



Cross-sectional Study

Perception of primary caregiver toward virtual pediatric clinics for type 1 diabetes mellitus during COVID-19 pandemic in Jeddah, Saudi Arabia: A cross-sectional study

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ABSTRACT

Background: Virtual phone clinics were adopted at King Abdulaziz Medical City, Jeddah, Saudi Arabia, as an alternative to in-person routine outpatient visits amid the COVID-19 pandemic. This study aimed to assess primary caregiver perceptions of the virtual phone clinics towards routine care of pediatric patients with type 1 diabetes mellitus (T1DM).

Methods: A cross-sectional research design was employed through a web-based research tool where the primary caregivers of pediatric patients with T1DM participated. Data were analyzed descriptively and statistically using independent t-tests and one-way analysis of variance.

Results: In total, 214 participants were included in this study. The average primary caregiver perception value towards virtual phone clinics was $66.71 \pm 23.1\%$, which suggested a satisfactory perception of their experience. Statistically significant differences ($p > 0.05$) were not found between the mean perception values and demographic characteristics. Higher mean primary caregiver perception values were associated with those who: (1) agreed or strongly agreed to be contented with their current state of health, (2) did not ask their physicians to be physically seen during a virtual visit, (3) preferred having four virtual visits or more, and (4) preferred having single to no in-person visits at all.

Conclusion: This study revealed a generally acceptable primary caregiver perception regarding virtual clinics. Telemedicine is recommended for routine treatment alongside regular in-clinic appointments to improve the quality of care for pediatric patients with T1DM.

1. Introduction

The World Health Organization (WHO) recognized the coronavirus disease 2019 (COVID-19) as a public health emergency of global concern on January 31, 2020, and a pandemic on March 11, 2020 [1,2]. With more than 500,000 cases and over 8000 pandemic-related deaths documented in Saudi Arabia as of October 2021, COVID-19 vaccinations are considered to be the only effective solution to control the virus [3,4].

Throughout the course of the pandemic, an upsurge in diabetic ketoacidosis cases among children was notable [5]. As per the International Diabetes Foundation, Diabetes affects approximately 27,800

people under the age of 20.5 years, with the yearly incidence of Type 1 Diabetes (T1DM) in children and adolescents being 2500 [6]. This is concerning as even before the pandemic, Saudi Arabia has already been reported to have one of the highest T1DM cases among children and adolescents.

In terms of economic impact, Diabetes was reported to contribute a significant burden on different healthcare services worldwide [7]. Alhawaish reported that compared to those without the condition, the medical healthcare expenses of patients with Diabetes are ten times higher [8]. Meanwhile, Roper et al. reported that those diagnosed with the said condition are prone to higher financial burden since they are at least 2–4 and 2–5 times more susceptible to experiencing morbidity and

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Abbreviations

T1DM	type 1 diabetes mellitus
WHO	World Health Organization
COVID-19	coronavirus disease 2019
HbA1c	glycosylated hemoglobin
ANOVA	one-way analysis of variance
LSD	least significant difference
GLM	general linear model

mortality from heart-related complications, respectively [9].

In 2011, 11% of the worldwide health expenses accounted for Diabetes [10]. In the United States, direct medical costs in Diabetes account to approximately 7% of the \$3.3 trillion healthcare budget, per year; this figure is relatively higher than the budget spent on other chronic diseases like cancer (5%) and heart-related illnesses (4%) [11]. Meanwhile, more than \$0.87 billion was the reported annual cost of Diabetes in Saudi Arabia [10]—this figure poses a significant financial burden on the healthcare system of Saudi Arabia [8].

Given the economic burden associated with Diabetes, a study in the United States regarding virtual consultations for the management of diabetes in pediatric patients revealed that remote consultations were found to be associated with lower financial burden, in addition to improved access to care, and lower instances of absenteeism [12]. Moreover, these consultations were also revealed to be comparable to traditional consultations in terms of maintaining glycosylated hemoglobin (HbA1c).

As a result of the restrictions brought about by the COVID-19 pandemic, virtual phone clinics were also adopted in place of in-person clinics for routine outpatient follow-up visits in many parts of the world. This allowed pediatric patients with diabetes to consult their physicians from the comfort and safety of their homes, thereby minimizing their exposure to the virus and limiting its transmission [13].

