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Satisfaction of smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic in Makah Al-Mukarramah Saudi Arabia 2022

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Abstract:

Background:

The coronavirus disease 2019 (COVID-19) pandemic has represented a challenge to medical practice in Saudi Arabia and worldwide. In contrary to the increasing numbers of COVID-19 patients, there was a limitation in the capacity of medical practices and access to healthcare. A growing body of evidence from healthcare settings in Saudi Arabia and worldwide has suggested a possible role for telemedicine in responding to this evolving need. smartphone App can be used for direct care, follow-up, and consultation. While telemedicine has several advantages, such as accessibility and cost-effectiveness, its diagnostic reliability should be further investigated. COVID-19 pandemic has forced the medical fraternity to quickly adopt telemedicine for patient care. Was sent to parents via the smartphone app and the questions were satisfaction, and expectations regarding the follow-up care delivered to children with T1D. The Saudi Vision (2030) has drawn up a roadmap to invest in digital healthcare during the coming decade,A web-based survey, developed with was sent to parents via the smartphone app, questionnaire items were analyzed.

Aim of the study: To assessmentthe Satisfaction ofsmartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic in Makkah Al-Mukarramah Saudi Arabia 2022.

Method:cross sectional study conducted about smartphone App Deliver Virtual Follow-up Care for

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Children with Type 1 Diabetes During the COVID-19 Pandemic intervention, the study consisted namely a smartphone App model. Our total participants were (200) patients with Children with Type 1 Diabetes attending a virtual integrated care clinic at a chronic Illness center in a family and community medicine department in in Makkah, Saudi Arabia 2022 during the COVID-19 pandemic, the clinical effectiveness (i.e. reduction in HbA1c) and the cost.

Results: Regarding distribution of the patient's with satisfaction and heave a significant relation between the total satisfaction and frequency while P-value<0.001 and X^2 48.6, participant toward Satisfaction study results show the majority of participant had Completely satisfied were(35.%) while satisfied were(28.0%) but Not satisfied were (11.0%), and Not completely satisfied were(10.0%) .

Conclusion: Previous research's found the simplicity of our smartphone App Telemedicine to deliver Virtual Follow-up Care for Children with Type 1 Diabetes during the COVID-19 Pandemic.

Keywords:COVID-19, Pandemic, smartphone App, Type 1 Diabetes, Virtual Follow-up, Children, Makah

Introduction

Type 1 diabetes (T1D) is one of the common chronic conditions during childhood and adolescence [1]. The patients require periodic follow-up visits to the clinic after the diagnosis of T1D. The onset of the COVID-19 pandemic caused a severe disruption in the follow-up care of children with T1D, besides causing delays in the diagnoses and acute care [2, 3]. In addition to several considerations for children and adolescents with T1D, an urgent and rapid expansion of telemedicine services for delivering diabetes care, precisely the virtual follow-up care, was quickly adopted by several institutions across the world during the initial phase of the pandemic [4, 5]

Type 1 diabetes mellitus in Children During the COVID-19 Pandemic has huge economic burden for both patient, parent and health-care system in Saudi Arabia . Management of the condition in Saudi Arabia faces multiple challenges such as paucity of trained medical and paramedical staff, poor quality, lack of satisfactionwithservices, and unaffordability of services. Children with Type 1 Diabetes during the COVID-19 Pandemic are emerging as an epidemic and its treatment is a huge economic burden both for the patient and for the health-care system. Management of this disease in Saudi Arabia faces multiple challenges, such as low levels of awareness, paucity of trained medical and paramedical staff, patient satisfaction with health-care facility, and unaffordability of medications and services.[6,7] Patient’s satisfaction in the smartphone App to Deliver Virtual Follow-up Care depends upon the quality of health-care services provided. Previous research in

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Saudi Arabia have shown that although people have better trust in traditional care compared to smartphone App[8]

