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RESEARCH ARTICLE

Type 1 diabetes patient experiences and management practices during the COVID-19 pandemic in rural Uganda

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Abstract

Background The COVID-19 pandemic has impacted various aspects of the lives of persons with chronic diseases, including type 1 diabetes (T1D). However, the diabetes care experiences and practices adopted by persons living with T1D after the declaration of the COVID-19 pandemic in Uganda have not been well documented.

Objectives We investigated diabetes management practices and experiences of persons with T1D during the COVID-19 pandemic lockdown in a rural district of southwestern Uganda.

Methods Using interactive sequential explanatory mixed methods, we conducted a cross-sectional study of persons with T1D aged 18–25 years, their caregivers and health workers. Quantitative data was exclusively collected from patients with T1D using Kobo Toolbox™ and analysed with SPSS™ version 26; qualitative interviews were used to elicit responses from purposively selected patients with T1D, plus caregivers and health workers that were analysed using a thematic framework approach.

Results The study enrolled 51 (24 males) patients with T1D; diabetes duration (mean ± SD) 6.6 ± 5 years. Access to insulin syringes significantly worsened in 19.6% of participants ($p = 0.03$). Insulin injection frequency ($p = 0.01$), blood glucose monitoring ($p = 0.001$) and meal frequency ($p = 0.0001$) significantly decreased. Qualitative interviews highlighted COVID-19 restriction measures had reduced household income, frequency of clinic visits, and access to food, diabetes support and social services.

Conclusions Experiences and practices were consistent with decisions to prioritise survival, even with known risks around metabolic control.

Keywords COVID-19 · Type 1 diabetes · Diabetes self-management · Self-monitoring of blood glucose · Uganda

Introduction

Type 1 diabetes (T1D) care services in Uganda are provided free at the point of care under the T1D programme of the ministry of health of Uganda and its partners [1]. More than 1,000 people with T1D, mostly children and adolescents, across Uganda are believed to be receiving diabetes care services under the programme at various healthcare establishments, both government and private-not-for-profit [1]. The fact that these services are available at the point of care implies that persons with T1D are required to overcome any accessibility challenges to receive the services. With the outbreak of COVID-19, T1D care dynamics faced a drastic transformation triggered by the country's unprecedented COVID-19 control measures. While these measures targeted containment of COVID-19 and facilitated management of infected cases, they caused many disruptions in healthcare service delivery and access, especially in rural settings [2, 3]. Studies from high-income countries have shown that COVID-19 has adversely impacted T1D self-management, reduced patient access to care, and altered hospital presentation patterns for T1D diagnosis [4–6]. In rural settings of

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less-resourced countries, the impact of COVID-19 on T1D-related care delivery and access has yet to be adequately documented.

Upon reporting its first confirmed case of COVID-19 on 21st March 2020, Uganda instituted nationwide restrictions that saw closure of borders to non-cargo movements, banning of passenger service transport and non-essential private vehicles, closure of non-essential businesses and trade, and institution of a 7pm-6am curfew [7]. Security forces were also deployed across the country to patrol and arrest any person not in compliance with lockdown restrictions and public-health guidelines [8]. Evidence of travel restriction waivers were required of individuals seeking access to emergency and chronic healthcare, and both pre- and antenatal services [7, 8].

Two months following the introduction of COVID-19 lockdown measures, a phased manner of eased restrictions was implemented, which included allowing operation of passenger transportation services; subject to carrying half the licensed passenger number. During this period, it became worth assessing and exploring how T1D management experiences and practices were influenced by the COVID-19 pandemic and related restrictions, to inform future planning for similar situations. It was against this background that this study was undertaken in Kasese District, a rural district in southwestern Uganda.

Materials and methods

This was a cross-sectional study carried out in September 2020 at Kagando hospital, where children and young adults with T1D receive support from the Life for a Child program [9]. The study used interactive sequential explanatory mixed methods to achieve complementarity of quantitative and qualitative data. Data from qualitative interviews were used to provide explanations for quantitative results, which were merged to achieve broader and deeper understanding of findings.

