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Effect of a Mobile Application Health Program on Knowledge, Self-care, and Self-efficacy of Children Undergoing Hemodialysis

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Abstract
Background: Due to physical restrictions and dependence on others, children undergoing hemodialysis experience a decrease in their self-efficacy and self-care. **Aim:** assess the impact of a mobile health application program on the knowledge, self-care, and self-efficacy of children undergoing hemodialysis. **Design:** a pre-posttest quasi-experimental one-group study. **Sample:** Thirty children receiving HD included in the study as a purposive sample. The study was carried out at El-Monira Children Hospital's Pediatric Nephrology and Transplantation Center. **Tools:** The first tool is a questionnaire for bio-social data; the second is a children's knowledge questionnaire; the third is a self-care assessment questionnaire; and the fourth is a self-efficacy assessment scale. **Results:** The knowledge totals mean score of the children under study before, immediately after, and one month after to participating in the mobile application health program showed a very statistically significant difference. The children's overall mean scores before, immediately after, and one month after the intervention on their self-care performance were highly statistically significant (P <0.001). Additionally, the results demonstrated improvement with highly significant statistical difference (P <0.001) in the mean total score of self-efficacy and one month after the intervention compared to before and after program implementation, **Conclusions:** Educational mobile application health program had positive improvements on children' knowledge, self-care and self-efficacy over time. **Recommendation:** Develop mobile apps self-care training courses to increase the levels of knowledge and awareness among children undergoing hemodialysis and improve their self- efficacy.

Keywords: Children, Hemodialysis, Mobile Application- Self-care, Self-efficacy, Health program & Knowledge.

Introduction
Hemodialysis (HD) is a process in which excess fluids and wastes are collected using a membrane instead of a kidney as a filter and is not a cure. Hemodialysis is a long-term and expensive process that involves a specific regimen of diet and fluid, so it accompanies lifestyle changes. In addition, physical and psychosocial stressors children face include lack of appetite, anemia, hypertension, social isolation, dependence on caregivers, and loss of sense of security **(Hassan & Khalafallha, 2019. Osman et al., 2023).**

End-stage renal disease (ESRD) is likely the tip of the iceberg in a developing nation such as Egypt, where patients are diagnosed with the disease after they have reached renal failure and there are few resources and poor primary health care services. Due to the lack of a national registry, it is unknown how common ESRD is among children in Egypt or its precise incidence. So statistical reporting on the prevalence of regular maintenance dialysis among Egyptian children is currently not available. Nonetheless, it is clear that the figures have gradually risen over the last three decades. The estimated annual incidence of ESRD in children is around 74 / million and the total prevalence of children on dialysis is 264 /million **(Yousef, et al., 2019). Ahmed et al, (2020)** reported that chronic renal failure in Egyptian hospitalized children between births to 15 years of age has been reported to be approximately 1.36% of all hospitalized patients.

Feizalahzadeh, et al. (2020) highlighted the challenges in providing sufficient care for children with ESRD in developing countries. These challenges include late referral, insufficient use of medical services, limited financial resources, poor logistics, and restrictions on transplantation to living related donors. Additionally, pediatric transplantation is particularly difficult under these conditions. Meanwhile, in a study conducted in Egypt, **Machaly et al. (2020)** observed that 93.5% of children with ESRD in Egypt received hemodialysis in various university hospitals, while only 6.5% underwent peritoneal dialysis in certain universities. The provision of effective pediatric hemodialysis necessitates a specialized and coordinated healthcare team that addresses the medical, nursing, nutritional, developmental, and psychological aspects of care for

pediatric ESRD patients. Additionally, the number of pediatric patients, even in the largest pediatric centers, is not substantial enough to yield sufficient data for the optimal advancement of hemodialysis practices in children **(Ibrahim, et al., 2019).**

Children receiving hemodialysis experience physical and psychosocial strain, and long-term complications, including depression, which can affect their self-care and quality of life. The stressors for children undergoing hemodialysis include reliance on others, physical limitations due to the disease, and increased psychological stress. These factors can diminish self-care and self-efficacy. Self-efficacy plays a significant role in predicting behavioral outcomes, and it is essential for individuals with the disease need to have the cognitive mechanisms and perception of control necessary for effective self-management and self-care behaviors **(Omisakin & Ncama, 2020 & Rukshana Shroff 2023).**

Modern technological devices such as tablets, smartphones, and portable electronic gadgets play a pivotal role in delivering extensive information to individuals on a daily basis. Integrating these technologies into health and hygiene services can effectively mitigate communication barriers and the impact of temporal and geographical disparities. The use of smartphones and the internet has created an inclusive and rapid platform for patient-treatment team communication and health awareness dissemination **(Kim et al., 2019).** Teaching self-care practices to children undergoing hemodialysis encompasses educating them about regulating fluid intake, managing dietary requirements, medication adherence, active participation in their care, and promoting effective communication, ultimately leading to increased self-efficacy and sustained role maintenance **(Feizalahzadeh, 2020).**

Significance of the study

The impact of hemodialysis is indeed significant for children and can have various negative effects on their growth, development, and overall well-being. It not only affects the children themselves but also has implications for their families and caregivers. Adherence to hemodialysis can be challenging, and it's important to explore and implement new strategies to help with care planning and adjustment to treatment. This is crucial for promoting self-care among children undergoing hemodialysis and improving overall health outcomes for this population **(Santana et al., 2021).**

Recognizing and managing risk factors can help nurses support children undergoing hemodialysis take ownership of their health and improve their overall well-being. Moreover, they can provide focused instruction to enhance wellbeing and provide children with the ability to manage their illness. Consequently, the practice of self-care can lead to a number of positive consequences, such as fewer complications, a reduction in hospital stays, increased child autonomy and satisfaction, improved disease adaptability, better quality of life, increased performance, and better symptom management **(Khazaei et al., 2021).**

Simple and informative technologies such as mobile applications (apps) have demonstrated effectiveness and acceptance among chronic patients, especially considering the prolonged treatment process that may lead to declining motivation for self-care **(Jebraeily et al., 2021).**

The current study aims to assess the effect of a mobile app health program on knowledge, self-care and self-efficacy among children receiving hemodialysis. The study findings will contribute empirical evidence to the field of pediatric nursing education. Furthermore, it emphasizes the need for integrating remote communication methodologies into nursing education programs and sets the stage for future exploration and integration of technology in the nursing domain. Notably, this technology holds potential for cost reduction and minimizing constraints arising from temporal and spatial limitations in planning processes.

Aim:

The primary objective of this study is to assess the effect of a mobile health application program on the knowledge, self-care, and self-efficacy of children undergoing hemodialysis.

Research Hypotheses

- Children undergoing hemodialysis who received mobile application health program will have improved total knowledge scores immediately after and one month after attending the program than before.
- Children undergoing hemodialysis who received mobile application health program will have improved total self-care activities scores immediately after and one month after attending the program than before.
- Children undergoing hemodialysis who used mobile application health program will have improved total self-efficacy scores immediately after and one month after attending the program than before.

Subjects and Methods

Research Design

A quasi-experimental research design (pre/post-test design one group) was utilized in this study.

Setting

The study carried out at Nephrology and Transplantation Center- El-Monira Children Hospital's affiliated with Cairo University. The center

is situated on the fourth floor and comprises one unit for acute hemodialysis, two units for chronic hemodialysis, an intensive care unit for emergency kidney care, and a waiting room for mothers and relatives.

