Effect of Mobile-Based Nursing Intervention on Preventive Measures of COVID –19 among Children Suffering from Chronic Kidney Diseases

Hanaa Mohamed Ibrahim Nassar [(1)], Fathia El-Sayed El-Ghadban [(2)], Thorea Mohamed Mahmoud [(3)], Omima Mostafa Abd Elzaher Mohamed [(4)], Manal Mohamed Ahmed Ayed [(5)]

(1) Pediatric Nursing Department, Faculty of Nursing, Port Said University, Egypt
(2) Pediatric Nursing Department, Faculty of Nursing, Fayoum University, Egypt
(3) Community Health Nursing Department, Faculty of Nursing, Sohag University, Egypt
(4) Community Health Nursing Department, Faculty of Nursing, Sohag University, Egypt
(5) Pediatric Nursing Department, Faculty of Nursing, Sohag University, Egypt
E-mail of the corresponding author: Manal_ayed@yahoo.com
DOI: https://orcid.org/0000-0003-0922-5823

Abstract

Background: Mobile-based nursing intervention is a trial to enable children to be safe during the COVID-19 epidemic especially those children with chronic kidney disease and who have no immunity. Now days using mobile becomes a part of universal technology for improving the care of children with such conditions. **This study aimed to** evaluate the effect of mobile-based nursing intervention on preventive measures of COVID-19 among children suffering from chronic kidney diseases. **Design**: A quasi-experimental design was adopted. **Sample**: A purposive sample including 70 children suffering from chronic kidney diseases with predetermined criteria (receive regular kidney dialysis, have no history of previous COVID-19 or previous kidney disease complications and well-being mental health) **setting**: The study was conducted at the Pediatric Kidney Dialysis Unit at Sohag University Hospital. **Tools for data collection**: A structured questionnaire was used to collect data concerning characteristics of the studied children (pre/posttest questionnaire) as well as to assess the level of child knowledge regarding mobile intervention, preventive measures of COVID-19 and dialysis therapy, a checklist to assess reported practice as regards preventive measure of COVID-19. And Mobile-based nursing intervention which had been designed by the researchers. **Results**: There was a statistically significant difference towards using mobile-based nursing intervention in the area of children's knowledge and practice about COVID-19 preventive measures at post-intervention compared to pre-intervention. **Conclusion**: Mobile-based nursing intervention had a positive effect on improving preventive measures of COVID-19 among children suffering from chronic kidney diseases. **Recommendations:** apply mobile-based intervention in other pediatric kidney dialysis units and hospitals to achieve a better preventive measure of COVID-19 among children with chronic disease.

Keywords: Children, chronic kidney diseases, mobile health, COVID-19, nursing intervention.

Introduction:

Chronic kidney disease (CKD) is recognized as a major public health problem. However, the magnitude of CKD varies from one geographical area to another due to genetic and environmental factors. In the absence of a national registry, the exact incidence and burden of CKD in children in Egypt is not known. In a developing country such as Egypt, with limited diagnostic resources and poor-quality primary health care, end-stage renal disease (ESRD) patients are diagnosed with renal disease. In contrast, little is known about the epidemiology of CKD in the pediatric population **(Tong and Stevenson, 2016).**

During coronavirus disease, 2019 (COVID-19) children with chronic CKD and infants might have severe clinical manifestations **(Dong and Bouey, 2020).** Because those children are malnourished, undergo maintenance hemodialysis and increasing the risk of infection. According to the analysis of confirmed children with COVID-19 reported to the Center for Disease Control (USA) revealed that children with CKD were 11 to 14-times more liable to hospitalization and require intensive care compared to those without CKD **(Ministry of Health and Family Welfare, 2020 a).** Since children with CKD are infected with coronavirus, children and their caregivers must follow preventive measures. They should

maintain contact with the physicians and nurses, especially about symptoms of COVID-19 including fever and worsening respiratory symptoms. The pediatric patients should continue taking antihypertensive medications and measuring blood pressures **(CDC COVID-19 Response Team, 2020).**

Nursing intervention about the care given by health professionals to improve the lack of knowledge, education, and understanding the needed skills to follow is very important. Also, the Internet can provide benefits to health care, and promote care when used as a source of health information this can be useful for children with CKD as a way of obtaining health information **(Swallow et al., 2014).**

Internet is used among 40% of the world's population. Access has been driven by rapid growth in the use of smartphones, with 95% of the world's population living in areas covered by mobile phone networks **(International Telecommunication Union, 2015).** In children, 58% of the population aged 10 years and over had access to the Internet and 41% sought health information **(Brazilian Internet Steering Committee, 2016).**

The care for children with CKD is a complex disease due to complicated medication schedules, nutritional restrictions, and invasive procedures such as three times weekly hemodialysis or daily nocturnal peritoneal dialysis. To help these children cope with the difficulties encountered during all stages of their child's CKD, support, and information is necessary. However, interventions to assist these children with the day-to-day management and its consequences are lacking. So, online support programs are very important for them described the need among children with CKD for continuously available, accessible, and reliable support **(Swallow et al., 2014)**.