Quantitative phase

Participant characteristics

All eligible persons with T1D, aged 18–25 years receiving healthcare at Kagando Mission hospital who consented to participate in the study were enrolled. Participants were required to have lived in Uganda for at least the previous consecutive six months, and be able to comprehend and respond to questions asked. Further, they were to not have a current respitarory infection, including with COVID-19, so as to prevent risk of cross infection and response bias. At the time of the study, there were 133 patients with T1D registered (retrieved from the database of Electronic Health Records) and regularly receiving diabetes care services at Kagando hospital, one of the centres of the national T1D care program in Uganda; 54 active patients were aged 18–25 years. Two patients were excluded based on inclusion and exclusion criteria, whereas one patient did not consent to participate, giving a final total of 51 participants.

Data collection tool

A 42-question interviewer-led questionnaire with open- and close-ended structured questions was developed through review of literature, team discussions and expert review. This questionnaire, in addition to collecting data on demographics and clinical characteristics, also captured data on patient experiences and practices related to diabetes care and self-management, before and during the COVID-19 pandemic and related restrictions in Uganda. Three trained and experienced interviewers verbally administered the pretested questionnaire and responses were directly entered into the open-source mobile data collection programme KoboToolbox™ (Harvard Humanitarian Initiative, Massachusetts, USA).

Approach to data analysis

Data collected were exported from KoboToolbox™ to SPSS™ (IBM, New York, USA) version 26 software for statistical analysis. Patient demographics and clinical characteristics were summarised using descriptive statistics. i.e., mean ± standard deviation (SD) for continuous variables, and number or percentage for categorical variables where appropriate. Differences between means such as age and T1D were examined with t-tests, all using variables chosen based upon clinical and/or theoretical reasons. The impact of COVID-19 (before and during) on acute diabetes-related complications were analysed with McNemar's test. Differences between proportions were examined using Pearson's chi-squared statistic followed by a pairwise comparison with "N-1" Chi-squared (X^2) [10], and multiple comparisons were adjusted using the Bonferroni correction. This test was implemented in *MedCalc* online software [11]. $p < 0.05$ was considered as significant. Incomplete questionnaires ($n = 6$) were included in analyses where possible, with results presented as $n = 51$ unless otherwise stated.

Qualitative phase

Participant characteristics

A total of eight participants, including three patients (n = 2 females) with T1D, three caregivers (n = 1 male) of patients with T1D, and two (all male) health workers were interviewed. Whereas all patients from the quantitative phase voluntarily expressed their availability for qualitative interviews, we purposively selected three patients for interviews. We also purposively sampled caregivers and health workers who had been primary carers and working in the T1D clinic respectively. Caregivers were parents to patients with T1D. Health workers were registered nurses trained in T1D management and having healthcare experience that ranged from 3 - 11 years. The number of participant interviews met the minimum sample number as guided by Stake (2006) [12].

Data collection tool

A semi-structured interview guide was developed through team discussion and expert review. An open-ended and probing approach to interview questions captured broad and in-depth experiences related to diabetes care access and self-management (for patients); patient care and support (for caregivers), and diabetes care and service delivery (for health workers), before and during the COVID-19 pandemic and related restrictions in Uganda. The interviews were conducted in English and Lukhonjo (the local language) where appropriate by two interviewers (WS and MB) with training and experience in qualitative research methods, and responses captured using a digital audio recorder. The interviews lasted 15 - 30 min.