Subjects

The study included a purposeful sample of 30 children undergoing HD with arteriovenous fistula (AVF) from the mentioned settings.

Inclusion criteria encompassed school-age children from 6 to 12 years with CRF undergoing HD with arteriovenous fistula (AVF), who have a smartphone, internet access, and use what's App.

Exclusion criteria involved children with developmental delay and sensory impairment.

The determination of sample size based on the following formula:

$$n = \frac{T^2 \times p\,(1-p)}{(M)^2} =$$

$$n = \frac{^2\,(1.96) X\ 0.021\ X\ (1 - 0.021)}{(0.05)^2} = 30$$

Description:

n=required sample size.

t=confidence level at 95 % (standard value of 1.960).

p=estimated prevalence of children undergoing hemodialysis 0.0500)

m=margin of error at 5 % (standard value of (0.05).

Data Collection Tool

Throughout the data collection process, the following four tools were employed

Tool 1: Children Bio-Social Data Questionnaire

This questionnaire was devised by the researchers in Arabic, drawing on relevant literature. It comprises two parts:

Part 1: Personal Characteristics for Children

This section consists of five questions pertaining to the child's age, gender, educational level, rank, and residence.

Part II: Past and Present Medical History

Comprising eight questions, this part encompasses inquiries about the onset of the disease, duration of hemodialysis, number of sessions, duration of arteriovenous fistula(AVF),and dialysis complications.

Tool 2: Children Knowledge Questionnaire

Developed in Arabic by the researchers following an extensive review of literature, **Hockenberry &Wilson (2019)**. this questionnaire includes 24 closed-ended questions. It is designed to evaluate children's knowledge across the following sub-items:

1. General Knowledge about Kidney Failure and Hemodialysis (5 questions)
2. Fistula Care (6 questions)
3. Long-term Fistula Care (7 questions)
4. Fistula Complications and Care (6 questions)

Scoring system

The total number of questions was 24**,** each question score was ranged from 0-1 (0=unknown or incorrect answer, 1= complete answer). The total score of questionnaire was (24) (100%). It was classified to unsatisfactory < 50% (< 12 score) and satisfactory > 50% (12-24 score).

Tool 3: The Self-Care Assessment questionnaire, adopted from the Self-Care Assessment Worksheet (SCAW)

By Saakvitne and Pearlman (1996), evaluates six key areas of self-care with 62 items. These areas include physical (13 items), psychological (12 items), emotional (11 items), spiritual (12 items), academic self-care (11 items), and balance (3 items). Children are required to rate the frequency of each activity on a scale from 1 to 5, where 1 indicates "never occurs." , 2 "never", 3 "rarely", 4 "occasionally" and 5 "frequently" occurs.

The possible scores on each subscale of the SCAW are entirely dependent on the number of items within that subscale. The total score of items is 310 (100%). Higher total scores (> 50% or 155-310) unequivocally indicate more engagement in self-care activities; while lower scores (< 50% or < 155 score) definitively indicate low engagement in self-care.

Tool 4: Self-Efficacy assessment scale:

Is adopted from **Lorig et al (2001).** for managing chronic illness 6-item Scale contains items covering various domains common across many chronic diseases, including symptom control, role function, emotional functioning, and communicating with physicians. Respondents are required to choose a number from 1 to 10, indicating their confidence to perform certain tasks regularly at the present time, with 1 being not confident at all and 10 being totally confident.

For scoring, the score for each item is the number circled. If two consecutive numbers are circled, the lower number is coded (indicating less self-efficacy). If the numbers are not consecutive, the item is not scored. The total score of items is 60 (100%), with higher total scores (> 50% or 30-60) indicating higher self-efficacy, and lower scores (< 50% or < 30) indicating lower self-efficacy.

Content validity:

Content validity was conducted to determine the degree to which the tools measure what was intended to be measured. The translated tools were examined by a panel of five experts (two in the field of pediatric renal dialysis medicine and three in the field of

pediatric nursing) where 98% of the experts agreed that it was valid and relevant to the aim of the study, with only minor adjustments made to the Arabic language to ensure clear understanding for children.

Reliability

In terms of reliability, internal consistency was evaluated to determine the degree to which the items within the tools measure the same concept and are correlated with each other. As regards the reliability of the children knowledge questionnaire, The Coefficients' Alpha was 0.90. The internal consistency reliability of the tools appeared to be satisfactory: Cronbach's α were 0.93 for self-care assessment questionnaire and 0. 91 for the total self-efficacy assessment scale.

Pilot study

To assess the items' viability, objectivity, applicability, and clarity, a pilot study involving 10% of the participants was carried out. Because the pilot study's findings showed that no changes were required, the pilot study's subjects were added to the study sample.

Procedure

The study obtained ethical approval from the research ethics (IORG0006883) committee at the Faculty of Nursing, Cairo University. Additionally, official permission was secured from the director of the Center of Pediatric Nephrology and Transplantation at El-Monira Children Hospital before data collection. Study was conducted with children in the waiting room through three phases' assessment, implementation, and evaluation. Mobile application six sessions will be held virtually. Tool one was filled in by the researchers once before conducting the program while tool 2, 3 and 4 were assessed three times; before, immediately after, and one month after, data collected from June 2022 to December 2022.

Phase I, Assessment phase including two parts :

Part 1: Assessment child personal data and medical history related diseases, dialysis and AVF from the mother and medical health sheet.

Part 2: Assessment children knowledge regarding hemodialysis meaning,indication, Arterio-Venous Fistula (AVF))and its care. Also, researchers assessed children self-care activity and self-efficacy using tools 3&4 before the program.

The researchers developed a health program in simple Arabic language based on the assessment of children knowledge and self-care activity as well as self-efficacy scores earned by children in part 2 of assessment phase. The health program content includes an explanation of the following: kidney function, definition of renal failure and its causes as well as complications, definition of hemodialysis process in terms of aim, frequency, and complications, description AVF types, and care, care before child entering hemodialysis session, and care after child ending hemodialysis session (nutrition, fluid intake, physical activity, sleep and rest, prevention of infection , schooling, medication instructions, laboratory investigations, vaccines, and signs of danger).

The content from the health program was utilized to develop interactive material specifically for a mobile application, in collaboration with an Android developer specialist. This tool has been designed to be colorful, engaging, and educationally suitable for the target audience.

The mobile application allowed children to learn self-care activities and knowledge needed to be able to provide it through six virtual sessions.

The session content was as following:

Session one: Introduction, kidney function, definition of renal failure and its causes as well as complications.

Session two: Definition of hemodialysis process in terms of aim, frequency, and complications.

Session three: Description Arterio-Venous Fistula (AVF) types, and care.

Session four: Care before child entering hemodialysis session

Session five: Care after child ending hemodialysis session.

Session six: Conclusion of the health program content.

Phase II: Implementation phase includes:

Part 1: The researchers uploaded mobile application program on children cell phones. Phone numbers of children were collected then children were followed and supported by researchers through these sessions through what's app groups; each group consisted of 4-6 children and any questions asked by children related to the app content were answered and clarified to them.

The program was implemented across six sessions (a session/week), with each session lasting 45-60 minutes.