Online support programs are readily accessible and can lead to an improvement in users' knowledge, skills, self-efficacy, social support, health behaviors, and clinical outcomes. These programs have the potential to beneficially affect the children's perceived competence to manage home-based clinical care by developing and providing such an intervention **(Brazilian Internet Steering Committee, 2016).**

Creating new strategies for nursing care of children with chronic kidney diseases (CKD) access through using mobile to improve the quality of care is very important. Smartphones and mobile technologies are potential tools to promote children's care **(Rodig et al., 2018).** Using mobile apps provide concise information, be attractive, allows for personalization, remembering, privacy, broke down barriers during sessions, and discretion for activities (**Kenny et al., 2015).**

These mobile apps are focused on symptom assessment, education, and promoting engagement in care, skills practicing, or monitoring symptoms **(Anthes, 2016).** Advantages of mobile in health education include constant availability, greater access, equity of health resources, immediate support, anonymity, tailored content, lower cost, and increasing service capacity and efficiency. Mobile technology-based approaches may be particularly suited for pediatric patients and young people who may be more accepting of technology **(Bakker et al., 2016).** Mobile consultations with children and their families are encouraged to reduce hospital visits during the pandemic and simple strategies are employed to support the mental well-being of children and their families (**Board of Governors in Supersession of the Medical Council of India, 2020).**

Knowledge and practices of pediatric patients should be directed towards strict preventive measures to prevent the spread of the coronavirus infection. Facts about pediatric patients' perceptions and practices can be gained by assessing their knowledge about the coronavirus which helps to identify attributes that affect their adoption of healthy practices and responsive behaviors **(Babiker et al., 2014)**. The need to understand the children's knowledge, attitudes, and practice toward COVID-19 at this critical moment is necessary especially for pediatric patients suffering from chronic diseases such as CKD **(CDC COVID-19 Response Team, 2020).**

Nursing management regarding COVID-19 should focus on preventing the spread of infection. Pediatric nurses have an important role as teachers and advisors in educating

service users and caregivers, in providing health education in society, and in facilitating the development of other multidisciplinary team members. They should teach the pediatric patients to apply the ideal handwashing technique, follow the social distance, use the disinfectant materials such as alcohol, avoid shaking hands, put a tissue when coughing or sneezing on the mouth and nose, and wearing a mask to prevent the infection transmission. Also, educating them to encourage the child not to touch the eyes, nose, and mouth, about appropriate hand washing after contact with others, sneezing, or coughing and they should be discouraged from sharing towels, and washcloth **(WHO, 2020).**

The pediatric and community health nurses should advise the children with CKD to continue care sessions at home following the standard protocol and precautions, avoid hospital visits, and maintain adequate stock of fluids and consumables. The dialysis machine should be disinfected using 70% alcohol-based solution before and after each treatment. Children should keep in contact with the doctor or dialysis nurse, and inform promptly for fever, symptoms of COVID-19, and peritonitis. If COVID-19 is suspected in CKD, nurses should be shifted to an isolation facility if available or to a designated COVID-19 hospital as soon as possible and managed as per standard guidelines **(Schwierzeck et al., 2020).**

Educate children and their caregivers about COVID-19, as hand hygiene, respiratory hygiene and cough etiquette, use of facemasks, and disposal of contaminated items. At each dialysis visit, nurses must perform a structured interview for children and their caregivers, asking about the history of fever, cough, respiratory difficulty, and exposure to the pediatric patient with COVID-19. Children should be advised to use seats in the waiting area as separated by at least 1 meter. To avoid overcrowding, children should be accompanied by only one attendant who should also wear a facemask. During Dialysis and Disinfection, dialysis beds should be spaced at a minimum distance of 2 meters. Patients should be instructed to wash their hands and fistula arm before starting dialysis. Puncture sites should be cleaned and appropriately disinfected. Disposable gloves should be used when handling laundry from infected patients. Dirty laundry should not be shaken to minimize the possibility of dispersing the virus through the air. Bed linen should be changed between shifts and used linen placed in dedicated containers. Disposable gowns must be discarded after use **(World Health Organization, 2020b).**

Encourage the use of separate equipment, including stethoscopes, thermometers, saturation probes, and blood pressure cuffs, with cleaning and disinfection between shifts. Stethoscopes are disinfected with alcohol-based solutions. Dialysis personnel should not touch the patient or use stethoscopes, unless necessary **(Ministry of Health and Family Welfare Directorate General of Health Services).**

Significance of the study:

There is an increased flow rate of children with COVID-19 in Egypt 2020 **(Ministry of Health and Population in Egypt "MOHP", 2020).** Children representing 18.2% of the total Egyptian population are likely to be affected greatly by the long-lasting consequences of the pandemic and 52% of the Egyptian children and are considered to be among the most vulnerable groups to COVID-19's social and economic impact (**UNICEF Egypt Data, 2020**). To protect them should keep them away from infection and improve their knowledge and practice about preventive measures towards COVID-19. Especially, Children with chronic conditions, such as CKD might be at higher risk of serious illness with COVID-19. In Egypt, the exact incidence of CKD in children is not known, in a developing country such as Egypt, with limited diagnostic resources **(Safouh et al., 2015).**

Accordingly, availability and correct applying of preventive measures are essential to protect the pediatric patient during their coping with the COVID-19 pandemic. However, what is most important is their adherence to applying these preventive measures, which largely depends on their knowledge and practice about COVID-19. To ensure the protection of the pediatric patient and safeguard them from COVID-19 outbreak, there is an urgent need to understand the pediatric patient's awareness of COVID-19 **(Pal et al., 2020).** Knowledge and practices

about COVID-19 are affected by people's adherence to these preventive measures, following the "KAP theory" **(Ministry of Health and Population in Egypt "MOHP", 2020).**

The advances in technology as using mobile in nursing care for children suffering from CRD that have a long-term survival can affect and improve their health. One innovative approach is using mobile health technologies to help children with chronic kidney diseases better manage their disease and related conditions (**WHO, 2019**). So, the point of view of the researchers from this study there is an important aim to evaluate the effect of mobile-based nursing intervention on preventive measures of COVID-19 among children suffering from chronic kidney diseases.

Aim of the study

The study aimed to evaluate the effect of mobile-based nursing intervention on preventive measures of COVID-19 among children suffering from chronic kidney diseases through:

1. Assessing knowledge and practice of children suffering from chronic kidney diseases regarding preventive measures of COVID-19.
2. Design mobile-based intervention in the light of the actual need assessment of the study sample.
3. Implement and evaluate the effect of the mobile-based intervention on preventive measures of COVID-19 among children with chronic kidney disease.

Research Hypotheses:

Implementing mobile-based intervention will improve knowledge and practice of children suffering from chronic kidney diseases regarding preventive measures of COVID-19 among children

Subject and Methods:

Research design:

A quasi-experimental design was utilized in the current study.