Several global studies examined the impact of the prompt implementation of virtual clinics to aid the adult diabetic population. According to these investigations, patients with diabetes mellitus were satisfied with their virtual visit experience and reported that they would use the telemedicine service in the future [14,15]. In a similar study at the same institute, participants were reported to have acclimated to the virtual phone clinics as they expressed positive perceptions and satisfaction [16].

While there is limited research focusing on pediatric patients diagnosed with T1DM, another study in British Columbia found that families that attended a virtual visit regarded such approaches as having excellent usability and demonstrated greater willingness to utilize the telemedicine service more frequently than conventional outpatient visits in the future [15].

The objective of this study was to assess primary caregiver perceptions of virtual phone clinics towards regular management of diabetes among pediatric patients with T1DM throughout the COVID-19 pandemic and to determine the association between the demographics of respondents and poor perceptions of virtual phone clinics.

2. Materials and methods

2.1. Patients

The study was conducted online using a web-based questionnaire disseminated to primary caregivers of pediatric patients diagnosed with T1DM, who routinely attended follow-up checkups at the Pediatric Endocrinology and Diabetes Clinic. The participants included in the study were primary caregivers of patients from pediatric diabetes and endocrinology clinics under the care of consultants, associate

consultants, fellows, and pediatric residents. Notably, patients were allowed to attend in-clinic appointments, especially those requested to visit the clinic by their physician.

Patients and their primary caregivers were notified by a message about the virtual setting of their consultation a day before the schedule. During the virtual visit, several topics of concern were addressed, including discussion on the self-monitored insulin dosage regimen of the patients and interpretation of the glucose charts, blood glucose log-books, and monitoring reports, which were conveyed to the physician through online platforms.

2.2. Study design

This study employed a cross-sectional design through a web-based survey in agreement with the STROCCS 2021 guidelines [17] that enrolled all primary caregivers of pediatric patients aged 18 years and below, diagnosed with T1DM, and who had at least one virtual appointment in the pediatric endocrinology and diabetes clinic between September 30, 2021, to October 1, 2020. Primary caregivers of pediatric patients diagnosed with type 2 diabetes and maturity-onset diabetes were excluded. Those who refused to participate in the study or failed to complete the survey were excluded. Consecutive sampling was employed to enroll the eligible respondents. For confidentiality, all participants were assigned anonymous study numbers instead of their medical record numbers.

2.3. Data collection

Data collection was conducted between March 31 to April 15, 2022, through the electronic healthcare system (Best Care) of the hospital, using a web-based questionnaire prepared on Google Forms. Questions were distributed to eligible individuals through WhatsApp, which helped register their phone numbers in the health system. The primary caregivers were asked to complete the questionnaire anonymously.

The questionnaire was composed of three sections, consisting of the following questions: (1) patients demographics, (2) caregiver demographics, and outcomes of the virtual visit; and (3) assessment of primary caregivers' perceptions of the virtual phone clinics for routine pediatric diabetes management (measured on a 5-point Likert scale).

The questionnaire was pre-piloted on eight participants to ensure content clarity. The reliability analysis of the 45 participants yielded a Cronbach's alpha of 0.961. While questions were adapted from a previously published study conducted at the same institute [13], adjustments were made to tailor-fit the context of the pediatric population based on the views of two experts in managing T1DM in the said population.

2.4. Data analysis

The data were analyzed using IBM SPSS version 23 (IBM Corp., Armonk, N.Y., USA). An independent *t*-test was employed to compare the domain to demographic data between the two groups. For more than two groups, one-way analysis of variance (ANOVA) with least significant difference (LSD) was used as a post-hoc test. Alternatively, the LSD test was replaced with the Games-Howell test. Using the main effect model, univariate analyses of the general linear model (GLM) were employed to determine significant predictors. The null hypothesis was rejected, with associations yielding a *p*-value less than 0.05.

3. Results

Of the 375 patients, only 214 were able to complete the survey. Table 1 presents the demographic characteristics of the participants. The mean age was reported to be 12.64 ± 3.6 years. Meanwhile, the reported mean age at which the participants were diagnosed with T1DM was 6.89 ± 3.7 years. An average HbA1c of 9.10 ± 1.6 was reported among the

Table 1
Association of primary caregiver perceptions with the health and COVID-19 characteristics of pediatric patients with type 1 diabetes mellitus.