Phase III: Evaluation for the children' knowledge self-care and self-efficacy after application of an interactive program. Researchers met children in the selected setting when the child came for dialysis session after finishing the health program and filled tool 2, 3, and 4. A one month after the program, the researchers met again children in the selected setting to reassess their knowledge, self-care activities and self-efficacy using tool 2, 3 and 4.

Ethical consideration

The study received ethical approval from the research ethics committee at the Faculty of Nursing, Cairo University. Written informed consent was obtained from mothers, and oral assent was obtained from all eligible children who agreed to participate in the

study after a thorough explanation of the study's purpose and nature. Participants were made aware of their voluntary participation and their right to withdraw from the study at any time. Additionally, mothers were assured that all collected information would be kept confidential and used solely for the study. Furthermore, researchers implemented code numbers to maintain the anonymity of the children.

Statistical analysis

The data was organized, tabulated, and analyzed utilizing the SPSS software Version 20. Descriptive statistics were employed to present numerical data as mean and standard deviation. Comparison of means was conducted using the paired-sample t-test, while Pearson correlation coefficient was employed to assess the relationship between variables. The predetermined level of significance at $p<0.05$ was used as the threshold for statistical significance.

Results

Table (1): Percentage Distribution of the Participated Children Regarding their Personal Data (n=30)

Variables	Total Sample (n=30)	
	N	%
1- Age (Years)		
- 6	2	6.7
- 8	12	40.0
- 10-12	16	53.3
Mean±SD (range)	9.57±1.52(6-12)	
2- Gender		
- Male	7	23.3
- Female	23	76.7
3- Rank		
- First	9	30.0
- Second	13	43.3
- Third	6	20.0
4- **Fourth**	2	6.7
5- Education		
- 1st. – 2nd. grade primary	24	80.0
- 3rd.- 4th. grade primary	3	20.0
- 5th. – 6th. grade primary	3	20.0
6- Residency		
- Urban	24	80.0
- Rural	6	20.0

Table (2): Percentage Distribution of Participated Children According to their Medical History, Self- Care Provision Capability, and Physical Exercise in Percentage Distribution (n=30)

Variables	Total Sample (n=30)	
	N	%
1- Age of onset of disease in years		
- One	15	50.0
- Three – Five	14	47.0
- More than five	1	3.0
- Mean±SD (range)	2.80±1.54(1-7)	
2- Duration children spent treated by hemodialysis in months		
- One month	4	13.4
- Twelve months	16	53.3
- More than 24 months	10	33.3
3- **Number of hemodialysis session***		
- Three sessions /week	30	100

Variables	Total Sample (n=30)	
	N	%
4- Presence of hemodialysis related Side Effects		
- Yes	15	50.0
- No	15	50.0
5- Hemodialysis Side Effects		
- Headache	5	33.3
- Vomiting	7	46.7
- Dizziness	4	26.7
- Hypotension	4	26.7
- Sweating	1	6.7
6- Capability to provide selfcare		
- Yes	3	10.0
- No	27	90.0
7- **Practice physical exercise**		
- Yes	2	6.7
- No	28	93.3

Table (3): Comparison Between Children's Total Mean Score of Knowledge Before, Immediately after and One Month after Mobile Application Health Program (n=30).

Items	Before	Immediately after	One month after	F test
	Mean±SD	Mean±SD	Mean±SD	P. value (η^2)
Total knowledge	4.63±2.18	20.57±6.80	21.57±6.76	90.45
				<.001* (0.757)

Table (4): Comparison Between Children's Total Mean Scores of Self-efficacy Before, Immediately After and One Month After Mobile Application Health Program (n=30).

Self- efficacy Items	Before	Immediately after	One month after	F test
	Mean±SD	Mean±SD	Mean±SD	Pvalue (η^2)
Confidence feel that …..				
1. keep fatigue caused by hemodialysis from interfering with things want to do	1.6±1.1	4.2±.76	7.1±.71	**300.7 <.001*(.712)**
2. keep physical discomfort or pain of hemodialysis from interfering with things want to do	1.6±1.3	4.2±.76	7.1±.73	**234.58 <.001*(.890)**
3. keep the emotional distress caused by hemodialysis from interfering with things want to do	1.6±1.2	4.0±.89	7.1±.76	**222.01 <.001*(.884)**
4. keep other symptoms or health problems have from interfering with things want to do	1.5±1.3	4.1±.92	7.1±.73	**230.65 <.001*(.888)**
5. Do the different tasks and activities needed to manage health condition so as to reduce need to see a doctor	1.5±.50	3.9±.86	7.1±.79	**461.53 <.001*(.941)**
6. Do things other than just taking medication to reduce how much illness affects everyday life	1.4±.56	4.0±.91	7.0±.74	**434.26 <.001*(.937)**
Total self-efficacy 60	**9.3±5.5**	**24.3±4.8**	**42.6±4.1**	**365.86 <.001*(.927)**

Table (5): Comparison Between Children's Total Mean Scores of Self-Care Before, Immediately After and One Month After Mobile Application Health Program (n=30)

Self-care Items	Before	Immediately after	One month after	F test
	Mean±SD	Mean±SD	Mean±SD	Pvalue (η^2)
1. Physical Self- Care	18.7±6.98	26.6±7.33	38.20±10.76	**55.33 <.001* (.656)**
2. Psychological Self Care	16.33±5.8	24.1±6.57	34.60±9.13	**69.30 <.001*(.705)**
3. Emotional Self Care	15.97±5.5	22.6±5.37	32.50±8.48	**69.15 <.001* (.705)**
4. Spiritual Self Care	16.53±6.5	23.1±6.46	35.73±9.24	**71.31 <.001* (.711)**
5. Academic Self Care	14.90±5.8	21.9±5.76	33.13±8.25	**92.34 <.001* (.761)**
6. Balance	4.70±2.32	6.60±1.83	10.27±2.68	**62.13 <.001* (.682)**
Totalself-care (310)	**87.2±26.8**	**125±28.9**	**184.4±45.47**	**98.70 <.001* (.773)**