Setting:

The study was conducted at the pediatric Dialysis Unit at Sohag University. This unit provides dialysis therapy for children from Saturday to Wednesday, from 9 a.m. to 1 p.m. this setting was selected because of the high prevalence of children suffering from chronic kidney diseases in the selected settings and also, it serves the biggest region of the population from both rural and urban areas.

Subjects:

A purposive sample of 70 children undergoing dialysis therapy for 6 months was selected.

Sample size calculation:

The sample size was calculated based on considering the level of significance of power analysis of 0.95(β=1-0.95=0.5) at alpha .05 (one-sided) with a large effect size (0.5) was used as the significance, 0.001 was used as the high significance.

Inclusion criteria of the studied children:

1- Children with a confirmed diagnosis of chronic kidney disease undergoing dialysis therapy (regardless of their gender or residence in addition to the absence of complication).

2- Children in the age group of 10-18 years.

3- Able to read and write.

4- Availability and accessibility of the mobile phone

5- Having the willingness and skills of information technology.

Exclusion criteria:

Exclude children suffering from other chronic physical or mental illnesses and have no history of previous COVID 19.

Tools of data collection:-

1- ***Child's Medical Record:***

This record was used to check data related to children's characteristics as the following:

Part I: Children's characteristics such as age, gender, educational level, rank in the family, and level of education.

Part II: Medical history such as the history of consanguinity, relations with a child, previous hospitalization, and causes of hospitalization as well as the discovery of the disease, duration, and causes of illness.

Part III: Dialysis characteristics such as frequency of dialysis, duration of dialysis.

Part IV: Physical assessment including physiological growth (such as vital signs) and physical growth (such as weight and height).

2-Questionnaire sheet:-

This tool was developed by the researchers after reviewing the related literature to assess children knowledge regarding preventive measures of COVID-19, It consisted of questions for assessing children knowledge preventive measures for COVID-19: it included ended questions that assessed children knowledge regarding the followings items: Washing hands; duration and indication, social distancing guidelines, cloth face coverings indications, gloving indication, recommendation for visitors, cough and sneezing etiquette, stress management methods, recommended action when she experiences signs and symptoms of COVID-19 recommended action when she contacts with a person having signs and symptoms of COVID-19.

Scoring system for children' knowledge about preventive measures of COVID – 19:

The total children'**s** knowledge percentages were calculated for known and unknown answers. Each complete correct mark was given (2 marks) and an incomplete correct answer was given (1) and (zero marks) for wrong or unknown answers. For each area of knowledge, the scores of the items were summed up and the total answers were divided by the number of the items, giving a mean score for the knowledge. Then, these scores were converted to a percentage score. Children' knowledge was considered satisfactory if the percentage score was 60% or more and unsatisfactory if was less than 60%

3-Observation checklist:

The observation checklist was modified by the researcher from **Bowden & Greenberger (2003)**, to suit the nature of the study and to assess caregivers' reported practice regarding care of their children breathing & coughing exercise, hand washing, wear mask ……?

Scoring system for children' reported practice about preventive measures of COVID – 19:

The steps of the procedure of hand washing which was done correctly were scored (1), and the items not done or incorrectly done were scored zero. For each area, the scores of the items were summed up, and the total was divided by the number of the items, giving the mean score for the part. These scores were converted to a percentage score. Children'**s** performance was considered adequate if the percentage score was 60% or more and inadequate if was less than 60%.

Validity of the tools:

The study measures (I-II) were reviewed and tested for content validity by 5 experts in the community and pediatric nursing. Modifications were done accordingly to ascertain relevance and completeness.

Reliability of the tools:

Test-retest reliability was used. The internal consistency of the tools was calculated using Cronbach's alpha coefficients. Study tools revealed reliability at Cronbach's alpha 0.761 for the tool (I) and 0.842 for the tool (II).

Administrative design:

An official letter requesting permission to conduct the study was obtained before embarking on the study from the Dean of the Faculty of Nursing, to the directors of each study setting. This letter was explaining the purpose and importance of the study. Then, approval from the manager of the Pediatric Nephrology Unit and Dialysis Unit and Pediatric Nephrology Outpatient at Sohag University Hospital was obtained.

Ethical considerations:

According to the Faculty of Nursing Ethical Research Committee, the researchers got the children's consent before conducting the study. Assured them about confidentiality, safety, and privacy of data obtained.

Before the research started, Approval of the Ethical Research Committee of the Faculty of Nursing was obtained before conducting the study. The researchers met both medical and nursing directors of the selected settings to clarify the purpose of the study and take their approval. Written consent was obtained from parents to gain their cooperation. Oral consent was obtained from the children after the objective of the study was explained to them. The aim of the study was explained and the expected outcomes from the implementation of the study were included in this letter to obtain permission for data collection. The researchers informed them that, the study was voluntary; they were allowed to refuse to participate in the study. Children had the right to withdraw from the study at any time, without giving any reason. Children were assured that their information would be confidential and used for research purposes only.

A pilot study:

The pilot study was conducted on 10% (7 children suffering from chronic kidney diseases) of the total sample to ensure the clarity, applicability of the measures, and the time needed to be completed. According to the results obtained from the pilot study, the required modifications were performed**.** Studied children who were in the pilot were excluded from the research study.

Data collection procedure:

The researchers reviewed the current local and international related literature to be more acquainted with the problem, to design the study measures, and to finalize them by using scientific books, articles, magazines, and the internet. The actual fieldwork was carried out from the beginning of April 2020 to the end of December 2020 at Pediatric Nephrology and Dialysis Unit and Pediatric Nephrology Outpatient Clinic at Sohag University Hospital in Egypt. The researchers introduced themselves to the medical and nursing staff members in the previously mentioned settings. The researchers explained the nature and the purpose of the study and asked for cooperation.