A global pandemic has been declared by the World Health Organization after cases of coronavirus disease 2019 (COVID-19)were confirmed throughout the world.[9] To mitigate the spread of the virus, many countries implemented a shelter-in-place order and suspension of operations in nonessential businesses.[10] Routine clinic appointments, including those for patients with diabetes, especially children's clinics with Type 1 Diabetes During the COVID-19 Pandemic in were cancelled with a short notice, and due to the lack of well-established telemedicine systems in many countries also quickly found themselves with little to no medical support during this pandemic. Which led to the start of telemedicine and start to used telecare smartphone App to Deliver Virtual Follow-up Care a large number of children's with diabetes .[11,12]

Before the pandemic, many studies indicated the clinical effectiveness of telemedicine in diabetes care, including significant and clinically relevant reductions in HbA1c.31–38 It is currently believed that smartphone App to Deliver Virtual Follow-up Care telehealth could decrease costs on the health system, particularly when telehealth services prevent health system-funded travel, leading to reductions in secondary care, and when telehealth mitigates the need for costly specialist interventions by providing quality care in an efficient manner, including telemonitoring.[13,14] In addition, it has been reported that smartphone App to Deliver Virtual Follow-up Care has the to provide cost savings by increasing patients' working ability, independent living ability, quality of life, and reducing travel costs.[15]

Further, many healthcare workers had to self-isolate after getting in contact or infected with COVID-19, which led to shortages in medical staff and undermined the quality of healthcare [16]. These factors together reduced the capacity of medical practice and restricted people's access to healthcare [17]. Saudi Arabia was among the most affected countries by the COVID-19 pandemic in the Eastern Mediterranean Region, with a total of 537,374 confirmed patients and 8388 related deaths by 14 August 2021 [18]. As a consequence, the Saudi government took decisive measures to prevent the spread of COVID-19, such as imposing lockdown, enforcing social distancing measures, suspending public transportation, schools, and universities, preventing religious mass gatherings, and tracking travelers with possible COVID-19 infections.[19]

Literature Review

The COVID-19 pandemic, two studies from Japan[20] and Saudi Arabia[21] reported similar positive clinical outcomes in terms of glycemic control. In addition, it has been shown that increasing patient contact through frequent phone calls improves patient therapy adherence,

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motivation, and metabolic control.[22] However, only limited literature is currently available on the cost-effectiveness of telemedicine for diabetes care.[23]

Badawy et al,(2020) reported that telemedicine tools have shown potential in the management of diabetes in general and in improving glycemic control precisely [24]. The evidence of their usefulness was, however, confined to the non-crisis situations. With the advent of COVID-19, routine diabetes care had to be delivered through digital platforms due to restrictions on travel and lack of healthcare access. Several advanced diabetes centers in the developed countries that adapted and expanded their telemedicine services have reported benefits of virtual care smartphone App during the COVID-19 pandemic [25].

Rohilla,et al.(2021) findings that revealed that proper and more frequent telecommunication between patients and healthcare providers results in better adherence to medications and interventions and overall better diabetes care.[26]

Another two studies from Japan [20] and Saudi Arabia [21] reported similar positive clinical outcomes in terms of glycemic control. In addition, it has been shown that increasing patient contact through frequent smartpalhoneApp improves patient therapy adherence, motivation, and metabolic control.[27] However, only limited literature is currently available on the cost-effectiveness of smartphone App to deliver virtual follow-up care for children with Type 1 for diabetes care.[28]Sheehy, et al.(2014)The reported effectiveness of virtual diabetes care in high-income countries is due to better internet services and connectivity, the useof technologically advanced smartphone devices, and the parents 'ability to communicate, which largely depends on their higher literacy levels [29]

However, there are several constraints in using virtual care in the context of developing countries [14]. The acceptance of virtual care advice may be low as patients are conventionally used to physical visits. Internet services and connectivity is poor in remote areas. Additionally, several individuals need help in operating smartphone devices due to their low literacy [15]. Thus, the data on the feasibility and utility of telemedicine for childhood diabetes in resource constrained settings remains scarce.

A recent study from a low resource country found that telemedicine care was useful for children with diabetes during the COVID-19 pandemic [11].