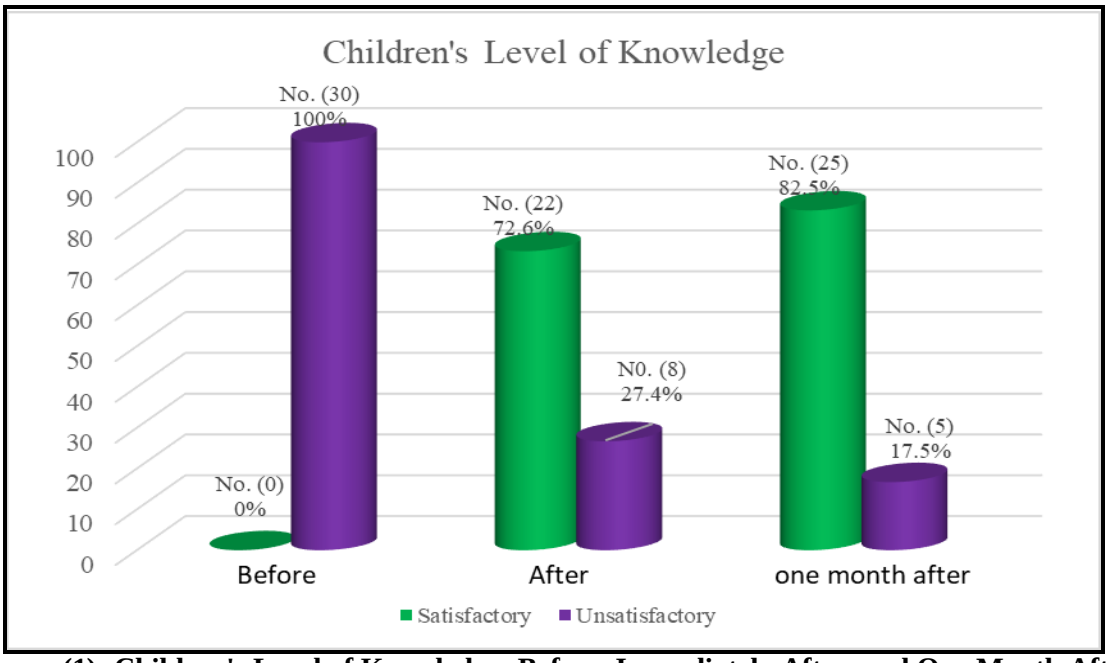

Figure (1): Children's Level of Knowledge; Before, Immediately After, and One Month After Attending Mobile Application Health Program.

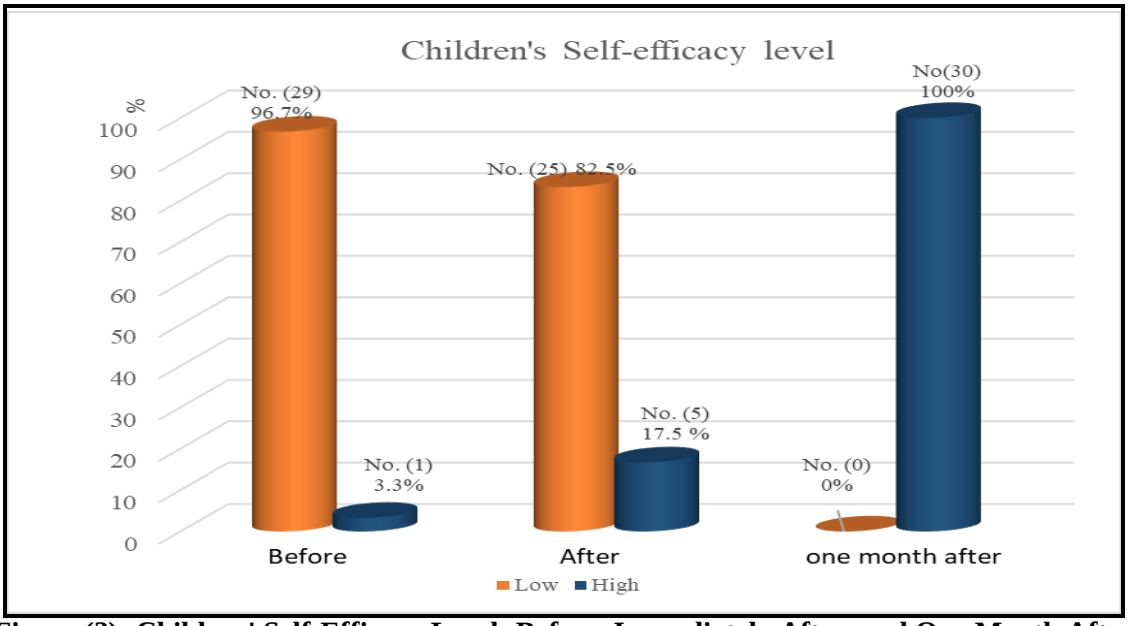

Figure (2): Children' Self-Efficacy Level; Before, Immediately After, and One Month After Attending Mobile Application Health Program

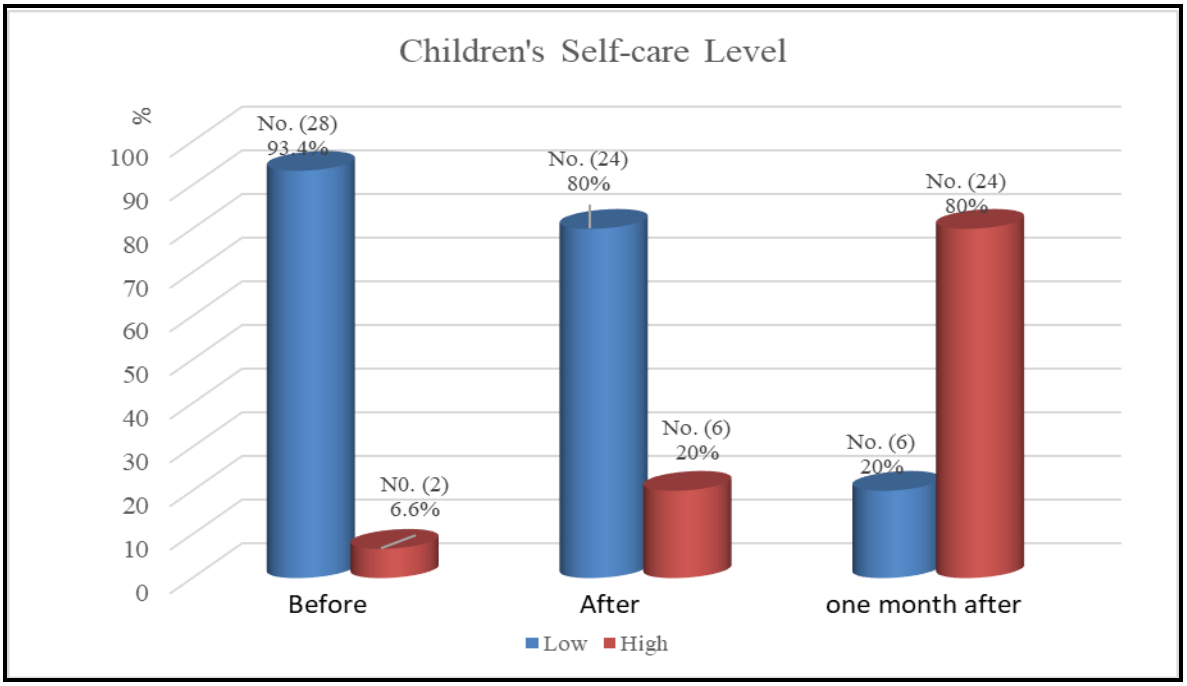

Figure (3): Children's Self- Care Level; Before, Immediately After, and One Month After Attending Mobile Application Health Program

Table (6): Correlation Between Total Mean Scores of Children's Knowledge, Self-Care and Self-Efficacy, Before, Immediately After, and One Month After Mobile Application Health Program

Items	Timing	Total knowledge mean scores		Total self-care mean scores		Total self- efficacy mean scores	
		Rho	P	r	P	r	P
Total knowledge mean scores	**Before**			-0.197	0.297	0.128	0.502
	Immediately after			0.185	0.327	0.275	0.142
	One month after			0.302	0.105	0.255	0.173
Total self-care mean scores	**Before**	0.128	0.52			0.421	**0.021***
	Immediately after	0.185	0.327			0.456	**0.011***
	One month after	0.302	0.105			0.521	**0.003***
Total self-efficacy mean scores	**Before**	-0.197	0.297	0.421	**0.021***		
	Immediately after	0.275	0.142	0.456	**0.011***		
	One month after	0.255	0.173	0.521	**0.003***		

Table (7): Regression Analysis of Study Children's Total Mean Scores of Self-care and Self- efficacy (n=30).