Table 1 Summary of demographic and clinical characteristics of participants in the quantitative study

Characteristic (n = 51)	Frequency
Age: Mean ± SD years	23.0 ± 2.2
Sex: Males / Females	25 / 26
Marital status**:	
Single (%)	24 (49.0)
Married (%)	15 (30.6)
Co-habiting (%)	9 (18.4)
Separated/divorced (%)	1 (2.0)
Age at T1D diagnosis: Mean ± SD years	16.3 ± 4.3
T1D duration* : Mean ± SD years	6.6 ± 5.0
Duration in program***: Mean ± SD years	4.5 ± 3.3
Current insulin regimen** :	
NPH with Regular (Basal – Bolus) (%)	32 (65.3)
Premixed (30R/70NPH) (Twice daily) (%)	9 (18.4)
Premixed (30R/70NPH) (Twice daily with Regular at lunch) (%)	8 (16.3)
Home-to-hospital distance*: (Mean ± SD) km	32.3 ± 27.0

SD: Standard deviation; km: kilometres;*1 participant missing data ** 2 participants missing data **3 participants missing data

Approach to data analysis

Interview responses were professionally transcribed verbatim and translated (for non-English interviews) to English. A priori codes (availability and affordability of transport means; influence on diabetes self-management; utilisation of diabetes supplies; changes in diet patterns; changes in diabetes support structures) were matched with text segments in the transcripts that provided characteristic meaning. Additional codes were also generated from transcript text as appropriate. Two researchers (WS and SB) with training and experience in transcript coding were involved in the manual coding and verifying the appropriateness of code matching. Where necessary, some a priori codes were modified to appropriately align with linked text segments. Thematic analysis was done by hand in deriving matching themes from codes, with back-to-back team consultations undertaken. A detailed research diary and coding manual were maintained to track the analysis process and account for objectivity.

Study conduct

The study was conducted in accordance with International Conference on Harmonization Principles of Good Clinical Practice guidelines and World Medical Association's Declaration of Helsinki for the ethics of research involving human subjects. Approval to conduct the study was obtained from the St. Francis Hospital Review and Ethics Committee in Uganda (SFHN-2020-4) and permitted by the Ugandan National Council of Science and Technology (HS987ES). The protocol of the study was also approved by the University of the Sunshine Coast Human Research Ethics Committee in Australia (A201444). Questionnaires and interviews were administered in designated private rooms at the diabetes clinic of the Kagando hospital. Informed consent was obtained from all participants.

Results

Demographic and clinical characteristics of participants

Participant demographics and clinical characteristics are presented in Table 1.

Diabetes care access

Before and during the COVID-19 pandemic and related restrictions, all participants reported having free access to available Life for a Child program supplies. Participants used a variety of modes of transport and some, combinations of modes, to access their diabetes supplies and attend diabetes-related healthcare appointments at the Kagando hospital, with mean ± SD (min-max) distance from home to the hospital (n = 50) being an estimated 32.3 ± 27.0 (5-110) kilometres. The most frequent mode of transport used was a bike (cycle or motorcycle) (n = 36, 70.6%), with six (11.8%) participants undertaking substantial walking. Some (n = 15 of 49, 30.6%) participants reported having to travel between 1–2 h. Nine (18.4%) participants reported travelling for > 3 h.

During the pandemic, the most common mode of transport continued to be use of a bike (cycle or motorcycle) (n = 30, 58.8%), though travel by foot (n = 25, 49%) had increased, with only 13 (25.5%) and 4 (7.8%) participants now travelling via car and bus, respectively. Consequently, travel times increased, taking most (of n = 50) participants between 1–2 h to travel (n = 15, 30%). For 19 (38%) participants, travel was now > 3 h.

During the COVID-19 lockdown period, access to diabetes supplies was reported to be of greatest concern and threat to care among participants (n = 36 of 50, 72%). Nevertheless, participants endeavoured to access supplies at the hospital in-person (70.2%), by sending someone else (24.5%) and through other means (5.3%).

Looking towards the remaining months of 2020, most (n = 39, 76.5%) participants were more (vs. less) concerned about their access to diabetes management supplies and care than currently. Concerns included maintaining access to insulin (n = 27, 69.2%), syringes (n = 21, 53.8%), blood glucose testing strips (n = 21, 53.8%) and standard care reviews (n = 25, 64.1%).