In another study found that a comparable developing country set up are similar and further demonstrate the usefulness of the exclusive use of the smartphone app WhatsApp to deliver virtual follow-up care for children with T1D. A notable feature of our study was a high level of satisfaction with the use of WhatsApp for follow-up care expressed by almost two-thirds of families. This is consistent with the high satisfaction rates observed in previous similar studies concerning diabetes

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care during the COVID-19pandemic [29].

The impact of telemedicine care on improving the outcomes of patients with DM is consistent with other studies reported in the literature.[30] For instance, one of the largest studies conducted to investigate the effect of telemedicine on DM outcomes is the Informatics for Diabetes Education and Telemedicine project that included 1665 patients. This randomized controlled trial compared the outcomes of DM patients provided with telemedicine care with DM patients not enrolled in telemedicine system.[31] The study participants in this project showed improvements in glycaemic control, blood pressure readings and cholesterol levels after following the participants for 1 year.[28]

Timpel, et al 2020 report that telemedicine (i.e. teleconsultations) encompassing frequent and intense patient–healthcare provider communication interactions resulted in significant clinically relevant reductions in HbA1c (−1.20%, 95% CI = −2.30 to −0.10; $p < 0.001$).[24]

Rationale:

Due to the increased risk of serious disease with COVID-19 in people with children with Type 1 Diabetes during the COVID-19 Pandemic, it is important that patients are well informed on the importance of optimal metabolic and glycemic control. Fears relating to COVID-19 that may lead patients to avoid seeking medical advice should be proactively addressed, particularly for those with uncontrolled blood glucose, a risk factor for severe COVID-19 disease. Ant hyperglycemic therapy should be optimized to achieve HbA1c targets while exercising caution regarding premature discontinuation of established therapy , the researcher found that children with Type 1 Diabetes During the COVID-19 Pandemic is not welcome to the approach telehealth

Aim of the study:

To assessment theSatisfaction of smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic in Makkah Al-Mukarramah Saudi Arabia 2022.

Objectives:

This study assessment theSatisfaction of smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic in Makkah Al-Mukarramah Saudi Arabia 2022. (i.e. HbA1c >9).

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Methodology:

Study design:

This study is a cross sectional study

Study Area

Mothers and fathers of children with type 1 diabetes aged <25 to >60 years and above with children with Type 1 Diabetes during the COVID-19 Pandemic attending in primary health care outpatient in the diabetes center, the patients were recruited from an integrated care clinic at the diabetes center and clinics of the Family and Community Medicine Department at Makkah Al-Mokarrama Saudi Arabia at diabetes center and clinics of the Family and Community Medicine Department, high-risk from children Type 1 Diabetes during the COVID-19 Pandemic (i.e. HbA1c > 9) are referred to this diabetes center and clinics of the Family and Community Medicine Department from, the children receive comprehensive diabetes care (i.e. intensive diabetic)

Study Population

The study has been conducted among children with Type 1 Diabetes during the COVID-19 Pandemic attending in primary health care outpatient in the Diabetic Center,family and Community Medicine Department in the Makkah, from July and September 2022

Selection criteria:

Inclusion criteria

- In this study, the inclusion criteria included the following: children with Type 1 Diabetes during the COVID-19 Pandemic with an HbA1c value > 9 before the study period and with a valid HbA1c value after the follow-up period.

Exclusion criteria :

- All children with Type 1 Diabetes during the COVID-19 Pandemic and those with HbA1c values < 9 at baseline or patients with no HbA1c values after receiving telemedicine care or traditional care were excluded. Based on these inclusion and exclusion criteria, in the traditional care model, we included all the first 100 children who met the criteria. Socio economic and clinical characteristics, such as age, sex, and comorbidities, were included in the smartphone App . Hence, to include the children managed through smartphone App. (200 children).
- **Sample size**

The sample size has been calculated by applying Raosoft sample size calculator based on (The margin of error: 5%, Confidence level: 95%, and the response distribution was considered to be

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20%) accordingly the Sample size is 200 of diabetic patients attending and adding 10 more to decrease margin of error. After adding 5% oversampling, the minimum calculated sample has been 107. Computer generated simple random sampling technique was used to select the study participants.