The researchers performed the study in the following phases:

1-Assessment Phase: The researchers met each child individually, introduced themselves to the children, and obtain their consent to the recruited in the study after explaining the purpose of the study and collected their demographic data, assessed children's knowledge about preventive measures of COVID-19 infection before the mobile-based nursing intervention by tools I &II.

2-Planning phase: The researchers prepared educational material about voluntary participation and confidentiality was assured by the researchers for each child by clarifying that all information will be used for scientific research only. All the study children were subjected to routine care of the study setting and then the content of nursing intervention through the mobile phone was prepared in the light of the actual need assessment of the children. Children involved in the study were interviewed and assessed to apply the mobile-based nursing intervention two times per week from 9:00 am to 11:00 am.

3-Implementation phase: The researchers provided (9) educational sessions including a booklet and audio sessions placed on mobile. Each session is lasting from 45 minutes to 1 hour. These sessions were illustrated by using a booklet, PowerPoint, and educational videos. The researchers wore personal protective equipment; gloves and facemask and follow COVID-19 precautions when contacting children and also children wore facemasks meanwhile the first and third sessions (knowledge sessions) were conducted with the mixed method including Individualized video meetings for children. Children were informed that their privacy was assured especially during the online meeting.

Mobile health education to all children with CKD includes nine sessions. **The first session** (30 minutes) focused on knowledge about mobile health education (meaning, types, and importance of it in control of CKD condition, methods, and uses). **The second session** (50 minutes) focused on knowledge about CKD (meaning, predisposing factors, clinical manifestations, a measure of blood pressure, complications, and management). The third session (60 minutes) focused on

knowledge about diet management for children with CKD (recommended and unrecommended diet and the relationship between diet and CKD control). The fourth session (60 minutes) focused on knowledge about dialysis (types, causes, procedure, management, and prevention of complications). The fifth session (40 minutes) focused on knowledge related to therapy (importance, types, sites, routes, preparation, storage, and complications). The sixth session (60 minutes) focused on problems that face children with CKD. The seventh session (30 minutes) focused on physical exercise (importance, precautions, types, and technique of suitable exercise). The eighth session (60 minutes) focused on personal hygienic care (importance, oral care, and skincare). The ninth session (30 minutes) focused on the importance of control CKD and follow-up. Videos and mobile were used to demonstrate the management and health education for children with CKD. SMS were sent weekly to the children to refresh their knowledge about CKD control by mobile phone. Chatting with the children was every two days to follow up on their health condition. Also, using mobile and telephone calls sometimes were needed to discuss any issue about CKD control.

The last Session: Practice session about COVID-19 precautions: the researchers helped the mothers to practice COVID-19 precautions through:

- **Hand washing in the right Way (CDC, 2020):** Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap. Lather your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails. Scrub your hands for at least 20 seconds. Rinse your hands well under clean, running water. Dry your hands using a clean towel or air-dry them**.**
- **How to wear a mask correctly (CDC, 2020):** Wash your hands before putting on your face covering**.** Put it over your nose and mouth and secure it under your chin**.** Try to fit it snugly against the sides of your face**.** Make sure you can breathe easily
- **How to remove mask correctly (CDC, 2020):** Untie the strings behind your head or stretch the ear loops**.** Handle only by the ear loops or ties**.** Fold outside corners together**.** Be careful not to touch your eyes, nose, and mouth when removing, and wash hands immediately after removing.
- **How can take a temperature with an oral thermometer (Potter & Perry, 2014):** wash your hands with soap and warm water. Use a clean thermometer. Do not eat or drink anything for at least five minutes before you take your temperature. Place the thermometer tip under the tongue. Hold the thermometer in the same spot for about 60 seconds. Read the measurement. Rinse the thermometer in the water, clean it with alcohol and rinse again.
- -**Evaluation** phase: Mobile-based nursing intervention was followed and carried out after two months by using pre and post the same tool (II).

Statistical analysis:

Statistical Design Data were analyzed using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage. The following tests were done: Chi-square (X2) test of significance was used to compare proportions between two qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: Probability (P-value) P-value <0.05 was considered significant, P-value <0.001 was considered as highly significant and P-value 0.05 was considered insignificant.

Results:

Table (1) shown that the mean age of the studied children was ranked as 10.9 ± 3.1 years, near two-thirds (62%) were males. While one quarter (25.0%) of them was fourth in birth order and most of the studied children (82.0%) of them were from rural. Finally, regarding education level, it was observed that (42.8%) of them were at the primary level, (34.4%) were at the preparatory level, and (22.8%) were at the secondary level.

Table (2) represented that most (80.0%) of studied children were had no past medical history and 20.0% had a past medical history

(e.g., recurrent tonsillitis, sore throat, dehydration, severe burns, hemorrhage, post-infectious glomerulonephritis or nephrotoxins), three quarter (75.0%) were had a negative family history of renal disorders. More than one thirds (36%) of them were the duration of illness was less than 1 year. While near two-thirds (65%) were at the first stage of the disease and 29% at the fifth stage (ESRD).

Table (3) showed that more than two-thirds (67.0%) of studied children was nephrotic syndrome the etiology of CKD and only 4.0% of them had multisystem conditions were the etiology of CKD.

It was noticed from **table**s **(4)** that, the majority of children have a knowledge deficit about covid-19. Most of the children had inadequate preventive measures practices' scores before using mobile-based nursing intervention, especially in measuring temperature**,** wearing a mask, use disinfectant materials like alcohol, and avoid shaking hands. After using mobile-based nursing intervention, highly statistically significant improvements were noticed in children's knowledge about the preventive measures regarding COVID-19 in all tested areas (P<0.001).

Table 5: Regarding participant's knowledge of COVID –19 preventive measures, the table showed that 4% of participants had satisfactory knowledge on pre-intervention compared to 94.7% at post-intervention meanwhile 96.0% of participants had unsatisfactory knowledge in pre-intervention compared to 5.30% on post-intervention. It showed a highly statistically significant difference between pre and post-intervention (McNemar test=123.4, P=.001).