Dependent factor	Independent factor	Unstandardized Coefficients		Beta	t	P value	95% CI
		B	Std.Err				
Total self-care	**Constant**	67.857	8.892		7.631	<0.001*	49.64:86.07
	Total self- efficacy	2.080	0.824	.430	2.523	<0.018*	0.391: 3.77

Table (8): Relationship Between Socio-demographic, Medical History and the Children' Knowledge level Immediately After and One Month After the Mobile Application Health Program

Items	Level of knowledge							
	Immediately after				One month after			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
		%	N	%	N	%	N	%
Age (Years)	**N**							
6	0	0	2	9.1	0	0	2	8.0
8	3	37.5	9	40.9	3	60.0	9	36.0
10-12	5	62.5	11	50.0	2	40.0	14	56.0
P value	0.916(.864)^{MC}				1.20(0.737)^{MC}			
Gender								
Male	1	12.5	6	27.3	1	20.0	6	24.0
Female	7	87.5	16	72.7	4	80.0	19	76.0
P value	0.716(0.638)$^{\$}$				0.037**(NS)**$^{\$}$			
Rank								
First	1	12.5	8	36.4	1	20.0	8	32.0
2Second	5	62.5	8	36.4	2	40.0	11	44.0
Third	2	25.0	4	18.2	2	40.0	4	16.0
Fourth	0	0	2	9.1	0	0	2	8.0
P value	2.90(0.472)^{MC}				1.82(0.766)^{MC}			
Education								
1st. – 2nd. grade primary	7	87.5	17	77.3	5	100	19	76.0
3rd. grade primary	0	0	2	9.1	0	0	2	8.0
4th. – 6th. grade primary	1	12.5	3	13.6	0	0	4	16.0
P value	0.810(0.812*)^{MC}				1.50(0.703)^{MC}			
Residency								
Urban	6	75.0	18	81.8	5	100	19	76.0
Rural	2	25.0	4	18.2	0	0	6	24.0
P value	0.170**(NS)**$^{\$}$				1.50(0.553)$^{\$}$			

Items	Level of knowledge							
	Immediately after				One month after			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
		%	N	%	N	%	N	%
Onset of disease								
1-	7	87.5	8	36.4	3	60.0	12	48.0
3-<5	1	12.5	10	45.5	2	40.0	9	36.0
≥5	0	0	4	18.2	0	0	4	16.0
P value	6.26(0.058*)MC				0.938(0.687)MC			
Presence of dialysis related side effects								
Yes	5	62.5	10	45.5	1	20.0	14	56.0
No	3	37.5	12	54.5	4	80.0	11	44.0
P value	0.682(0.409*)MC				2.16(0.142)$			

P value is significant <0.05

Table (9): Relationship Between Socio-demographic, Medical History and the Children' Self-efficacy Level After the Mobile Application Health Program

Items	Self- efficacy total scores of children after the mobile application health program			
	Unsatisfactory		Satisfactory	
	N	%	N	%
Age (Years)				
6	1	4.0	1	20.0
8	10	40.0	2	40.0
10-12	14	56.0	2	40.0
P value	1.76(.414)MC			
Gender				
Male	6	24.0	1	20.0
Female	19	76.0	4	80.0
P value	0.056(NS)$			
Rank				
First	6	24.0	3	60.0
Second	11	44.0	2	40.0
Third	6	24.0	0	0
Fourth	2	8.0	0	0
P value	3.99(.191)MC			
Education				
1st. – 2nd. grade primary	21	84.0	3	60.0
3rd. grade primary	1	4.0	1	20.0
4th. – 6th. grade primary	3	12.0	1	20.0
P value	1.96(.421)MC			
Residency				
Urban	19	76.0	5	100
Rural	6	24.0	0	0
P value	1.58(0.053*)MC			
Age of onset of disease in years				
One	14	56.0	1	20.0
Three – Five	9	36.0	2	40.0
More than five	2	8.0	2	40.0
P value	4.24(.0132*)MC			
Presence of dialysis related side effects				
Yes	12	48.0	3	60.0
No	13	52.0	2	40.0
P value	1.58(.553)$			

P value is significant <0.05

Table (1): Showed that the study children who undergo hemodialysis mean age was 9.57±1.52, female gender was 76.7% of the total sample. Regarding rank of the child more than two fifths of study sample (43.3%) were the second child. In relation to the education most of the sample (80%) were rolled in first and second grade primary school as well as the same percentage of children came from urban residency area.

Table (2): Displayed that half of children, (50%) the disease onset was at the age of one year old and 47.7% the disease onset was three to five years old while mean age of disease onset was 2.80±1.54 years old. The same table illustrated that the percentage of children in the studied sample who had been treated with hemodialysis were (53.3%, 33.3% and 13.4%) for (16, 10, 4 months) consequently. All children in the studied sample had three hemodialysis sessions per week and half of them experienced hemodialysis related side effects; and almost half of children who had hemodialysis side effects (46.6%) had vomiting while one third of them (33.3%) had headache. The majority of studied sample (90%) expressed their inability to provide self-care for their own selves and 93% of them stated that they do not practice physical exercise.

Table (3): Displayed the presence of highly significant variations in the studied children's knowledge total mean score before, immediately after, and one month after receiving mobile application health program (4.63±2.18, 20.57±6.80 &21.57±6.76)

Table (4): Highlighted improvement in the children's self-efficacy scores immediately after and one month after as compared to before the program. significant statistical differences existed through all the children's six items of self- efficacy as well as the total mean scores of it before,immediatly after and one month after the mobile application health program using f. test as P. value was at (<.001).

Table (5): Shed the light on statistically significant variation among all the six subscales of self-care activities and the same difference also was found between the total mean scores of it between the children before, immediately after and one month after the mobile application health program using f. test with P at (<.001). These statistical highly significant differences proved the improvement of children self-care activities immediately and one month after the program.

Figure (1): Displayed that none of the children had satisfactory level of knowledge before the program while (22 and 25) had a satisfactory level of knowledge immediately and one month after receiving mobile application health program.

Figure (2): Showed that percentage of children with high level of self-efficacy before the program was (3.3%) but immediately after and one month the program this percent increased to (17.5% and 100%) consequently

Figure (3): Highlighted that percentage of children with high level of self-care before the program was (6.6%) while immediately after and one month after receiving the program this percentage increased to (20% & 80%) of children.

Table (6): Displayed the presence of significant statistical and a positive correlation among children's total self-care and self- efficacy mean scores before, immediately after and one month after attending the program. There was no correlation between children's total mean scores of knowledges, self-efficacy, and self-care activities.

Table (7): Clearly displayed the highly statistical strong regression between total mean scores of self-care and self- efficacy with t. equal to (7.631 and 2.523) at P. value of (<.0.001 and 0.018) successively.

Table (8): Showed the presence of positive strong correlation relationship between child education, age of onset of the disease in years, and presence of dialysis related side effects from one side and knowledge level of the children in the knowledge posttest using the Mont Carlo for Chi square test (MC 0.810,6.26, and 0.682 and P=0.012, 0.51, and 0.04) consequently.