Sampling technique :

Systematic random sampling technique is adopted. By using systematic sampling random as dividing the total population by the required sample size; (200)

Data collection tool

- Children with Type 1 Diabetes During the COVID-19 Pandemic who were managed using smartphone App to Deliver Virtual Follow-up Care. Children were followed for at least 4 months to assess the smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes .
- Children' age, sex, disease duration, follow-up period, comorbidities, baseline and follow-up HbA1c levels, laboratory tests (e.g. complete blood count, serum creatinine, liver function tests, HbA1c), medications, medical supplies (e.g. glucometer, swabs, lancets, lancing pens, strips), shipping, and the frequency of physical and smartphone App visits were collected.
- Consequently, the costs, namely the costs of medications, laboratory tests, medical supplies, shipping, phone calls, and clinic visits (in-person and virtual visits), were collected. The costs ofvisits to the clinic and laboratory tests were retrieved from the cost center of the Ministry of Health, Saudi Arabia.
- The researcher has been examining the reliability of the questionnaire by testing and retesting.The questionnaire was translated to local language and then, retranslated back to English by another person to check its consistency and wording.

Data collection technique:

Researcher has been visits the selected Diabetic Center after getting the approval from the ministry of health.She has been explained the purpose of the study to all participants attending the clinic. The data has been collect through the May and October 2022.

Data entry and analysis:

The Statistical Package for Social Sciences (SPSS) software version 24.0 has been used for data

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entry and analysis. Descriptive statistics (e.g., number, percentage) and analytic statistics using test for the association and the difference between two categorical variables were applied. A p-value ≤ 0.05 has been considered statistically significant.

Pilot study:

A pilot study has been conducted to test the methodology of the study, the questionnaire has been clear **.**

Ethical considerations:

- Permission has been obtained, and has been Verbal consents from all participants in the questionnaire were obtained.
- All information was kept confidential, and a result has been submitted to the department as feedback.

Budget:

Self-funded

Results

Table 1Distribution of demographic data(age, gender, Level of education, Nationality, Marital status,economic level) **in our study(n=200).**

	N	**%**
Age		
<25	70	35
25-50	44	22
50-60	52	26
>60	34	17
Gender		
Female	76	38
Male	124	62
Level of education		
Primary	24	12
Intermediate	66	33
Secondary	36	18
High education	74	37
Nationality		

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Saudi	156	78
Non-Saudi	44	22
Marital status		
Married	110	55
Divorced	52	26
Widow	38	19
Economic level		
Low	78	39
Average	90	45
High	32	16

Table 1 shows there were 200 participants, and the majority age was(35.0%) in (<25)years, while the age(50-60)were(26.0%), the majority of them were males (62.0%) while female(38.0%),also regarding the Level of education most of participants high education were(37.0%), regarding the Nationality most of participants Saudi were(78.0%), regarding the Marital status most of participants Married were(55.0%), while divorced were(26.0%), regarding. Regarding the economic level the majority of participant average economic level were(45.8%).

Table 2.Distribution of characteristics of the patients of smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes andchanges in the HbA1c after > 3 months of follow-up of treatment for the smartphone App.

	N	**%**
Sources of information about smartphone App care		
Booklets and brochures	28	14
Mass media	24	12
Own personal experience	44	22
Educational films	50	25
Medical education in health centres and hospitals	42	21
Comorbidities of The Children with Type 1 Diabetes		
Congestive heart failure	12	6
Chronic kidney disease	30	15
Stroke	16	8
Cardiovascular disease	38	19