Table (6): Illustrated that there was a statistical difference in participants' practice of COVID –19 preventive measures post-intervention in a certain item which includes wearing a facemask, removal of facemask, hand washing, and temperature checking than pre-intervention (p<0.001).

Table (7) highlighted that 96% of the studied children had inadequate level of COVID –19 preventive measures practices before intervention as compared to 4% who had an adequate level of COVID –19 preventive measures practices, While, become 91% of them had an adequate level of practice after intervention as compared to before (9%) with statistically significant differences (p= 0.000).

Table (8) showed that there was a statistically significant relationship between children's total knowledge and their reported practice throughout the intervention phases.

Figure (1) demonstrated that 99% of the studied children were not having COVID–19 after preventive measures practices by using mobile-based nursing intervention and only 1% of them were having COVID–19 after nursing intervention.

Table (9): Illustrated that all (70%) of the studied children not attended any nursing intervention by using mobile, (97%) of the studied children reported that nursing intervention by using a mobile was effective, and (96%) of them stated that communication during the nursing intervention by using a mobile was easy and available.

Table (1): Distribution of the studied children regarding their demographic data (n=70).

Items	No	%
Age (years)		
• 6- < 10	23	32.8
• 10- < 14	30	**43.6**
• 14- 18	17	24.6
Mean± SD	**10.9 ± 3.1years**	
Sex		
• Male	44	**62.2**
• Female	26	37.8
Birth order		
• 1st	7	10.0
• Middle	50	**72.0**
• Final child	13	18.0
Residence		
• Rural		
• Urban	57	**82.0**
	13	18.0
Education level		
• Primary level	30	**42.8**
• Preparatory level	24	34.4
• Secondary level	16	22.8

Table (2): Percentage distribution of CKD children according to their medical history (N=70)

Items	No	%
Past medical history		
• Yes	14	20.0
• No	56	80.0
Family history of renal disorders:		
• Negative	52	75.0
• Positive	18	25.0
Diagnosis		
• Minimal change nephrotic syndrome	12	17.0
• Steroid dependent	22	32.0
• Steroid resistance nephrotic syndrome	11	16.0
• CRF (not on dialysis)	4	6.0
• ESRD (on regular dialysis)	21	29
Duration of disease (month)		
• Less than 1 year	25	36.0
• < 2 years	9	13.0
• < 3 years	15	21.0
• 3 years and more	21	30.0
Stages of CKD disease:		
• 1st	45	**65.0**
• 2nd	0	0
• 3rd	1	1.0
• 4th	4	5.0
• 5th	20	29

Table (3): Percentage distribution of CKD children according to their etiology of CKD (N=70)

Etiology of CKD	No	%
• Congenital abnormalities and hereditary conditions	14	20.0
• Nephrotic syndrome	47	**67.0**
• Multisystem conditions	3	4.0
• Unknown	6	9.0

Table (4): Distribution of children with CKD regarding their knowledge about the preventive measures about COVID-19 pre-and post- using mobile-based nursing intervention (n=70).

Preventive measures	Pre using mobile-based nursing intervention		Post using mobile-based nursing intervention		P-value
	No	%	No	%	
Measuring temperature	**5**	8	66	95	
Hand washing	24	34	67	96	<0.001*
Wearing mask	10	14	49	70	<0.001*
Use disinfectant materials as alcohol	6	9	35	50	<0.001*
Avoid shaking hands	11	16	68	97	<0.001*
Social distance	13	19	62	89	<0.001*
Put a tissue when coughing or sneezing on the mouth and nose	27	39	69	98	<0.001*

Table (5): Children total knowledge levels regarding COVID –19 preventive measures pre and post using mobile-based nursing intervention

	Pre mobile-based nursing intervention (n=70)		Post mobile based nursing intervention (n=70)		McNemar test	P-value
	No.	%	No.	%		
Satisfactory	3	4.00	66	94.7	123.4	p<0.001**
Unsatisfactory	67	96.0	4	5.30		

Table (6): Children practices regarding COVID –19 preventive measures pre and post using mobile-based nursing intervention

	Pre mobile-based nursing intervention (n=70)		Post mobile based nursing intervention (n=70)		McNemar test	P-value
	No.	%	No.	%		
1-Wearing mask:						
Not done						
Inadequate	50	66.7	15	22.7	56.1	p<0.001**
Adequate	20	33.3	17	25.3	51.3	
	0	0.00	38	52.0	0.60	
2-Mask removal:						
Not done						
Inadequate	50	66.7	15	22.7	56.1	p<0.001**
Adequate	20	33.3	18	25.3	51.3	
	0	0.00	37	52.0	0.60	
3-Temperature checking:-						
Not done						
Inadequate	70	100	30	46.7	54.5	p<0.001**
Adequate	0	0.00	4	5.30	37.5	
	0	0.00	36	48.0	2.86	
4-Hand washing						
Not done	0	0.00	0	0.00	86.8	p<0.001**
Inadequate	70	100	20	26.7	56.4	
Adequate	0	0.00	50	73.3	5.67	

Table (7): Distribution of the studied children regarding their levels of total practice of COVID –19 preventive measures before and after mobile-based nursing intervention (no =70)

Items	Pre mobile-based nursing intervention		Post-mobile-based nursing intervention	
	No	%	No	%
Inadequate	67	96	6	9
Adequate	3	4	64	91
X2= 8.244, p-value=0.000				

Table (8): Correlation between children' total knowledge and their total reported practice score pre and post using mobile-based nursing intervention

Knowledge	Children' practice			
	Pre		Post	
	R	P	R	P
Pre	.43	.047*	-	-
Post	-	-	.88	0.001*

Figure (1): Distribution of the studied children regarding having COVID –19 after practice preventive measures by using mobile-based nursing intervention (no =70)

