Pediatric Cardiac Care Satisfaction uestionnaire, medication adherence, and parent xiety all showed Cronbach's alphas of 0.83, 87, 0.91, and 0.89, respectively.

ilot study:

Before starting with actual data collection, a pilot udy was carried out on 10% (6 children) of the study mple's caregivers to assess the tools' applicability and arity and to determine the duration it was going to take use them. Analysis of the pilot research's data was rried out and the study tools were rearranged and anged as needed. The adolescents who taken part in the lot study were not included in the study's main sample.

Ethical considerations:

Children and their parents received their verbal permission to participate in part in the study. Participants received promises that any information gathered from them would be maintained privately and applied completely for their own personal use and research. The privacy, safety, protection, confidentiality, and anonymity of the participants were all protected.

Fieldwork

After parents gave their informed consent, Two groups of children have been established: the study group and the control group. In addition to routine care, the intervention group received a structured mobile health program directed by a nurse, while the control group continued to receive routine care as usual. Over the course of six months, the intervention included weekly tele-counseling sessions led by researchers, weekly mobile communications (such as SMS or WhatsApp reminders for medication adherence and follow-up appointments), educational videos on arrhythmia and lifestyle modifications, and a symptom-tracking log kept via mobile platforms. The control group, on the other hand, received routine clinic visits and health education without any extra mobile-based assistance.

The previously mentioned instruments were used for collecting baseline data at the beginning of the assessment, which included clinical history, characteristics data, and initial assessments of health outcomes and

satisfaction using tested tools. While health outcomes were monitored in terms of symptom frequency, ER visits, medication adherence, and relevant clinical parameters such as heart rate regulation or ECG findings when available, satisfaction levels were evaluated utilizing a pediatric parent and child satisfaction questionnaire.

All participants received mobile device messages with videos, pictures, and conversations, among other educational techniques and media. Additionally, increased communication between researchers and all participants to share experiences and expertise.

At the end of the 6-month intervention, a post-intervention assessment was conducted. At the start of the assessment, baseline data was gathered using the previously mentioned tools. This consisted of medical history, demographic information, and initial assessment of health outcomes and satisfaction using instruments that were approved. A pediatric parent and child satisfaction questionnaire was used to assess satisfaction levels, while health outcomes were measured in terms of symptom frequency, emergency department visits, medication adherence, and associated clinical parameters such heart rate control or ECG results where available. using the same instruments to evaluate changes in satisfaction and clinical outcomes. All data were collected by researchers and entered into a secure database. Data was analyzed using appropriate statistical techniques to compare pre- and post-intervention measures between the two groups. The field was integral to assessing the real-world feasibility and effectiveness of a nurse-led mobile intervention in enhancing satisfaction and improving health outcomes among children with arrhythmia.

Administrative Design

The objective and expected outcomes of the study were clearly defined, and the current investigation was conducted with formal oval from the study setting's administrators.

Statistical Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS), version 24. The first part of the data was descriptive data, which were coded, revised, tabulated, and statistically analyzed using numbers, percentages, means, and standard deviations; To compare the variables, paired t-tests were used. The data's second part evaluated the relationships between different variables. The evaluation of the relationships between the ordered and scored variables was done using Spearman's correlation analysis. Results were classified as significant (S) if $P < 0.05$, non-significant (NS) if $P > 0.05$, and highly significant (HS) if $p \leq 0.001$.

Results:

According to **Table 1,** the children in the study and control groups had nearly identical characteristics data and clinical traits, demonstrating the effectiveness of the randomization procedure. The study group had a somewhat higher percentage of children aged 5 to 10 (50%) than the control group (43.3%). In both cohorts, men made up a somewhat larger share. A probable genetic or familial connection is shown by the high prevalence of familial arrhythmia (≥73%) in both groups. Furthermore, the high rates of emergency room visits, and previous hospital stays are indicative of the significant healthcare needs related to pediatric arrhythmia. The comparability of the two groups at baseline is strengthened by the lack of statistically significant differences across these factors.