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Dyslipidemia	6	3
Depression	32	16
Hypertension	50	25
Hypothyroidism	16	8
Number of comorbidities		
<2	106	53
2–4.	56	28
4–6.	38	19
Disease duration		
Less than 1 years	32	16
2–4 years	58	29
4–6years	40	20
More than 6 years	70	35
Rang of HbA1c, glycated hemoglobin		
4 – 5.6% (20 – 38 mmol/mol)	90	45
values between 5.7% and 6.4% (39 – 46 mmol/mol)	64	32
over 6.5% (47 mmol/mol)	46	23
Impact of patients in after > 3 months of follow-up of Smartphone App to Deliver Virtual and the costs of treatment for the Smartphone		
Had a mean reduction in their HbA1c level	90	45
Had a mean increased in their HbA1c level	64	32
No differences in their HbA1c level	46	23
The costs of treatment for the Smartphone		
less than cost of the traditional care model	86	43
More than cost of the traditional care model	38	19
I don't know	76	38

Table (3) show the Sources of information about smartphone App care the majority of participant from Mass media were(31.8%), while educational films were (25.0%) , regarding the The Comorbidities of type 1 diabetes the majority of participant Hypertension were(25.0%), followed by Cardiovascular disease were (19.0%) while Chronic kidney disease were (15.0%), regarding the number of comorbidities the majority of participant <2 were (53.0%)followed by 2-4 were (28.0%),

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regarding the disease duration most of participants more than 6 years were(35.0%), regarding the Rang of HbA1c, glycated hemoglobinshown the majority of participant in values between 4 – 5.6% (20 – 38 mmol/mol) were (45.0%) followed by values between 5.7% and 6.4% (39 – 46 mmol/mol) were(32.0%) followed by over 6.5% (47 mmol/mol) were(23.0%), regarding Impact of patients in after > 3 months of follow-up and the costs of treatment for the Smartphone the majority of participant answer(Had a mean reduction in their HbA1c level (45.0%), followed by Had a mean increased in their HbA1c level were(32.0%), regarding The costs of treatment for the Smartphone the majority of participant answer less than cost of the traditional care model were (43.0%), followed by I don't knowwere (38.0%),

Table 3 . Distribution of the questionnaire items and responses by parents and children to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes smartphone App

Item	Not at all		Partly		Completely		% Of satisfaction	Chi-square	
	N	%	N	%	N	%		X^2	P-value
Improved access to healthcare services?	24	12	44	22	132	66	84.67	99.04	0.00
Saved time traveling to a hospital?	6	3	22	11	172	86	94.33	251.56	0.00
Provided for the child's healthcare needs?	16	8	32	16	152	76	89.33	165.76	0.00
Using smartphone App group for queries was easy to learn?	38	19	44	22	118	59	80.00	59.56	0.00
Using smartphone App group for queries was simple?	40	20	38	19	122	61	80.33	68.92	0.00
Liked using the WhatsApp group?	68	34	50	25	82	41	69.00	7.72	0.02
WhatsApp group reply was easy to understand?	42	21	30	15	128	64	81.00	85.72	0.00
Were able to express yourself effectively?	76	38	44	22	80	40	67.33	11.68	0.00

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Could easily interact with staff using the WhatsApp group?	38	19	54	27	108	54	78.33	40.36	0.00
Could understand the doctor just as well as if met in person?	80	40	64	32	56	28	62.67	4.48	0.11
In general (not just during COVID-19), is the WhatsApp group an acceptable way to receive healthcare services?	52	26	68	34	80	40	71.33	5.92	0.05
In general (not just during COVID-19), would choose to use WhatsApp group again for interacting with your doctor?	32	16	44	22	124	62	82.00	75.04	0.00

Table (3) show that questionnaire items and responses by parents and children to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes smartphone App regarding the improved access to healthcare services the presented Complete satisfaction were (66.0%) followed by Partly were(22.0%)and a significant relation were P-value=<0.00 X^2 99.04, and % Of satisfaction were (84.67%), regarding the Saved time traveling to a hospital presented Complete satisfaction were 86.0%) followed by Partly were(11.0%)and a significant relation were P-value=<0.00 $X^2$251.56, and % Of satisfaction were (94.33%), regarding the Provided for the child's healthcare needs presented Complete satisfaction were (76.0%) followed by Partly were(16.0%)and a significant relation were P-value=<0.00 X^2(165.76%), and % Of satisfaction were (89.33%), regarding Using smartphone App group for queries was easy to learn presented Complete satisfaction were (59.0%) followed by Partly were(44.0%)and a significant relation were P-value=<0.00 X^2(59.56%), and % Of satisfaction were (80.00%). Regarding the Using smartphone App group for queries was simple presented Complete satisfaction were (61.0%) followed by Not at all were(20.0%) and a significant relation were P-value=<0.00 X^2(68.92%), and % Of satisfaction were (80.33%), regarding Liked using the WhatsApp group presented Complete satisfaction were (41.0%) followed by Not at all