Demographics	Total	Primary caregivers' perception of the virtual phone clinics	p-value
Total	214	66.71 ± 23.1	-
Age of the child/ adolescent			0.693
4–8 years old	31	65.89 ± 24.2	
9–12 years old	61	64.10 ± 22.7	
13–16 years old	96	67.84 ± 22.4	
>16 years old	26	69.62 ± 25.5	
When was the child/ adolescent diagnosed with type 1 diabetes			0.547
1–4 years	63	68.77 ± 22.2	
5–8 years	77	64.55 ± 22.7	
>8 years	74	67.20 ± 24.2	
Person filling questionnaire			0.388
The father	53	70.61 ± 24.7	
The mother	151	65.68 ± 22.4	
A family member	2	73.75 ± 12.4	
The legal guardian	8	58.44 ± 25.2	
Recent virtual clinic attendance			0.542
The child/ adolescent only	32	62.58 ± 25.8	
Parent(s)/family member(s)/ guardian(s) ONLY	61	67.05 ± 21.7	
BOTH parent(s)/ family member (s)/guardian(s) & child/adolescent	121	67.62 ± 23.0	
Sex of the child/ adolescent			0.890
Male	109	66.49 ± 22.2	
Female	105	66.93 ± 24.0	
Type of treatment used for type 1 diabetes:			0.081
Multiple daily injections	198	67.49 ± 22.8	
Insulin pump	16	57.03 ± 25.2	
Monitoring of blood sugar levels method			0.586
Continuous glucose monitoring system/sensor	133	66.03 ± 22.5	
Glucometer	81	67.81 ± 24.0	
HbA1c			0.404
<7	4	78.75 ± 25.7	
7–9	134	65.47 ± 23.0	
>9	76	68.26 ± 23.0	
Since the beginning of the COVID-19 pandemic, how many times has the child/adolescent been admitted to the hospital due to severe complications			0.472
None	152	66.78 ± 23.7	
1 time	44	69.43 ± 20.1	
2 times	14	58.39 ± 22.2	
>2 times	4	63.13 ± 31.4	
Number of comorbidities:			0.771
None	154	66.80 ± 23.3	
One comorbidity	50	65.10 ± 22.8	
Two comorbidities	8	72.19 ± 21.9	
Three or more comorbidities	2	77.50 ± 24.7	
As a primary caregiver, I am satisfied with the current health status of the child/ adolescent right now. ^b			0.031 ^a
Strongly disagree	3	45.83 ± 45.0 ^A	
Disagree	8	63.75 ± 25.6 ^{AB}	
Neutral	29	61.29 ± 27.0 ^A	
Agree	137	65.93 ± 20.6 ^A	
Strongly agree	37	76.15 ± 24.2 ^B	
Patients with diabetes can be more vulnerable to severe complications when infected with COVID-19.			0.710
Strongly disagree	6	73.33 ± 25.5	
Disagree	5	55.00 ± 37.3	
Neutral	54	65.74 ± 21.3	
Agree	90	66.47 ± 21.9	
Strongly agree	59	68.26 ± 25.1	
Has the child/ adolescent been diagnosed with COVID-19 infection?			0.107
Yes	50	62.10 ± 25.0	
No	164	68.11 ± 22.3	

*CAPITAL letters indicate Post-Hoc multiple pairing summary indicators. Having the same letter means the same measure statistically.

^a -significant using one-way analysis of variance test at <0.05 level.

^b -Post-Hoc Test = LSD.

patients. Most of the patients' primary caregivers were between 31 and 40 years of age (43.0%), employed (46.7%), had completed higher education (61.2%), and had a family income of 5.001–10.000 Saudi Riyals (32.7%). Mothers mostly composed the respondents of the questionnaire (70.6%).

Majority of the participants agreed or strongly agreed that they could be more predisposed to severe complications from contracting COVID-19 (69.6%), and reported that the concerned child or adolescent had not been diagnosed with COVID-19 through naso- or oro-pharyngeal swabs (76.6%). Many of the respondents did not request face-to-face consultation with their physician (68.7%), and correspondingly, most were also not asked to visit for consultation by their physicians (57.5%).