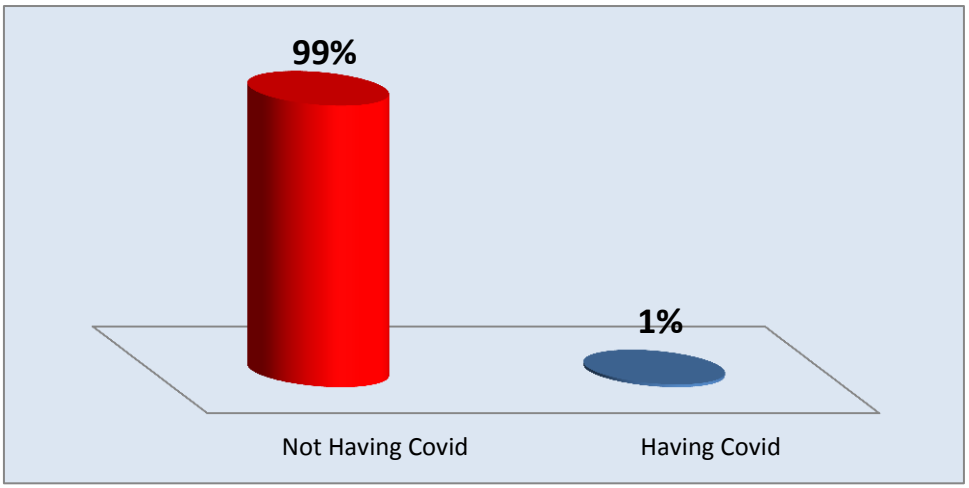

Table (9): Distribution of children with CKD regarding their knowledge about using mobile-based nursing intervention (n=70).

Items	No	%
Attending nursing intervention by using mobile-based before:		
Yes	0	0
No	70	100
Is nursing intervention by using mobile-based was effective		
Yes	68	97
No	2	3
Is communication during using mobile-based nursing intervention was easy and available:		
Yes	67	96
No	3	4

Discussion:

Digital technology is considered a way of increasing access to evidence-based interventions. Mobile technologies, in particular, are being adopted at an increasing rate; by 2020, it is estimated there are 6.1 billion mobile phone users globally. The majority of children and adolescents in 2017 have used a mobile phone (72% of children aged 0-11 years and 96% of those aged 12-17 years) **(Ericsson, 2016).** Mobile tablet use is also increasing with seven in 10 (71%) children aged 5 to 15 years having access to a tablet at

home. Therefore, using mobile health education offers a particularly powerful and ubiquitous platform for delivering health interventions to children. Mobile health education uses the functions of a mobile device, but most commonly relies on the download of mobile apps to help support health care delivery **(Ofcom, 2017).** So the study aimed to evaluate the effect of mobile-based nursing intervention on preventive measures of COVID-19 among children suffering from chronic kidney diseases.

The present study revealed that the mean age of studied children was 10.9 ± 3.1 years. These findings are consistent with those of **Hooper et al., (2017)** which were 10- 13 years (33.4%) and in Zagazig university hospital a study was done on 15 patients with end-stage renal disease (ESRD) on regular hemodialysis between 5 and 14 years (mean age 10.6± 2.8 years) by **(Youssef et al., 2017).** These findings are in contrast with those of **Mohamed E, (2018)** in which sociodemographic data showed that the highest percent of school-age children with nephrotic syndrome (60 cases) between 6- 8 years was 48.3 % in Assiut Children University hospital.

In the current study near two-thirds of children with CKD were male. This finding is similar to those of **Ragab M and Ragab A, (2017)** in Mansoura Children University hospital which stated that 32% were females and 68% were males. Also, **Ahmad et al., (2019)** in their study in Iran stated that, among 181 studied children, 58% were males, and **Mohamed, (2008)** found that 56.7% were males and 43.3% were females.

The finding of the present study indicated that regarding the residence of children with CKD it was observed that more than three-quarters of them were from rural. This observation may be explained by that rural families are often from low socioeconomic levels, which in turn seek medical advice in the local unequipped health units or may delay seeking medical advice. This result is in agreement with a study conducted by **Mohamed, (2018)** and found that 5% were living in urban and 95% were living in rural areas.

The finding of the present study revealed that more than two-thirds of studied children were nephrotic syndrome the etiology of CKD and only less than one ten percent of them had multisystem conditions were the etiology of CKD. This result supported that Kamal**, 2018** who studied the effect of chronic kidney diseases negatively on the physical growth and intelligence quotient of children and adolescents and reported that congenital abnormalities and hereditary conditions represent that nephrotic syndrome was the cause of CKD among a high percentage of studied subjects. On the other hand, **Ahmad et al., 2019** in their study in Iran stated that congenital malformations and hereditary conditions were the commonest cause of CKD.

The finding of the present study revealed that after using mobile-based nursing intervention, highly statistically significant improvements were noticed in children's knowledge about the preventive measures regarding COVID-19 in all tested areas ($P<0.001$). This reflected the positive effect of using mobile-based nursing intervention in improving knowledge among children suffering from CKD. This result is similar to the study conducted by **Dong et al., (2020)** who studied "Epidemiology of COVID-19 among children in China" and found that there is an improvement in knowledge among children during covid-19 after the intervention.

The current result was in the same line with **Rodig et al., (2016)** that studied "Pediatric renal transplantation," in Pediatric Nephrology and reported that there was an improvement in the total knowledge means scores post-implementation nursing care by using mobile technology, while was at preprogram. It may be explained by that the achievement of the main goals of nursing care by using mobile to improve the total knowledge by reducing the side effects of the disease, improving the health education, help children to accept their disease, facilitating a normal lifestyle, and providing link and communication with the physician/nurse that may be helpful to alleviate their problem. Lower scores of children with CKD on pre-intervention could be explained by the clinical fact that those children suffer from many short-term and long-term complications that change

their life such as frequent hospitalization, painful procedures, school absence, and restriction of activities that have a negative emotional outcome.