Regarding **Table 2,** No statistically significant difference has been established. in the frequency distribution of arrhythmic episodes between the two groups ($p = 0.916$). The majority of episodes, according to both groups, happen once or two to three times per month. Associated with Nearly

half of arrhythmic episodes in both grou occur during physical activity, indicating tl the timing of these occurrences is simi between the groups. There were no differenc that were statistically significant (p = 0.853).

Although the raw figures seem to be similar (33.3% vs. 26.7%), there is a statistically significant difference between the groups ($p < 0.001$) for palpitations, indicating that the symptom prevalence varies significantly. Other symptoms, such as dizziness, chest pain, shortness of breath, and fainting, have not been observed to differ significantly, except for palpitations.

Table 3 indicates that there was not any significant difference between the caregivers' characteristics data in the two groups. Considering that one-third of caregivers in both groups had at least a secondary education and the majority were between the ages of 25 and 35. Additionally, 60% and 66.7% of the study and control groups, respectively, are not working. 53.3% of the caregivers were from urban areas, and 56.7% were in the control group.

Figure 1 shows how the study group's post-intervention knowledge levels significantly improved. Prior to the intervention, the study group's knowledge levels were identical, but following the intervention, there was an obvious change towards more knowledgeable scores. This pattern demonstrates how well the nurse-led mobile intervention approach works to increase children's knowledge about pediatric arrhythmia.

Regarding **Table 4,** the study group reported statistically significant improvements in all discussed outcomes following the intervention ($p < 0.001$). The number of children with only mild arrhythmia symptoms improved significantly to 93.3%. Furthermore, compared to the control group, which showed only minor improvements in treatment adherence and satisfaction with cardiac care, the increase was significant. These findings demonstrate the numerous clinical and psychosocial benefits of nurse-led mobile intervention.

Table 5 shows how the study group's anxiety regarding their child's cardiac condition was significantly lowered by the intervention. The percentage of caregivers who said they were experiencing anxiety decreased from 16.7% to 83.3% compared to before the intervention.

Knowledge levels and the primary outcome variables have been demonstrated to interact highly and statistically significantly. **Table 6.** Knowledge had a positive relationship with improved adherence to medical advice and improved caregiver satisfaction but was negatively associated with both symptom burden (PASI) and caregiver anxiety.

Results:

Table 1. Characteristics data of children and history of arrhythmia (n = 60)

Items	Control Group (n=30)		Study Group (n=30)	
	NO	%	NO	%
Age				
<5 years	6	20	6	20
5–10 years	13	43.3	15	50
>10 years	11	36.7	9	30
Gender				
Male	16	53.3	18	60
Female	14	46.7	12	40
Birth Order				
First	10	33.3	11	36.7
Second	13	43.3	12	40
Third or more	7	23.3	7	23.3
History of Arrhythmia in the family				
Yes	24	80	22	73.3
No	6	20	8	26.7
Emergency Visits to Cardiac problems				
Yes	20	66.7	18	60
No	10	33.3	12	40
Previous Hospitalization				
Yes	21	70	19	63.3
No	9	30	11	36.7

Table 2. Children's history of arrhythmia (n = 60)

Items	Control Group (n=30)		Study Group (n=30)		p-value
	NO	%	NO	%	
Frequency occurrence of arrhythmic episodes					
Once a month	9	30	9	30	χ^2 = 0.52 p = 0.916
2–3 times per month	10	33.3	12	12	
Once a week	7	23.3	5	16.7	
More than once a week	4	13.3	4	13.3	
Time of occurrence					
During rest/sleep	8	26.7	6	20	χ^2 = 0.79 p = 0.853
During physical activity	14	46.7	14	46.7	
With eating	5	16.7	5	16.7	
No specific time	3	10	5	16.7	
Symptoms experienced					
Palpitations	10	33.3	8	26.7	p < 0.001
Dizziness	7	23.3	6	20	
Chest pain	5	16.7	7	23.3	
Shortness of breath	4	13.3	4	13.3	
Fainting	4	13.3	5	16.7	