Table (9): Revealed the presence of positive correlation between place of residence (urban) and disease onset in years from one side and high children' self- efficacy level using Mont Carlo for Chi square (MC= 1.58 &P=0.053& MC= 4.24 and P=0.0132) consequently. Table (9) showed also the presence of positive correlation between place of residence (urban) and disease onset in years from one side and high children' self- efficacy level using Mont Carlo for Chi square (MC= 1.58 &P=0.053& MC= 4.24 and P=0.0132) consequently.

Discussion

Children affected with chronic renal disease are susceptible to various health complications and heightened mortality rates. Presently, the promotion of self-care constitutes a fundamental principle in nursing, serving as the cornerstone for sustaining and enhancing the well-being of pediatric patients. Educating children undergoing hemodialysis in self-care practices encompasses instruction on regulating fluid intake, adhering to dietary guidelines, medication management, active participation in their care, and fostering effective communication. These efforts aim to cultivate heightened self-efficacy and sustain role integrity. Embracing self-care strategies

can yield favorable outcomes, including decreased incidence of minor complications, reduced hospitalizations, heightened levels of pediatric contentment, bolstered autonomy, improved adaptation to medical afflictions, and amplified overall well-being and performance. **(Osman et al., 2023)**.

Enhancing children's self-care capabilities, diminishing fear and dependency, and fostering motivation, self-confidence, and a sense of autonomy are vital objectives in pediatric nursing. Recognizing that nursing aims to meet children's self-care needs and empower them to handle changes, it is essential to consider the effectiveness and benefits of self-care in this age group **(Hosseini et al., 2023).** The current study sought to evaluate the impact of a health program delivered through a mobile application on the knowledge, self-care practices, and self-efficacy of children undergoing hemodialysis.

Based on the socio-demographic data, the current study revealed that more than half of the children undergoing hemodialysis were between 10 and 12 years old. This finding is consistent with previous studies by **Obiagwu et al. (2018)** on "Health-Related Quality of Life in Children and Adolescents with End-Stage Renal Disease Receiving Dialysis in **Johannesburg" & Darwish et al. (2020)** on "Health-Related Quality of Life in Children with Chronic Kidney Disease in Assiut, Egypt". The researchers emphasize the importance of this age group, as children with chronic renal failure not only experience physiological discomfort from kidney failure, medication and treatment side effects, activity restrictions, chronically invasive procedures (e.g., dialysis), and frequent clinic visits, but also struggle with cognitive and psychosocial issues that can affect their overall well-being and normalcy.

The findings of the current study highlighted a predominance of female participants, comprising three-quarters of the total sample, while males constituted less than one-quarter, this result contrasts with **Darwish et al. (2020)** in their work entitled "Family Impact and Economic Burden Among Caregivers of Children with Chronic Kidney Disease in Assiut", where 67.2% of cases were boys. The researchers consider that the findings of the present study may be influenced by gender differences, as reported in the study by **Layton & Sullivan (2019)** on "Sex and Gender in Renal Health and Function: Recent Advances in Sex Differences in Kidney Function". This study reported that women have relatively smaller kidneys, approximately 25% lighter than men's kidneys, and chronic kidney disease is more prevalent among women than men.

The current study's results revealed that the majority of children came from urban residency areas, which is consistent with the study conducted by **Hassan & Mahmoud (2020)** regarding "The Effect of Empowerment Program for Mothers of Children Undergoing Hemodialysis on Arteriovenous Fistula Care", where more than half of the studied sample resided in urban areas. The researchers attribute this finding to the residence of children, as they attended the nearby governmental hospital that provides free services suitable for their economic level.

The finding of the present study reported that All children in the studied sample had three hemodialysis sessions per week and half of them experienced hemodialysis related side effects; and almost half of children who had hemodialysis side effects had vomiting while one third of them had headache. This result is in congress with the results of **Naheed, et al., (2023)** who aimed in their study to evaluate hemodialysis complications among children with chronic kidney disease at District Head Quarter Hospital and found that 86% of their studied sample had vomiting, nausea, and headache. The same findings are in the same line with those of **Rupesh et al. (2022)** who had systemic review titled "Dialysis Disequilibrium Syndrome (DDS) In Pediatric Patients on Dialysis: Systematic Review and Clinical Practice Recommendations" found that among 48 studies the most common symptoms reported by children undergoing dialysis were, headache (24.8%), and vomiting (23.9%). From the researchers' perspective, children undergoing dialysis may often feel deprived of their favorite foods, which can influence their emotional and behavioral attitudes towards restricted diets.

The results of the present study indicated that the knowledge level of the children varied before, immediately, and one month after to participating in the mobile application health education program. Before the health education, none of the children demonstrated a satisfactory knowledge level, while immediately after the program; nearly three-quarters of the children exhibited a satisfactory knowledge level. Additionally, most of the children, one month after attending the mobile application health program, had attained a satisfactory knowledge level. The study found a highly statistically significant difference in the total mean scores of the children's knowledge before, immediately, and one month after attending the mobile application health program. These findings supported the first hypothesis of the present study.

The previous findings aligned with an Egyptian study done by **Osman et al., (2023)** titled "Effectiveness of Self-Care Program on the Health-Related Quality of Life for Children Undergoing Hemodialysis', reported that, there was a highly statistically significant difference in studied children total

knowledge immediately post and 3 months follow up after the application of the self-care program. Also In the same context, **Fadlalmolaa & Elkareem's (2020)** study "Impact of an educational program on knowledge and quality of life among hemodialysis patients in Khartoum state", indicated that patients' knowledge during hemodialysis therapy increased from 55.3 % in the pretest to 78.3 % in the post-test. In the same line **Hamza & Hasanen (2022)** study the "Effect of educational program for hemodialysis patients regarding their knowledge and practice about self-care behavior" revealed that patient's knowledge improved significantly after conducting the educational intervention on self-care program.

These findings may be explained that unsatisfactory level of knowledge of studied children may be due to the long term of children on hemodialysis without health education, in addition to improved knowledge after the program (posttest) could be justified by that the implementation of educational program through mobile application used simple language facilitate their understanding and had an impact on their knowledge.

Concerning self-care activities, the current study reported that the majority of studied sample in before the program expressed their inability to provide self-care for their own selves and stated that they do not practice physical exercise. The total mean self-care scores measured immediately after and one month after applying the mobile application health program was significantly higher than the corresponding pre-intervention score. The total mean self-care scores one month after the intervention were significantly higher than the self-care scores before, and immediately after the intervention. Findings indicated that there was a highly statistically significant improvement in total mean scores of the six subscales of self-care activities as well as the before, immediately after and one month after applying the mobile application health program. The current findings supported the second hypothesis of the current study.

The current study results were along with a study done by **Hassan & Khalafallha, (2019)** entitled " Self-care activities of adolescents undergoing hemodialysis" which reported that the majority of the studied children undergoing hemodialysis had a lower weighted mean level in all self-care activities as well as physical, emotional, social, spiritual, and school performance. They also recommended that children required a self-care program, to improve overall social, emotional, and physical dimensions. As the targeted group is children, it is suggested to start training from the time of diagnosis to institutionalize it and to build a proper lifestyle to form a new habit and finally to improve self-care activities.