The responses of the participants regarding their perceptions of recent virtual phone clinic visits are summarized in Table 2. Notably, the majority of the respondents affirmed that virtual phone clinics can minimize the probability of being exposed to COVID-19, allow for a routine follow-up with their condition, and improve diabetes control among patients. Most respondents also demonstrated their interest in having as many as four or more virtual (36.0%), and in-person visits (36.0%) as shown in Figs. 1 and 2.

Furthermore, the majority concurred that virtual phone clinics enhanced accessibility to healthcare, and minimized healthcare costs, decreased productivity and attendance at work, school, or the household. In their future consultations, the majority also expressed their interest to continue virtual phone consultations more than face-to-face appointments for routine diabetes care.

While the majority of the respondents demonstrated satisfaction with their children's current health status, most of them also showed satisfaction with the service of consulting their physician through a phone call relative to the traditional face-to-face clinic setting, with the average perception value of 66.71 ± 23.1%.

Association of primary caregiver perceptions with the health and COVID-19 characteristics is shown in Table 1. Notably, substantially higher mean primary caregiver perception values (p < 0.001) were reported by participants who agreed or strongly agreed to be satisfied with the current state of health of their children. Additionally, higher mean perception values (p < 0.001) were associated with not asking physicians to be physically seen (70.70 ± 21.5), having four virtual visits or more (77.56 ± 19.0), having no in-person visits at all (87.50 ± 21.6), and having a single in-person visit (80.96 ± 14.6).

4. Discussion

Satisfactory perception values toward virtual phone clinics were demonstrated by the respondents in the present study; nonetheless, this is marginally less than the average perception value reported in a same study among adult patients [16]. The insignificant variation between the reported perception values could be attributed to differences in the context and study periods. In the previously cited study, data were collected between January 23 and February 10, 2021, when stricter rules and restrictions were in place, and vaccines were recently made available to the public [18]. Meanwhile, in the current study, data collection took place between March 31 and April 15, 2022, when vaccines have become extensively available. Additionally, vaccines have already been made available to children between 5 and 11 years of age [19]. All primary, intermediate, high school, and university students are also continuing their courses in person. In addition, all students, instructors, and faculty members must still be completely immunized before returning to school. Travel restrictions had also been lifted during this time. These could have caused slightly lower average perception values recorded in the present study.

Table 2
Participants' perceptions of virtual phone clinic visits.

Variables n = 214	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	N (%)	N (%)	N (%)	N (%)	N (%)
Virtual phone clinics decrease the risk of contracting COVID-19 infection because they do not require physical presence.	7(3.3)	17(7.9)	25 (11.7)	81 (37.9)	84(39.3)
Virtual phone clinics improve the ability to follow-up on diabetes mellitus with the physician routinely.	7(3.3)	31 (14.5)	37 (17.3)	79 (36.9)	60(28.0)
Virtual phone clinics improve the accessibility to health care.	10(4.7)	27 (12.6)	46 (21.5)	81 (37.9)	50(23.4)
Virtual phone clinics can help save money.	16(7.5)	36 (16.8)	47 (22.0)	77 (36.0)	38(17.8)
Virtual phone clinics can decrease nonattendance to work, school, or household duties.	6(2.8)	16(7.5)	19(8.9)	91 (42.5)	82(38.3)
Compared to traditional clinics, we feel satisfied with the health service provided by physicians over the phone.	10(4.7)	27 (12.6)	35 (16.4)	82 (38.3)	60(28.0)
The physician can better understand the medical problem over the phone.	11(5.1)	38 (17.8)	36 (16.8)	90 (42.1)	39(18.2)
Virtual phone clinics can improve our ability to control diabetes.	8(3.7)	38 (17.8)	50 (23.4)	82 (38.3)	36(16.8)
Overall, we are satisfied with our experience with the virtual phone clinics for routine follow-ups of diabetes mellitus.	6(2.8)	17(7.9)	34 (15.9)	101 (47.2)	56(26.2)
In the future, we would prefer to continue attending routine diabetes follow-up appointments through virtual phone clinics rather than through traditional clinics	23(10.7)	45 (21.0)	38 (17.8)	60 (28.0)	48(22.4)

Although the COVID-19 situation has relatively eased, the populace still deems virtual clinics acceptable, further substantiating the integration of virtual clinics with in-person visits for the management of T1DM. Statistically significant associations were established between the mean perception values and the number of desired virtual visits and in-person visits among patients, where higher mean perception values were associated with having four or more virtual visits and having single to no in-person visits. Fung et al. reported that telephone and virtual visits were more useful and easier to comprehend [20]. Remote communication with the physician was also reported to be associated with a high level of flexibility and comfort in the families of pediatric patients with T1DM [20].