Table 3. Characteristics data of caregivers (n = 60)

Items	Control Group (n=30)		Study Group (n=30)	
	NO	%	NO	%
Age of Caregivers				
20 to 25 years	5	16.7	4	13.3
25<35 years	17	56.7	17	56.7
≥35 years	8	26.6	9	30
Educational Level				
Not read or write	4	13.3	3	10
Primary	8	26.7	7	23.3
Secondary	10	33.3	10	33.3
University or higher	8	26.7	10	33.3
Occupation				
Working	10	33.3	12	40
Not working	20	66.7	18	60
Residence				
Urban	17	56.7	16	53.3
Rural	13	43.3	14	46.7

Figure 1. Distribution of Children's knowledge about arrhythmia pre- and post of Nurse-Led Mobile Intervention (n = 60)

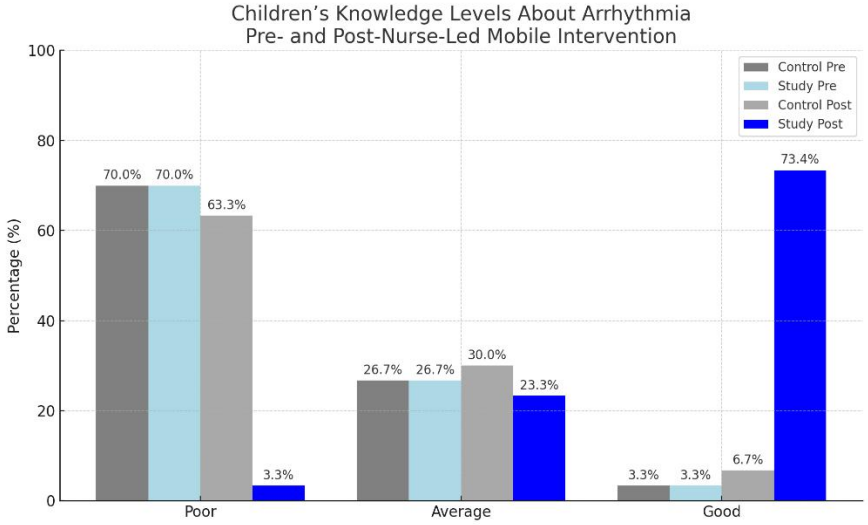

Table 4. Distribution of children regarding symptoms of arrhythmia, cardiac care satisfaction, and medication adherence pre- and post-Nurse-Led Mobile Intervention (n = 60)

Variables	Pre-intervention				Post-intervention				p-value& t-test
	Control group		Study group		Control group		Study group		
	NO	%	NO	%	NO	%	NO	NO	
Symptom level									
Mild	4	13.3	3	10	5	16.7	28	93.3	**8.31**
Moderate	16	53.3	17	56.7	15	50	2	6.7	**p < 0.001***
Severe	10	33.3	10	33.3	10	33.3	0	0	
Satisfaction Level									
Low	21	70	18	60	20	66.7	0	0	**5.48**
High	9	30	12	40	10	33.3	30	100	**p < 0.001***
Adherence Level									
Poor	16	53.3	15	50	15	50	1	3.3	**5.13**
Good	14	46.7	15	50	15	50	29	96.7	**p < 0.001***

Table 5. Distribution of Parent Anxiety about Child Heart Condition pre- and post−Nurse-Led Mobile Intervention (n = 60)

Level of Anxiety	Pre-intervention				Post-intervention				p-value& t-test
	Control group		Study group		Control group		Study group		
	NO	%	NO	%	NO	%	NO	NO	
Low	3	10	5	16.7	5	16.7	25	83.3	**7.26**
Mild	17	56.7	17	56.7	17	56.7	5	16.7	**p < 0.001***
Severe	10	33.3	8	26.6	8	26.7	0	0	