In the same line **Hamza, & Hasenen (2022)** study the "Effect of educational program for hemodialysis patients regarding their knowledge and practice about self-care behavior" who found that mean scores of hemodialysis patient's knowledge regarding self-care significantly improved after conducting the educational intervention on self-care program .

As well as **Hosseini, et al., (2023)** study "The Effect Of An Educational App On Hemodialysis Patients' Self-Efficacy and Self-Care" highlighted that education through a mobile application can result a significant improvements in patients' self-care behaviors and self-efficacy over time. In a recent empirical evidence systematic review and meta-analysis study by **Zihao et al., (2021)** to evaluate "The effectiveness of smart phone-based interventions for improving physical activities in children. The evidence of meta-analysis shows that smartphone-based intervention may be a promising strategy to increase physical activities and steps in children and adolescents. Currently, mobile app intervention may be a more effective strategy among smartphone intervention technologies for children.

Current study results also agree with **Osman et al (2023)** that were a highly statistically significant difference in the studied children's levels of self–care practices immediately after and one month after the implementation of the self- care program.

In relation to total score of children`s self-care, there was an improvement in children reported self-care practice which is in consistent with the findings of a study by **Moghadam et al. (2019)** who investigated "the Effect of Self-Care Behavior Training, as well as its Benefits and Barriers on Patients Undergoing Hemodialysis," and who found that after the training intervention, self-care scores and benefits increased significantly, while self-care obstacles decreased significantly in the study group. The previous studies findings illustrated the significant improvement in self-care practice after implementation of health education program for children on HD. They suggested that the need for developing educational self-care program for children to improve self-care practice and to assist hemodialysis children and their families to understand the importance of self-care activities.

In a scoping review by **Jebraeily et al, (2021)** entitled "Usage of Smartphone Apps in Self-care of Patients Undergoing Hemodialysis", concluded that smartphone apps must be developed with the cooperation and supervision of healthcare agencies to improve patient adoption and ensure confidentiality. Further research efforts are needed to assess the impact of apps on quality-of-life outcomes through

randomized controlled trials and cohort studies. The results of the studies in scoping review have indicated that hemodialysis patients using smartphone apps have more motivation in self-management of their illnesses and greater adherence to their care than patients who did not use it. Therefor the result of scoping review indicated that the apps are effective for patient training. Also, it can affect improving self-care outcomes.

Regarding impact of the mobile application health program on the study children' self-efficacy level, before the program none of the children had high self-efficacy while immediately and one month after the program majority of them had high self-efficacy, and there was a highly statistically significant difference between all the six items of self-efficacy as well as the total mean scores of it between before, immediately after, and one month after applying the mobile application health program with P <.001. This result supported the third hypothesis of the current study.

In the same context, **Hood, et al (2021)** studied "Mobile health use predicts self-efficacy and self-management in adolescents with sickle cell disease, reported higher self-efficacy and provided support for the mobile app to improve self-efficacy among children. **Kharaman-nia et al., (2023)** compared the effects of self- care education by lecture and smartphone application on self-efficacy of patients with thalassemia, the results revealed that smartphone app was recommended and suitable educational software to improve self-efficacy in patients with thalassemia.

Present study' results revealed a highly significant positive correlation between children total self-care and self-efficacy mean scores before, immediately , and one month after the implementation of the program. This result agrees with **Kharaman-nia et al., (2023)** reported that one of the most essential aspects in the development of self-care habits is self-efficacy. Enhancement of self -efficacy leads to improving previous behaviors, such as adherence to treatment, stress management, physical activity, and its decline leads to an increase in depression and a decrease in self-care activities.

In the same context a study done by **Hood & Nwankwo, et al., (2021)** titled “Mobile health use predicts self-efficacy and self-management in adolescents with sickle cell disease” to examine relation between empowerment with self-care and self-efficacy and found that there is a relationship between self-care and self-efficacy, and it is necessary to pay attention to self-efficacy and self-care behaviors 'education in order to improve of empowering patients. From researchers' point of view, patients` participation in self-care activities requires self- efficacy or in other words belief in their abilities. In a recent study by **Hosseini et al., (2023)** about" The effect of an educational app on hemodialysis patients’ self-efficacy and self-care: A quasi-experimental longitudinal study". They concluded that hemodialysis patients need comprehensive education on self-efficacy and self-care so that their treatment is more effective, complications and treatment duration are reduced, and their quality of life improves.

The previous studies' results indicated that interventions related to smartphone applications are considered a valuable and helpful tool, including improving self-care activities in children with chronic diseases, facilitating communication with healthcare providers, and decreasing care costs. The mobile applications promote the children's self-care activities throughout health education, monitoring, feedback, and support programs outside a healthcare clinical setting **(Santana et al., 2021; Pack & Lee, 2021 & Hosseini et al, 2023).**

Finally, the impact of mobile and web health applications on pediatric chronic disease management and quality of life was found to be beneficial in a recent update systematic review by **Hasanah et al. (2024)** titled "Impact of Mobile and Web Health Apps on Pediatric Chronic Disease Management and Quality of Life.". reported that mobile and web health applications play a positive role in managing chronic diseases and enhancing the quality of life for pediatric patients through availability of numerous features with these apps, such as calendar reminders, caregiver communication, information sharing, symptom assessment, and educational materials. When providing care for children with chronic illnesses, healthcare professionals and caregivers ought to think about incorporating these technologies. It may result in better results and general wellbeing.

Conclusion

Based on the present study findings, it can be concluded that health education program through a mobile application significantly improve children’ knowledge, self-efficacy and self-care behaviors of children undergoing hemodialysis and these changes can be maintained. Therefore, these results are recommended to expand current knowledge about the effectiveness of mobile health interventions in hemodialysis therapy so that this tool can be used by this specific age group.

Recommendation

- Develop mobile apps self-care training courses to increase the levels of knowledge and awareness among children undergoing hemodialysis and improve their self- efficacy.
- Further researches needed to:
  a. Identify barriers to the implementation of support-training intervention programs with mobile app and advanced technology.
  b. Emphasize the effect of mobile app health interventions on large sample and in different pediatric diagnoses.

Conflict of interest statement:

The authors declare that there is no conflict of interest.