The finding of the present study indicated that only four percent of the studied children had an adequate level of COVID –19 preventive measures practices before intervention while the majority of them become had an adequate level of practice after intervention with statistically significant differences (p= 0.000) after the intervention.

This result is in the same line with the study done by **Fan et al**., (**2020)** about the " Development and psychometric testing of the Knowledge, Attitudes, and Practices (KAP) questionnaire among student, KAP theory" and reported that, a health behavior change when gaining the right knowledge and adopting the practice**.** Also**,** the result is similar to a recent study conducted by **Rana et al., (2020)** titled "Assessment of knowledge regarding chronic kidney diseases among non-medical university students in Bangladesh: a cross-sectional study" which found that sufficient individual knowledge is associated with effective prevention, control of disease and promotion of person's health**.** Also, the current study results are supported by the study done by **Ricardo et al., (2018) titled"** Knowledge, attitudes, and practices (KAP) regarding leptospirosis among residents of riverside settlements of Santa Fe, Argentina" who reported that knowledge deficit is associated with poor health and maladaptive disease preventive behavior**.**

The findings of the present study revealed that there was a statistically significant relationship between children's total knowledge and their reported practice. This association is explained by that improvement in knowledge is reflected in an improvement in practice. Also, mean when the studied children had sufficient knowledge they can practice well.

Nowadays, the Internet has become more important as a source of information about CKD. The physicians, nurses, and other health professionals must be aware of their role, understand it, and use their knowledge and experience to assess the underlying evidence By sharing information with the physician and nurses about the status and perform searches on the Internet is related to the health of children.

The findings of the present study highlighted that 99% of the studied children were not having COVID–19 after preventive measures practices by using mobile-based nursing intervention and only 1% of them were having COVID–19 after nursing intervention. This reflected the success of the mobile-based nursing intervention and its positive effect.

The findings of the present study illustrated that all of the studied children not attended any nursing intervention by using mobile, which indicated the need for introducing nursing intervention by using mobile-based

The findings of the present study illustrated that majority of the studied children reported that nursing intervention by using a mobile was effective, and stated that communication during the nursing intervention by using a mobile was easy and available, which indicated the positive effects of nursing intervention by using mobile.

The COVID-19 pandemic has taken a heavy toll on the healthcare system and health professionals who have to work in risky conditions to minimize the spread of the disease and deal with other ailments. Finding can be used to improve child care by nursing intervention through using a mobile that can be effective through: Ensuring continued access to essential child healthcare services by » Training health professionals on planning and tracking the continuity of services provided at primary healthcare facilities. Launching the updated guidelines for integrated management of children illnesses include COVID-19 case management (**UNICEF Egypt Data, 2020**).

Procuring and distributing equipment and medicine needed for children health. Continuing the promotion of child health and nutrition by training health professionals to use online platforms to disseminate information and raise awareness. Helping protect people and prevent the spread of the pandemic by rehabilitating in healthcare facilities. Child protection services are especially important during a time of crisis as they can help prevent and mitigate some of the risks that children

deal with. To ensure access to adequate child protection services, Strengthening mechanisms for alternative care arrangements for children who were left without care providers due to hospitalization or death. Providing care homes with personal protective equipment and information for children with chronic diseases about infection prevention and control (**UNICEF Egypt Data, 2020**).

Conclusion:

Based on the results of the current study and hypotheses, it was concluded that there was an improvement in the preventive measures among children suffering from chronic kidney diseases post than pre-mobile-based nursing intervention. This supports the research hypothesis. There was an improvement in the children's knowledge and practice level regarding COVID-19 preventive measures post than pre-mobile-based nursing intervention. This supports the research hypothesis No (1, 2). Thus, all research hypotheses are accepted.

Recommendations:

- Apply mobile-based intervention in other pediatric kidney dialysis units and hospitals to achieve a better preventive measure of COVID-19 among children with chronic disease.
- Periodic and constant follow-up using mobile-based intervention as regards COVID-19 is very important to discuss and facilitate any difficulties that may face the children suffering from chronic kidney disease.
- Illustrated CD and videos about preventive measures of COVID-19 should be available to be distributed for each child with CKD and their families.

References:

Ahmad, A., Valavi, E., Zangeneh-Kamali, M., & Ahmadzadeh, A. (2019): *Iran Journal of Pediatrics*, Chronic kidney disease in southwestern Iranian children, vol. 19, No. 2; P 147.

Anthes, E. (2016): Mental health: there's an app for that. Nature Apr 7; 532(7597):20-23.

Bakker, D., Kazantzis, N., Rickwood, D., & Rickard, N. (2016): Mental health smartphone apps: review and evidence-based recommendations for future developments. *JMIR Ment Health;* 3(1):e7.

Board of Governors in Supersession of Medical Council of India Sector-8, Pocket-14, Dwarka Phase-1, New Delhi·110077, 2020.

Brazilian Internet Steering Committee (CGI.br) (2016): Survey on the use of information and communication technologies in Brazilian households: ICT households [Internet]. São Paulo.

Bryan, A., Türkmen, I., & Bilge, A. (2018): Quality of life in children with chronic kidney disease (with child and parent assessments)," *Pediatric Nephrology*, vol. 25, no. 8, pp. 1487–1496, 2018.

Bullinger, S., & Quitmann, J. (2014): Quality of life as patient-reported outcomes: principles of assessment," *Dialogues in Clinical Neuroscience*, vol. 16, no. 2, pp. 137–145, View at Google Scholar

Center for disease control and prevention (CDC) (2020): Interim considerations for infection prevention and control of coronavirus disease 2019 (COVID-19) in inpatient pediatric healthcare settings.