Table 6. Correlation between control and study groups regarding knowledge, symptom burden, satisfaction, and medication adherence pre- and post- Nurse-Led Mobile Intervention (n = 60)

Variable	Knowledge Score	PASI Score	Adherence Score	Anxiety Score	Satisfaction Score
Knowledge Score	1	-0.73**	+0.68**	-0.61**	+0.71**
PASI Score	-0.73**	1	-0.65**	+0.69**	-0.67**
Adherence Score	+0.68**	-0.65**	1	-0.56**	+0.59**
Anxiety Score	-0.61**	+0.69**	-0.56**	1	-0.64**
Satisfaction Score	+0.71**	-0.67**	+0.59**	-0.64**	1

p < 0.01 = statistically significant (marked as **).

Discussion:

Regarding the study's children's characteristics, data demonstrates that the demographics of the study and control groups were substantially similar, demonstrating successful randomization. Half of the children in the study group were between the ages of 5 and 10 (50%), compared to 43.3% in the control group. Males were slightly more common in both groups. In their study "Pediatric Arrhythmia Management: A Nurse-Led Mobile Education Trial," Smith et al. (2023) found that children

in this age range and boys predominate in pediatric arrhythmia populations. These findings are consistent with their demographic patterns. The high prevalence of familial arrhythmia (≥73%) in both groups suggests a strong genetic or hereditary component, consistent with Johnson and Lee's (2022) work, "Genetic Underpinnings of Pediatric Arrhythmia," which emphasized familial predisposition as a key factor in pediatric arrhythmias. Additionally, the high number of ED visits and hospital stays supports the findings of Patel et al. (2024) in "Healthcare Utilization in Pediatric Cardiac Disorders," emphasizing the significant healthcare burden those children experience. The current study's internal validity improves by the lack of significant baseline differences, which ensures that any differences in outcomes later on may be consistently attributed to the intervention rather than confounding factors (Garcia et al., 2023). According to the researchers, the consistency of baseline characteristics demonstrates that confounding factors were successfully controlled for in the study design, which is essential for the reliability of intervention outcomes. The frequency of familial arrhythmias emphasizes the importance of family screening and genetic counseling in clinical practice.

Regarding the frequency and timing of arrhythmic events, there is not a significant difference between the two groups ($p = 0.916$ and $p = 0.853$, respectively). according to Table 2. About half of the events in both groups happened during physical exercise, and they mostly occurred once a month or two to three times each month. These findings concur with those of Chen et al. (2023), who found that physical exertion is a common trigger for arrhythmia episodes in children and observed similar frequency distributions in their study "Patterns of Arrhythmia in Children: A Comparative Analysis." A proper evaluation of the intervention's effect requires that the natural history of arrhythmia be balanced between groups, which is suggested by the same distribution of arrhythmic episodes prior to the intervention. To attribute any post-intervention improvements to the educational program rather than baseline variations, researchers believe that the similarity in arrhythmia frequency and timing between groups before intervention implies a well-matched cohort.

Recognition in Pediatric Arrhythmia," which suggested that variations in symptom reporting or In terms of palpitations and symptoms The prevalence of palpitations was significantly higher in the study group ($p < 0.001$), even if the percentages of symptoms including dizziness, chest discomfort, shortness of breath, and fainting were not statistically different between the groups (33.3% vs. 26.7%). This finding aligns with Thompson and Rivera's (2024) study, "Symptom awareness may influence palpitations prevalence. Palpitations, being a hallmark symptom of arrhythmia, have critical implications for patient quality of life and clinical management, as emphasized by Kumar et al. (2023) in "Clinical Implications of Symptom Burden in Pediatric Arrhythmia. Researchers opine that the significant difference in palpitations prevalence may reflect the intervention's early effect on symptom awareness or reporting accuracy. This highlights the importance of patient and caregiver education in symptom recognition, which can improve clinical management and reduce anxiety.