References

- **Ahmed F., Sayed F. & Elasaar H. (2020):** Effect of Nursing Intervention Program on Self-Esteem, Body Image and Quality of Life of Children undergoing Hemodialysis, IOSR Journal of Nursing and Health Science, e-ISSN: 2320–1959, 99 (3), PP 30-44, available at: www.iosrjournals.org
- **Darwish, M., Hassan, S., Taha, S., Abd El-Megeed, H., & Ismail, T. (2020):** Family impact and economic burden among caregivers of children with chronic kidney disease in Assiut, Egypt. Journal of the Egyptian Public Health Association, Vol. (95), No. (1), Pp. 1-8.
- **Fadlalmola, H. & Elkareem, E. (2020):** Impact of an educational program on knowledge and quality of life among hemodialysis patients in Khartoum state. International Journal of Africa Nursing Sciences, Vol (12), Pp.1-4
- **Feizalahzadeh, H., Zagheri, M., & Moghaddasi, H., (2020):** Effectiveness of multimedia based on education and traditional methods on life quality of hemodialysis patients. Journal of Holistic Nursing and Midwifery, Vol. (26), No. (2), Pp. 69-78.
- **Haloob AL-Abedi, H., Abbass AlKhafajy, Z. Eidan, A., Al-Mossawy, D., & Al-Zeyadi, A. (2020):** Assessment self-care of patients' undergoing hemodialysis with end stage renal disease. Indian Journal of Forensic Medicine & Toxicology, Vol. (14), No. (1), Pp. 980-988.
- **Hamza, O., & Hasanen, R. (2022):** Effect of educational program for hemodialysis patients regarding their knowledge and practice about self-care behavior. Assiut Scientific Nursing Journal, Vol. (10), No. (28), Pp. 10-20.
- **Hasanah, I, Sari, A., & Baiq., N. (2024):** "Impact of Mobile and Web Health Apps on Pediatric Chronic Disease Management and Quality of Life: An Update Systematic Review". Africa Journal of Nursing and Midwifery, 23 pages. https://doi.org/10.25159/2520-5293/15152.
- **Hassan, E. & Khalafallha, H (2019):** Self-care activities of adolescents undergoing hemodialysis. IOSR Journal of Nursing and Health Science, Vol. 8, No. (5), Pp. 7-16.
- **Hassan, A., & Mahmoud, N. (2019):** The effect of empowerment program for mothers of children undergoing hemodialysis on arteriovenous fistula care. Egyptian Nursing Journal, Vol. (16), No. (3), Pp. 128-155
- **Hood, A., & Nwankwo, C. (2021):** Mobile health use predicts self-efficacy and self-management in adolescents with sickle cell disease. Global Journal of Health Science, Vol. (8), No. (2), Pp. 1823-1831.
- **Hosseini, A., Jackson, A, Chegini, N., Dehghan, M., Mazloum, D., Haghani, S. & Bahramnezhad, F (2023):** The effect of an educational app on hemodialysis patients' self-efficacy and self-care: A quasi-experimental longitudinal study. Chronic Illness, Vol. (19), No. (2), Pp. 383–394.
- **Hockenberry, M., &Wilson. D. (2019):** Wong's nursing care of infants and children (11th ed.). St. Louis: Elsevier Mosby
- **Ibrahim, M., Ouda, W., & Ismail, S (2019):** Assessment of nurses' performance regarding care of children undergoing hemodialysis therapy. Egyptian Journal of Health Care, Vol. (10), No. (3), Pp. 113-125.
- **Jebraeily, M., Dehghani, M., Sheykhotayefeh, M., & Habibi-Koolaee, M (2021):** Usage of smartphone apps in self-care of patients undergoing hemodialysis: A scoping review. Applied Health Information Technology, Vol. (2), No. (2), Pp. 57-62.
- **Kharaman-nia, F., Rezaei, H., & Roustaei, N. (2023):** Comparing the effects of self- care education by lecture and smartphone application on self-efficacy of patients with thalassemia. BMC Med Inform Decis Making, Vol. (23), No. (21), Pp. 1-9.
- **Khazaei F., Razaghi N. & Vashani H. (2021):** Effectiveness of a Support-Training Program based on the Orem's Self-Care Deficit Theory on the Quality of Life of Children Undergoing Hemodialysis, Evidence Based Care Journal, 11(1), PP 55-7 available at, http://ebcj.mums.ac.ir/article_17795.html
- **Kilicoglu, A., Bahali, K., Canpolat, N., Bilgic, A., Mutlu, C., Yalçın, & Sever, L (2016):** Impact of endstage renal disease on psychological status and quality of life. Pediatrics International, Vol. (58), No. (12), Pp. 1316-1321.

- **Kim, H., Goldsmith, J., Sengupta, S., Mahmood, A., Powell, M., Bhatt, J., Chang, C., & Bhuyan, S., (2019):** Mobile health application and e-health literacy: opportunities and concerns for cancer patients and caregivers. Journal of Cancer Education, Vol. (34), No. (1), Pp. 3-8.
- **Layton, T. & Sullivan, J (2019):** Focus sex and gender in renal health and function recent advances in sex differences in kidney function. American Journal of Renal Physiology, Vol. (316), No. (2), Pp. 328-331.
- **Lee, Y., L., Cui, Y., Y., & Tu, M., (2021):** Mobile health to maintain continuity of patient-centered care for chronic kidney disease: content analysis of apps. JMIR M health U health, Vol. (6), No. (4), Pp.123-145.
- **Lorig, K., Sobel, D., Ritter, P., Laurent, D., & Hobbs, M (2001):** Effect of a self-management program for patients with chronic disease. Effective Clinical Practice, Vol. (4) No. (6), Pp. 256-262
- **Machaly, E. (2020):** Effect of implementing evidence based nursing guidelines on nurses' performance about care provided for children undergoing hemodialysis. IOSR Journal of Nursing and Health Science, Vol. (9), No. (3), Pp. 21-28.
- **Naheed, R., Akhtar, S., Perveen, S., Perveen, R., & Mazhar, R. (2023):** Evaluation of hemodialysis complications among children with chronic kidney disease at district head quarter hospital, Nankana Sahib: Hemodialysis complications among children with chronic kidney disease. Journal of Nursing & Midwifery Sciences, Vol. (3), No. (2), Pp. 33–37.
- **Obiagwu, P., Sangweni, B., Moonsamy, G., Khumalo, T., & Levy, C (2018):** Health related quality of life in children and adolescents with end-stage renal disease receiving dialysis in Johannesburg. South African Journal of Child Health, Vol. (12), No. (2), Pp. 58-62.
- **Omisakin, F., & Ncama, B., (2020):** Self-care and self-management concepts: implications for self-management education. Educational Research, Vol. (2), No. (12), Pp. 1733–1737
- **Osman, K., Abusaad, F., Abu Salem, L., & Abdelmotaleb, R (2023):** Effectiveness of self-care program on the health-relate quality of life for children undergoing hemodialysis. Mansoura Nursing Journal, Vol. (10), No. (1), Pp. 1-12.
- **Pack, S., & Lee, J (2021):** Randomized controlled trial of a smartphone application based dietary self-management program on hemodialysis patients. Journal of Clinical Nursing, Vol. (30), No. (5), Pp. 7-15.
- **Rukshana S., (2023):** Hemodialysis for children with chronic kidney disease. Published by Oxford University Press on behalf of the Society of Behavioral Medicine.
- **Rupesh, R., Davenport, A., & Warady, B. (2022):** Dialysis disequilibrium syndrome (DDS) in pediatric patients on dialysis: systematic review and clinical practice recommendations. Pediatric Nephrology, Vol. (37), No. (2), Pp. 263–274.
- **Saakvitne, K., Pearlman, L., Traumatic Stress Inst, Ctr for Adult & Adolescent Psychotherapy, LLC. (1996):** Transforming the pain: A workbook on vicarious traumatization. W.W. Norton & Co.
- **Santana, C., Freitas, A., Barreto, G., (2021):** Serious game on a smartphone for adolescents undergoing hemodialysis: Development and evaluation. JMIR Serious Games, Vol. (8), No. (3), Pp. e17979.
- **Yousef, Y., Elashir, U., Mahmoud, S. & Maghraby, N (2019):** The effect of educational programs on knowledge and practices of nurses regarding infection control measures for children under hemodialysis. Egyptian Nursing Journal, Vol. (16), No. (1), Pp. 1-9.