Dong, L., & Bouey, J. (2020): Public mental health crisis during COVID-19 Pandemic, China, *Emerg. Infect. Dis.* 26(7), 1616-1618. doi:10.3201/eid2607.202407

Ericsson, A. (2016): Ericsson mobility report: on the pulse of the networked society URL: https://www.ericsson.com/ mobility-report [accessed 2017-01-10] [WebCite Cache ID 6nPXPKRxA]

Goldstein, N., Graham, T., Burwinkle, B., Warady, R., Farrah, J. W., & Varni, A. (2016): Health-related quality of life in pediatric patients with ESRD," *Pediatric Nephrology*, vol. 21, no. 6, pp. 846–

850.View at: Publisher Site | Google Scholar

Hooper, S., Gerson, A., Butler, R., Gipson, D., Mendley, S., & Lande, M. (2017): The American Society of Nephrology, Neurocognitive functioning of children and adolescents with mild-to-moderate chronic kidney disease, vol. 6; P 1824.

International Telecommunication Union (2015): Measuring the Information Society Report [Internet]. Geneva. Available: http://www.itu.int/en/ITUD/Statistics/Pages/publications/.aspx.

Karimi, A., & Brazier, J. (2016): Health-related quality of life and quality of life: what is the difference?" *PharmacoEconomics*, vol. 34, no. 7, pp. 645–649, 2016.View at: Publisher Site | Google Scholar

Kenny, R., Dooley, B., & Fitzgerald, A. (2015): Feasibility of "CopeSmart": a telemental health app for adolescents. *JMIR Ment Health* Aug 10; 2(3):e22 [FREE Full text] [doi: 10.2196/ mental. 4370] [Medline: 26552425]

Kiliś-Pstrusińska, A., Medyńska, I. B., & Chmielewska, A. (2013): "Perception of health-related quality of life in children with chronic kidney disease by the patients and their caregivers: multicentre national study results," *Quality of Life Research*, vol. 22, no. 10, pp. 2889–2897.View at: Publisher Site | Google Scholar

McKenna, E., Keating, A., Vigneaux, S., Stevens, A., & Williams, D. (2006): "Quality of life in children with chronic kidney disease: patient and caregiver assessments," *Nephrology Dialysis Transplantation*, vol. 21, no. 7, pp. 1899–1905, 2006.View at: Publisher Site Google Scholar

Ministry of Health and Population Egypt. "MOHP" (2020): COVID-19 in Egypt, available at https:// www. care. gov. eg/ Egypt Care/index.aspx

Ministry of Health-Egypt. (2020): COVID-19 Overview. May 16; Available from: https://www.care.gov.eg/EgyptCare/Index.aspx

Mohamed, E. (2018): Self-Care for School-Age Children with Nephrotic Syndrome in Assuit University Hospital, thesis for Ph.D., Assuit University, Egypt; p 96-104.

Neul, G., Minard, H., Currier, S. L., & Goldstein, A. (2012): "Health-related quality of life functioning over 2 years in children with end-stage renal disease," *Pediatric Nephrology*, vol. 28, no. 2, pp. 285–293.View at: Publisher Site | Google Scholar

Ofcom. (2017): Children and parents: media use and attitudes report URL: https://www.ofcom.org.uk/research-and-data / media-literacy-research/ children/ children- parents-oct-14 [accessed 2017-01-10] [WebCite Cache ID 6nPYLrMYE]

Potter, A., Perry, G., Stockert, P., & Hall, M. (2014): Canadian fundamentals of nursing (5th Cdn. ed.) (J. C. Ross-Kerr, M. J. Wood, B. J. Astle & W. Duggleby, Cdn. Adapt.). Toronto, ON: *Elsevier Canada*.

Ragab, S., & Ragab, A. (2017): Assessment of lipid profile in Egyptian children with chronic kidney diseases on conservative therapy and those under regular dialysis, *Journal of medical sciences*, Vol. 7, No.5; P 825-829.

Rodig, K., Vakili, W. E., & Harmon, A. (2016): "Pediatric renal transplantation," in Pediatric Nephrology, vol. 73, pp. 2502–2510, *Springer*, *Heidelberg*, *Germany*, 7th edition. View at:

Safouh, F., Fadel, R., Essam, A., Salah, A., & Bekhet, A. (2015): "Renal data from the Arab world-causes of chronic kidney disease in Egyptian children," *Saudi Journal of Kidney Diseases and Transplantation*, vol. 26, no. 4, pp. 806–809, View at Publisher Site | Google Scholar

Schwierzeck, V., Jens, K., Joachim, K., Alexander, M., Heymut, O., Martin, K., Thomas, K., & Stefanie, K., (2020): First reported a nosocomial outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in a

pediatric dialysis unit, 2020; Published online Apr 27. Doi: 10.1093/cid/ciaa491

Solans, S., Pane, M., & Estrada, M. (2008): "Health-related quality of life measurement in children and adolescents: a systematic review of generic and disease-specific instruments," *Value in Health*, vol. 11, no. 4, pp. 742–764.View at: Publisher Site | Google Scholar

Swallow, V.M., Hall, A.G., Carolan, I., Santacroce, S., Webb, N.A., & Smith, T. (2014): Designing a web application to support home-based care of childhood CKD stages 3–5: a qualitative study of family and professional preferences. *BMC Nephrol*; 15:34. Pmid: 24548640

Tjaden, M. A., Grootenhuis, M., Noordzij, J. W., & Groothoff, A. (2016): "Health-related quality of life in patients with pediatric-onset of end-stage renal disease: state of the art and recommendations for clinical practice," *Pediatric Nephrology*, vol. 31, no. 10, pp. 1579–1591.View at: Publisher Site | Google Scholar

Tong, B., & Stevenson, C. (2016): Co-morbidity of cardiovascular disease, diabetes, and chronic kidney disease in Australia. www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=6442455043.

UNICEF Egypt Data Snapshot (2020): COVID-19 in Egypt, Issue 5, June.

World Health Organization. (2020): https://www. who.int/dg/speeches/detail / who director general opening remarks at the-media briefing-on-covid-19, 11-march, Accessed 23March.

Youssef, M. (2017): Results of Recombinant Growth hormone Treatment in Children with End-Stage Renal Disease on Regular Hemodialysis, Zagazig University, Egypt, *Saudi Journal*