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were(34.0%)and a significant relation were P-value=<0.02 X^2(7.72%), and % Of satisfaction were (69.00%), regarding WhatsApp group reply was easy to understand presented Complete satisfaction were (64.0%) followed by Not at all were(21.0%)and a significant relation were P-value=<0.00 X^2(85.72%), and % Of satisfaction were (81.00%), regarding Were able to express yourself effectively presented Complete satisfaction were (40.0%) followed by Not at all were(38.0%)and a significant relation were P-value=<0.00 X^2(11.68%), and % Of satisfaction were (67.33%), regarding Could easily interact with staff using the WhatsApp group presented Complete satisfaction were (54.0%) followed by Partly were(27.0%)and a significant relation were P-value=<0.00 X^2(40.36%), and % Of satisfaction were (78.33%), regarding Could understand the doctor just as well as if met in person presented Not at all satisfaction were (40.0%) followed by Partly were(32.0%)and no significant relation were P-value=<0.11 X^2(4.48%), and % Of satisfaction were (62.67%), regarding In general (not just during COVID-19), is the WhatsApp group an acceptable way to receive healthcare services presented Complete satisfaction were (40.0%) followed by Partly were(34.0%)and a significant relation were P-value=<0.05 X^2(5.92%), and % Of satisfaction were (71.33%)

Table 4 Distribution of the frequency of the patient's with Satisfaction of about smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic

Total Satisfaction		
	N	**%**
Completely satisfied	70	35
Satisfied	56	28
Somewhat satisfied	32	16
Not satisfied	22	11
Not completely satisfied	20	10
Total	200	100
X^2	48.6	
P-value	<0.001*	

Table 4 Regarding distribution of the patient's with satisfaction and heave a significant relation between the total satisfaction and frequency while P-value<0.001 and X^2 48.6, participant toward Satisfaction study results show the majority of participant had Completely satisfied were(35.%) while satisfied were(28.0%) but Not satisfied were (11.0%), and Not completely satisfied were(10.0%) .

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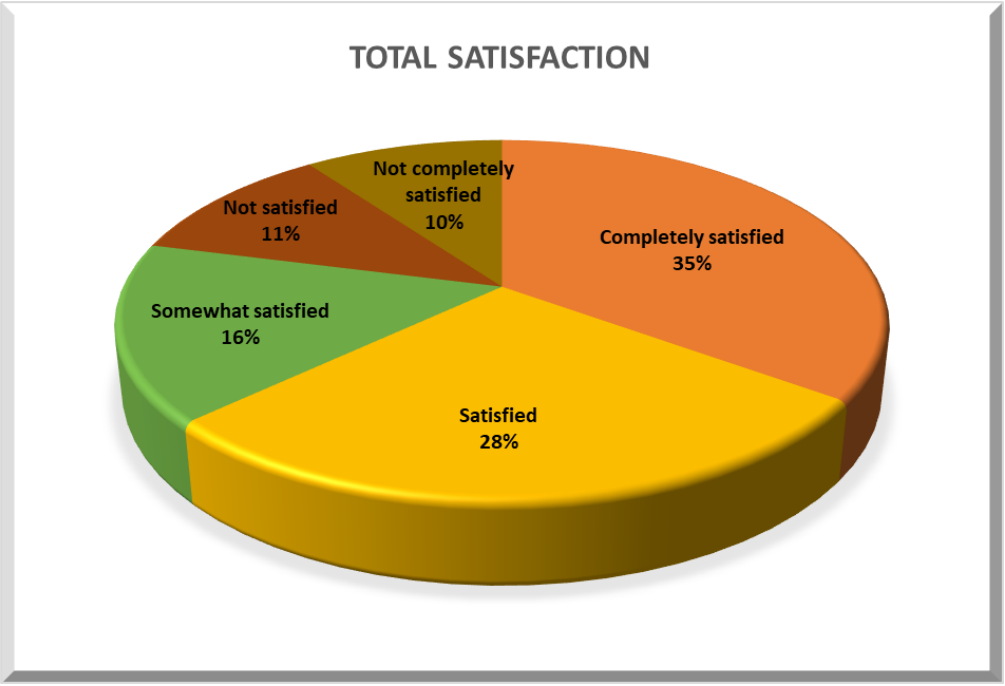
Figure 1 Distribution of the frequency of the patient's with Satisfaction of about smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic



Discussion

We undertook the current study to assessment the Satisfaction of smartphone App to Deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic in Makkah Al-Mukarramah Saudi Arabia 2022. shows there were 200 participants, and the majority age was(35.0%) in (<25)years, majority of them were males (62.0%) also the Level of education most of participants high education were(37.0%), the Nationality most of participants Saudi were(78.0%), regarding the Marital status most of participants Married were(55.0%), the economic level the majority of participant average economic level were(45.8%).(See Table 1)

The current study provides new insights into the clinical and economic impact of implementing a telemedicine service to a high-risk group of patients with Children with Type 1 Diabetes During the COVID-19 Pandemic. Several telemedicine tools have shown potential in the management of diabetes in general and in improving glycemic control precisely [31]. The evidence of their usefulness was, however, confined to the non-crisis situations. With the advent of COVID-19, routine diabetes care had to be delivered through digital platforms due to restrictions on travel and lack of healthcare access. Several advanced diabetes centers in the developed countries that adapted and expanded theirtelemedicine services have reported benefits of virtual care during the COVID-19 pandemic [24,32,33]. The reported effectiveness of virtual diabetes care in high-income countries is due to better internet services and connectivity, the use of technologically advanced smartphone devices, and the parents' ability to communicate, which largely depends on their high

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literacy levels [9, 10]. However, there are several constraints in using virtual care in the context of developing countries [24].The acceptance of virtual care advice may be low as patients are conventionally used to physical visits. Internet services and connectivity is poor in remote areas. Additionally, several individuals need help in operating smartphone devices due to their low literacy [14]. Thus, the data on the feasibility and utility of telemedicine for childhood diabetes in resource constrained settings remains scarce. A recent study from a low resource country found that telemedicine care was useful for children with diabetes during the COVID-19 pandemic [34]. Our current study results in a comparable set up are similar and further demonstrate the usefulness of the exclusive use of the smartphone app smartphone App to deliver virtual follow-up care for children with T1D.(See Table 2,3)

A notable feature of our study was a high level of satisfaction with the use of smartphone App for follow-up care expressed by almost (35.0%) of families. This is consistent with the high satisfaction rates observed in previous similar studies concerning diabetes care during the COVID-19 pandemic [24]

Additionally, almost all families found smartphone App communication easy to learn and use; this indicates that this telemedicine tool is feasible for virtual care in our settings. The finding that approximately high percentage of families felt the smartphone App care was as good as physical care hints at the possibility of a reduction in the number of in person follow-up clinic visits in the future. This will be particularly useful for patients with limited financial resources and living in remote areas who find traveling to the hospital costly and time-consuming [35].(See table 4)

Conclusions

Smartphone App can offer a convenient way of expanding access to healthcare in Saudi Arabia accurately and cost-effectively while minimizing the risk of COVID-19 transmission. More efforts should be exerted to provide healthcare settings with technical equipment and training needed for smartphone App in the telemedicine. Regulations to implement telemedicine on a large scale in Saudi Arabia while protecting data privacy are also needed, as a result of adopting to the deliver Virtual Follow-up Care for Children with Type 1 Diabetes During the COVID-19 Pandemic.

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