Diabetes self-management

Participants reported changes in daily frequency of insulin injections, self-monitoring of blood glucose (SMBG) and meals. There was a significant decrease in frequency across all these aspects during the pandemic (all $p < 0.05$), as shown in Fig. 1. Patients who reduced the number of times self-monitoring blood glucose were likely to be younger at diagnosis (15.3 vs. 17.7 y; $p = 0.048$) and therefore had a longer T1D duration (8.4 vs. 4.3 y; $p = 0.003$).

Of 47 participants, in the months preceding the COVID-19 pandemic, most had experienced self-treated hypoglycaemia (n = 29, 61.7%) or hyperglycaemia (n = 25, 53.2%). Severe hypoglycaemia occurred in the same number of participants as diabetic ketoacidosis (n = 5,10.6%). No significant differences were found between those who did or did not experience an acute complication when considering age (as a continuous variable), 18–20 (no/yes) and 21–25 (no/yes), male sex (no/yes), age at T1D diagnosis, T1D duration, and marital status (single no/yes).

During the pandemic, acute complications of T1D were again reported, with most (of 48 participants) having experienced self-treated hypoglycaemia (n = 29, 60.4%) or hyperglycaemia (n = 24, 50.0%). Severe hypoglycaemia and diabetic ketoacidosis were experienced in 05 (10.4%) and 03 (6.3%) participants, respectively. However, of 45 participants this was of no statistically significant difference to before the COVID-19 pandemic had begun. Participants of older age at T1D diagnosis were significantly more likely to report having experienced unusual hypoglycaemia (not severe) (n = 29, mean ± SD 17.2 ± 3.2 vs. n = 19, 14.5 ± 5.1

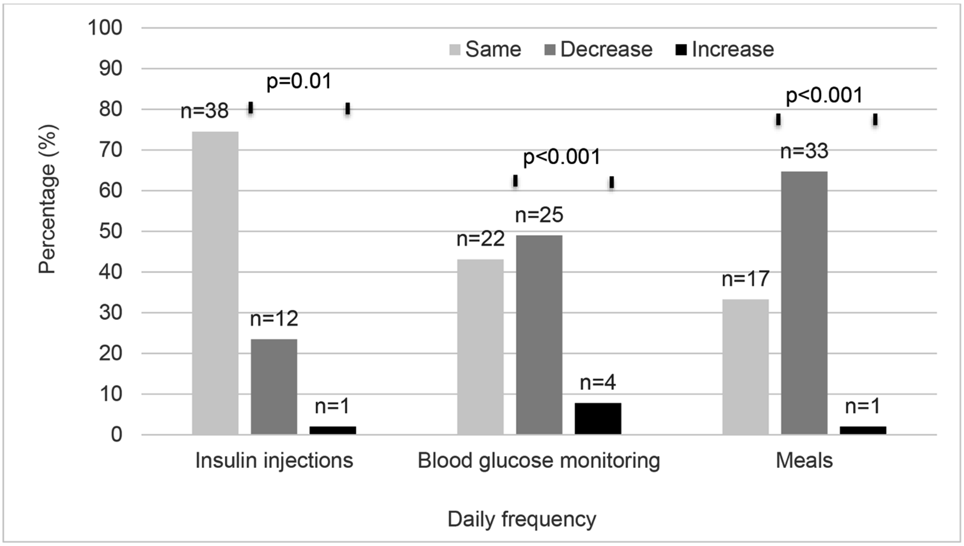

Fig. 1 Changes in daily frequency of insulin injections, self-monitoring of blood glucose and meal frequency during the COVID-19 pandemic and related restrictions (n = 51)

y, p = 0.03). No significant differences were found between complications prior to and during the lockdown.

Qualitative findings

The T1D duration of patients ranged from 3–7 years. Interview responses were aligned to three broad themes: (i) diabetes care service access encounters; (ii) influence on diabetes self-management and support; and (iii) outlook for sustaining diabetes service availability.

Diabetes care service access encounters

i) **Availability and affordability of transport means** Patients and caregivers reported having had very limited travel options to link to the health facility for their routine clinic appointments and replenish essential diabetes supplies during lockdown phases. Walking became a common option of connecting to the health facility, especially during the total lockdown phase. Moreover, the only accessible motorised travel options proved very costly and competitive.