Interestingly, a statistically significant association was also established between the primary caregiver perception of virtual clinics and the satisfaction of patients with their current health status, in which higher primary caregiver perception values were reported by participants who demonstrated satisfaction with their current health state. A study by Bronner et al. (2020) revealed that a little less than half of the respondents scored substantially worse than the control or healthy group on all domains except social functioning [21]. Similarly, an older investigation conducted by Abdul-Rasoul et al. (2013) found that the quality of life among pediatric patients diagnosed with T1DM was significantly worse than that of controls [22].

Higher mean perception values were also found to be associated with not requesting physicians for physical examination. The same trend of responses was demonstrated in the adult population, but at relatively higher percentages [16]. Both studies revealed that most respondents were content with their virtual physician consultation compared to the face-to-face clinic setting. Through virtual consultations, they were able to effectively manage their T1DM, and more so, they were given an avenue for routine follow-up consultation with their physicians. Furthermore, both studies reported an improved access to healthcare.

In line with this, several studies show that virtual consultations helped patients with T1DM to communicate with their physicians from the comfort of their own homes [16,23]. An online survey conducted by Fung et al. (2020) revealed that telehealth visits during the pandemic have improved healthcare service access among patients with T1DM, despite the lack of face-to-face communication with a physician [20].

The current study also revealed respondents are able to satisfactorily communicate with their physicians regarding their medical problems through a phone call. This finding appeared to be similar to the results of the adult population, in which most participants also responded positively. With such findings, the perceived acceptance of virtual clinics has been evident in the present study despite being a new method to cope with the COVID-19 pandemic. This makes sense since the patients in the present study were relatively younger; thus, they were more eager and adaptable to technology than older patients. Nonetheless, incorporating both in-clinic and virtual visits is still recommended to enhance the future patient experience [24–26].

4.1. Strengths and limitations

The current study highlights primary caregiver perceptions toward the introduction of virtual phone clinics for the first time to provide diabetes care among Saudi pediatrics with T1DM, especially during the COVID-19 pandemic. Our research can be used as basis for policymakers to formulate recommendations for better treatment modalities through routine check-ups for T1DM. This study is not without limitations. Evidently, only those individuals with Internet connectivity could complete the online survey, insinuating a potential response bias during the data-gathering phase.

5. Conclusion

The COVID-19 pandemic has resulted in a surge in the use of telemedicine. The utilization of virtual phone clinics for assisting patients with diabetes is strongly recommended, as substantiated by several studies.

In the present study, primary caregivers generally showed acceptable perceptions of virtual clinics. A considerable number of patients with T1DM at the diabetic clinic have become accustomed to virtual consultations, reporting high mean perception levels in addition to greater inclination and willingness to utilize the technology. Therefore, virtual clinics may be implemented for routine treatment alongside regular in-clinic appointments to improve the quality of care in the post-COVID-19 period. However, procedures must be kept in place to ensure accessibility of healthcare services, particularly in situations that could warrant lockdowns. Further studies are needed to determine the long-term