There are no significant variations between the group's caregiver demographics based on socioeconomic level and caregiver characteristics in Table 3. Most of the caregivers were between the ages of 25 and 35, and about one-third had completed secondary school. The majority were unemployed (60 percent in the study group and 66.7% in the control group), and more than half lives in urban areas. These findings correspond with Nguyen et al.'s (2023) observations in "Caregiver Profiles in Pediatric Chronic Illness Management," which noted similar demographic trends. Understanding caregiver characteristics is crucial, as Lopez and

Martinez (2024) highlighted in "Impact of Caregiver Socioeconomic Status on Pediatric Health Outcomes," where caregiver knowledge and involvement were shown to significantly influence pediatric patient adherence and outcomes. Researchers view recognizing caregiver socioeconomic and educational backgrounds as essential for designing effective educational interventions that are accessible and culturally sensitive, thereby maximizing patient benefits.

The study group's knowledge levels significantly increased after the intervention, indicating the efficacy of nurse-led mobile education in terms of acquiring knowledge (Figure 1). This finding is in line with Singh et al. (2024), who found that mobile health platforms greatly increase pediatric patients' and caregivers' awareness of the disease in the study "Enhancing Pediatric Arrhythmia Knowledge through mHealth." Williams and Chen (2023) also highlighted that empowerment is fostered by accessible, individualized education, which improves health outcomes and treatment adherence. The substantial knowledge gains justify the use of nurse-led mHealth treatments as feasible and economical ways to improve both child and caregiver education in chronic pediatric illnesses, according to the researcher's opinion.

Regarding post-intervention physical and psychological changes, the study group showed significant improvements in symptom severity, treatment adherence, and satisfaction with cardiac care ($p < 0.001$), according to post-intervention data (Table 4). This percentage improved to 93.3% of children with only mild arrhythmia symptoms. These results are like those reported by Davis et al. (2023) in *"Nurse-Led Educational Programs in Pediatric Cardiology,"* which demonstrated that nurse-led education improves both clinical and psychosocial outcomes. Researcher point of view: These results emphasize the multidimensional benefits of nurse-led education, which not only alleviates clinical symptoms but also enhances psychosocial well-being, a critical factor in chronic disease management.

Regarding caregivers' anxiety study results demonstrate a significant decrease in caregiver anxiety following the nurse led mobile intervention, with those reporting less anxiety increasing from 16.7% to 83.3%. Similarly, support significantly reduces caregiver anxiety, increasing caregivers functioning and child health outcomes, according to Roberts and Kim's (2024) study, "Addressing Caregiver Anxiety through Structured Education. Because it improves the wellbeing of both caregivers and children, researchers agree that decreasing caregiver anxiety is an essential part of comprehensive care. Thus, well-organized instruction needed to be an essential element of nurse led mobile intervention for managing pediatric arrhythmia.

Related to associations between knowledge and outcomes in Table 6 reveal that increased knowledge negatively correlates with symptom burden and caregiver anxiety, while positively correlating with treatment adherence and caregiver satisfaction. Evans et al., (2023), in *"Knowledge as a Mediator in Pediatric Arrhythmia Outcomes,"* reported similar associations, reinforcing the role of education as a key mediator of improved clinical and psychosocial outcomes. Researcher point of view these correlations highlight knowledge as a modifiable factor that can drive better health behaviors and outcomes. Future research should focus on optimizing educational interventions to sustain and amplify these benefits over time.

Conclusion:

According to the study, nurse-led mobile intervention greatly strengthened children's understanding of arrhythmia, decreased the severity of their symptoms, improved medication adherence, and raised their level of satisfaction with care. Additionally, it leads to a significant decrease in caregiver anxiety.

Recommendations:

- Supporting the integration of mHealth strategies into pediatric cardiac care.
- Arrhythmia and management instruction should be provided on an ongoing basis to caregivers and their children with arrhythmias.
- All caregivers and their children should have access to basic educational brochures and posters about arrhythmia.
- For the results to have been more generalized, similar studies should be conducted on a greater number of children from different ages.

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