"With the initial total lockdown, there were no means to travel but foot…. after easing some travel restrictions, the fares have doubled, and you must compete like never before. Boda-Bodas [passenger motor bikes] have always been our best option but they have now become very expensive to hire or send." (**Patient**).

This was further exacerbated by diminished household incomes attributed to closure of trade centres and non-essential businesses, causing financial constraints among participants to afford the high cost of transport.

"We no longer have a reliable source of income because they closed where we used to earn, yet you have these costs that have also gone up" (**Caregiver**).

ii) **Evasive travel manoeuvres** As a means of overcoming challenges around travel costs, participants would reportedly use other people visiting or working within the hospital vicinity to collect their diabetes supplies.

"We come in turns or request someone we know to pass-by and collect the supplies. He is young to move alone yes but then the cost. At least that way we can afford to come more times and have what he needs, until things get back to what they used to be" (**Caregiver**).

When group travelling was inevitable, alternative isolated and distant travel routes would be used. Otherwise, pleading or bribing COVID-19 enforcement teams along the way would be the only remaining options.

"You had to deal with LDU [COVID-19 guidelines enforcement]. You would have to plead with them or get them something for your passage [corrupt through your way through] …. otherwise get ready to use other roads that are far away from where they [LDU] stage" (**Patient**).

iii) **Evasive travel risks and consequences** Making improvised movements during the COVID-19 lockdown did not come without risks. Participants reported having been physically assaulted by law enforcement or having some of their diabetes supplies unlawfully confiscated as they navigated through travel restrictions.

"There is a time I got a beating from them [LDU] but it only happened once …. and they [LDU] also confiscated my [blood glucose] meter. That time pleading did not work" (**Patient**).

Yet, navigating isolated routes to avoid detection of COVID-19 enforcement teams was feared, putting patient lives at risk should diabetes-related emergencies occur during transit, where medical care cannot be reached.

"…. Coming through those routes [isolated roads]. Should any emergency occur on the road, the chances of getting help or being rushed to the nearest health centre are very minimal" (**Diabetes nurse**).

Influence on diabetes self-management and support

i) **Utilisation of diabetes supplies** The high costs of transport and limited affordability due to loss of income further led to a reduction in frequency of clinic attendances, and refills of essential diabetes supplies. Consequently, this influenced unfavourable sparing behaviours among patients.

"I could only come to pick supplies when they [parents] had money for me. There was time I ran out of insulin even when I had tried to use it very sparingly, after realising my parents had not got money for me to travel for my medicines. I learnt to test (for blood glucose) when it matters and not to throw away my syringes, just in case" (**Patient**).

ii) **Changes in dietary patterns** Loss of income did not only affect access to transport but also dietary intake as affordability and access to food were hampered by increased food costs and closure of communal food markets. Moreover, the COVID-19 pandemic coincided with deadly flash floods that caused destructions of many food gardens in the district, worsening the food crisis.

"There has been a shortage of food in homes during this period. The incomes have been frustrated by COVID restrictions, the heavy floods that hit our district have destroyed farms and gardens, and food markets were closed due to corona [COVID-19]. So, this has affected food access and changed the way of feeding. The number of meals they have in a day has reduced. The quantities and quality of food has also reduced" (**Diabetes nurse**).

Consequently, uncertainty of daily meal frequency and quantities was a concern that reportedly complicated insulin use among participants.

"See, sometimes we would eat two times and other times have only porridge for the day [lunch or supper], and I do not know how to match her insulin to that …. that has been a very big puzzle" (**Caregiver**).

iii) **Changes in diabetes care service delivery** The mode of delivery of diabetes care services at the health facility also changed, as traditional group interactive diabetes education sessions were replaced with time-limited one-to-one sessions, to address individual-specific challenges.