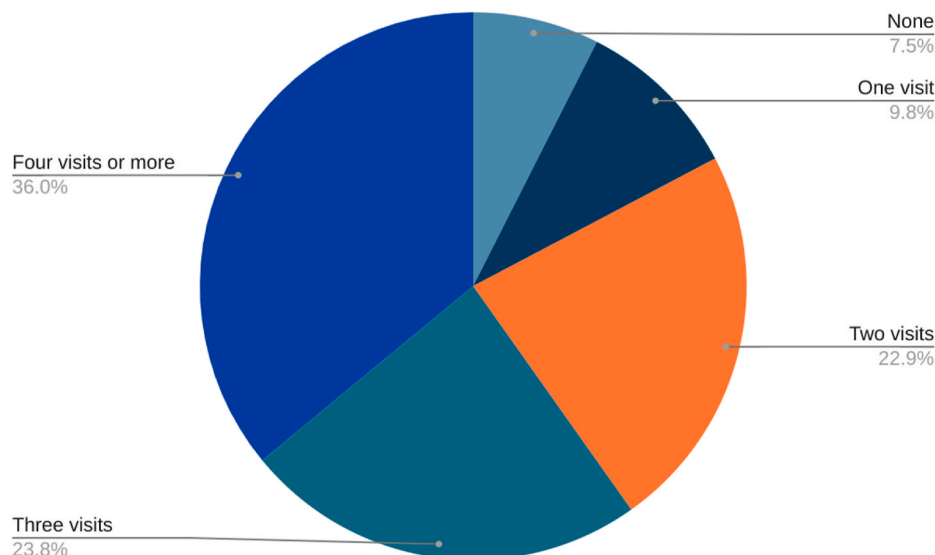


Fig. 1. Number of virtual visits preferred by respondents in a year.

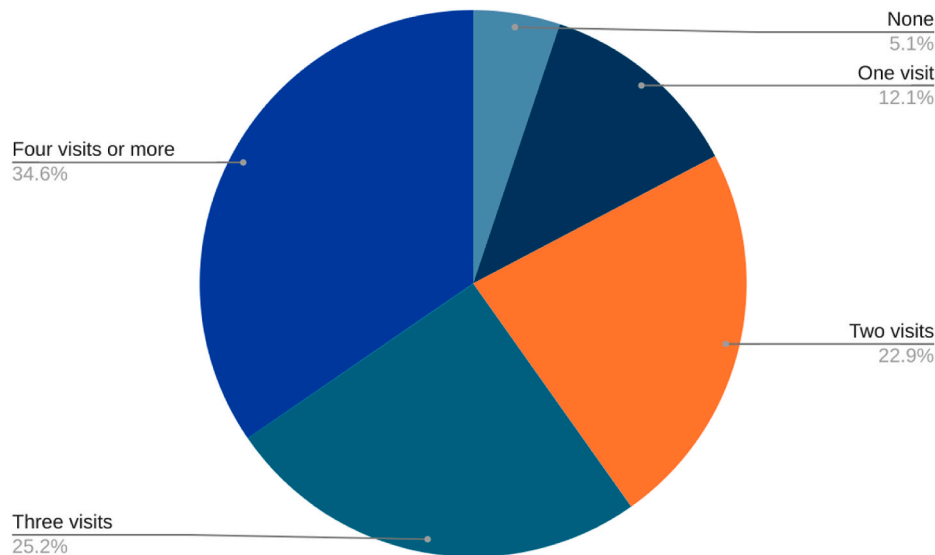


Fig. 2. Number of in-person visits preferred by respondents in a year.

applicability of virtual phone clinics in a post-pandemic setting.

Ethical approval

Ethical approval (reference number: IRBC/2488/21) was granted by the Institutional Review Board of King Abdullah International Medical Research Center, National Guard Health Affairs, Riyadh, Saudi Arabia. This study was conducted in accordance with the principles of the Declaration of Helsinki.

Sources of funding

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Author contributions

Abdullah M. Alzahrani contributed in proposal and manuscript writing and editing. Sultan F. Magliah was involved in proposal and manuscript writing in addition to data collection and analysis. Haneen

A. Turkistani, Bahaa A. Abulaban, and Mahmoud F. Sabban assisted in proposal and manuscript writing in addition to data collection. Manar A. Mashat participated in data collection and manuscript writing. Adnan M. Al Shaikhi contributed in revising the questionnaire and the manuscript. All authors granted approval of the final version of the manuscript.

Registration of research studies

1. Name of the registry: Research Registry <http://www.researchregistry.com>
2. Unique Identifying number or registration ID: researchregistry8049
3. Hyperlink to your specific registration (must be publicly accessible and will be checked):

<https://researchregistry.knack.com/research-registry#user-researchregistry/registerresearchdetails/62babf60e6954d001ec634a7/>

Guarantor

The Guarantor is the one or more people who accept full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

Consent

Informed consent was obtained at the start of the questionnaire.

Provenance and peer review

Not commissioned, externally peer reviewed.

Declaration of competing interest

The authors declare no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104550>.

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