"*The food challenges that they have been experiencing have called for us to adjust regimens for many on an individual basis, to try and somewhat match their food pattern. We have therefore needed more one-to-one sessions than we used to*" (**Diabetes nurse**).

However, the time health workers devoted to patients reduced, as they had to ensure patients returned home in a timely manner, as well as the need to reduce contact time due to risk of contracting COVID-19.

"*A patient could tell you they started their journey at about six in the morning am and would get here [hospital] at 10 or 11 am. You would want to immediately serve them [with medical supplies], to allow them to embark on their return journey as early as possible to beat the curfew"* (**Diabetes nurse**).

iv) **Disruption of social support networks** During the COVID-19 pandemic and related restrictions, it was reported that social support networks were disrupted with closure of learning institutions and social activities. Patients were physically separated from their peers who they considered supportive in their general life aspects.

"I left school. I could no longer meet with my school friends, with whom I used to play and do other things. I am confined at home, and I find it boring and less inspiring. My parents and my siblings do not give me the same good company [as the friends]" (**Patient**).

Outlook for sustaining diabetes service availability

i) **Disaster management planning** When asked on what they thought could be a better approach for similar future occurrences, participants reported the need to plan for adequate stock supplies should future lockdowns present similar problems, including securing various accessible emergency access service points and outreach provisions.

"Securing and keeping enough supplies at the centre especially when alerts indicate of an incoming situation such as was the case with Corona. We need to create emergency points that can be activated in case such situations befall, especially for chronic disease care and management because patients will always need their treatment" (**Diabetes nurse**).

ii) **Investing in patient livelihood income** Participants noted the need for income projects for patients with T1D which they said could minimise the uncertainty and anxiety associated with donor reliance.

"We need income projects for these people. Most of their challenges are income-related and finance-dependency. So going forward, we need income generating projects for them to earn, save and to know they can be safe in the future even when such [support] programmes pull out" (**Diabetes nurse**).

Discussion

Our study explores experiences and practices by persons with T1D, their families and a diabetes care team in a typical rural setting of Uganda, during the 2020 COVID-19 pandemic and related restrictions. The impact of COVID-19 pandemic was realised at individual, household and institution levels with consequences directly or indirectly impacting on persons with T1D.

The influence of financial and non-financial healthcare access barriers on behaviour and management outcomes in chronic care programs has been well documented [13, 14]. Our study reveals that restrictions around the COVID-19 pandemic resulted in health choices and diabetes management practices among patients and their caregivers that were deviant from, and contrary to, existing diabetes guidelines for T1D management [15]. These included decreasing the frequency of daily insulin injections and self-monitoring of blood glucose, which are associated with sub-optimal glycaemic control and increased risk for complications [16–18]. These portray the adverse long-term metabolic effects that the institution of COVID-19 restrictions can have on young persons with T1D. Research elsewhere, however, have shown that worldwide, patients of all ages with T1D have not experienced a deterioration in their glucose control throughout lockdown periods [19].

Practices undertaken by participants were not volitional, but an outcome of failed attempts to ensure reliable access to essential diabetes supplies. COVID-19 restrictions not only created physical barriers but also occasioned serious household income loss amidst soaring cost prices for commodities and services, including food and transport means. This impacted negatively on their purchase power of basic household items and affordability of service costs such as travel fare or hiring fees. Collectively, these created uncertainties in regular possession of adequate essential medical and non-medical supplies among households of persons with T1D, and consequentially, unfavourable sparing usage and hoarding became inevitable. The financial pressure of people as a result of COVID-19 has been well documented.

For instance, in the United States, 24% of people with diabetes have used savings, loans, or money from a provided stimulus cheque to pay for diabetes care [20].

Findings raise concerns around the continued quality and safety of diabetes supplies utilised at home, especially insulin and syringes, which require strict observance of manufacturer conditions of storage and use [21, 22]. It is probable that with the abrupt institution of COVID-19-related restrictions and their extension beyond two months, some patients with T1D may have used their insulin and syringes beyond recommended duration and conditions of use. The quality of insulin and safety of insulin syringes have a bearing on overall glycaemic outcomes. Some studies have reported significant loss of insulin potency with extended storage of insulin at room temperature beyond two months [23]. The use of an insulin syringe beyond the recommended number of times has also been shown to expose users to risk of injection site infection [24, 25]. The sparing use and hoarding of diabetes supplies reported among patients and caregivers in our study further demonstrate the vulnerability to injection site infection and ultimately poor glycaemic control that persons with T1D faced owing to the COVID-19 lockdown. While we did not assess glycaemic control, these practices may explain reported concerns of hyperglycaemia among patients with T1D during the pandemic and occurrence of diabetic ketoacidosis. Moreover, given the reported limited health worker-patient contact time, coupled with increased patient clinic appointment absenteeism during the pandemic, patients more likely missed out on undergoing physical examination of injection sites and review of their insulin vials and administration techniques like was standard clinic practice prior to the COVID-19 pandemic. This means that any mistakes in self-management that were occurring during the pandemic would more likely go uncorrected by health workers. Unfortunately, patient peer support networks that provide self-care assistance, and buddy experience-sharing were also disrupted by COVID-19-related social restrictions; prompting patients to avoid physical contact with their counterparts and social circles, yet considered impactful in building self-management care skills, confidence and mental wellbeing among persons with T1D [26]. This gap leaves the patient with no alternative care assistance to consult or review their management actions.

Appropriate meal planning was another area that was affected by the institution of the COVID-19 lockdown. Changes in dietary patterns among persons with T1D were observed in our study, stemming from limited food access, availability and affordability. Adequate dietary intake is key in achieving optimal diabetes management outcomes and nutritional wellbeing for normal growth, physical productivity and mental health [27]. Changes in dietary patterns do not only affect growth and productivity, but also complicate home insulin management. The diet changes experienced during the COVID-19 pandemic and related restrictions were unpredictable, owing to uncertainties surrounding daily meal frequencies and meal content and quantity. This not only affected participants' diet adequacy but also insulin management, considering insulin-based meal plans could be frustrated by unpredictability in household food access and availability, with some patients having limited knowledge to manipulate such situations [28].

Our study also reveals the need to financially empower people with T1D through establishing income-generating projects to ensure they are able to afford out-of-pocket diabetes care expenses when they reach the "program-exit" age or should diabetes care programs leave.

Limitations

Due to the strict COVID-19-related restrictions at the time of data collection, the study was only able to recruit a small number of participants. Although a bigger sample size may have enriched results, drawing from a diverse study sample and using a mixed methods approach provided reasonable depth in understanding the context of findings. Responses to occurrence of acute complications were self-reported rather than being confirmed by self-monitoring records, and therefore may not represent the actual picture.

Conclusion

The impact of COVID-19 pandemic was mainly related to nation-wide restrictions and guidelines instituted for the prevention of spread of COVID-19, with adverse consequences on the social, financial, metabolic and psychological wellbeing of patients with T1D. The experiences and practices of patients with T1D during the COVID-19 pandemic and related restrictions were tough, with choices consciously prioritised on keeping alive at the cost of risking long-term and irreversible diabetes complications. Policy interventions in the wake of similar nationwide occurrences and emergencies should be instituted and implemented, with an understanding and consideration of the needs of individuals in chronic care; especially those whose survival depends on daily use of essential medicines and medical supplies.

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Authors' contribution WS, SJ, MB, EK, GO, MM, RW and SB co-designed the study protocol. WS and MB collected the data. WS, SB, SJ and JM analysed the data. All authors contributed to the drafting and revision of the manuscript. All authors have approved the final manuscript.

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Availability of data and material Data related to this work is available and can be provided on reasonable request from the corresponding author, subject to ethical considerations.

Declarations

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval Approval to conduct the study was granted by the Ugandan National Council of Science and Technology (HS987ES) and the University of Sunshine Coast Australia (A201444). The study was conducted in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent Written informed consent was obtained from all study participants.

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