Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Between Survival and Supply: Managing Type 1 Diabetes among Young People During Gaza's Health-System Collapse — A Rapid Qualitative Study

Mohammed Seyam

Mohammed.seyam@hpi.de

University of Potsdam

Baraa Alhendawi

Al-Azhar University – Gaza

Malak Nasr

Mariam A. AbuSalah

Al Quds University

Amro Hamada

Al-Azhar University – Gaza

Éimhín Ansbro

London School of Hygiene & Tropical Medicine

Research Article

Keywords: type 1 diabetes, children, Gaza, armed conflict, qualitative research, insulin access, humanitarian crisis, caregiver experiences, healthcare providers, food insecurity

Posted Date: June 23rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10028618/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Gaza's health system has experienced precipitous collapse since October 2023, threatening the survival of an estimated 2,500 children and young adults living with type 1 diabetes (T1D). Evidence capturing how affected families and healthcare providers navigate this crisis from within Gaza remains scarce. This qualitative study aims to characterise how the ongoing crisis affects the daily management of T1D among children, adolescents, and young adults (≤ 25 years), from the perspectives of caregivers and healthcare providers, and to identify feasible strategies to sustain safe care under protracted emergency conditions.

Methods

A qualitative study was conducted using semi-structured telephone interviews with 25 caregivers of young people with T1D (14 male, 11 female), and 6 healthcare providers (HCPs), purposively sampled from the Diabetes Palestine registries and clinical networks in Gaza. Interviews were conducted by a trained researcher a month after the October 2025 ceasefire announcement. A hybrid deductive–inductive thematic analysis was performed. Reporting follows COREQ guidelines.

Results

Six overarching themes were developed: systematic barriers to accessing insulin and cold-chain failure and displacement; a shift from structured diabetes management to crisis-driven survival care described as "blind management"; severe clinical deterioration including recurrent diabetic ketoacidosis, hypoglycaemia, and malnutrition; pervasive psychological distress with a bidirectional relationship between stress and hyperglycaemia (stress worsened glycaemic control, and unstable glucose in turn intensified emotional distress); and dependence on family networks, predominantly mothers, as the primary support system. HCPs described total fragmentation of the health system, the personal burden of delivering care while themselves displaced and food-insecure, and the emergence of improvised telemedicine solutions.

Conclusions

Findings from caregivers and HCPs position the T1D care disruption in Gaza as a preventable consequence of the systematic disruption of health infrastructure and humanitarian access. Young people with T1D are a high-priority population whose survival depends on uninterrupted insulin supply, cold-chain integrity, nutritional adequacy, and psychosocial support, none of which can be improvised at the family level alone. Integrating this population into humanitarian frameworks, emergency

preparedness protocols, and disaster risk reduction programming is both a clinical imperative and an obligation under international humanitarian law.

Background

Type 1 diabetes mellitus (T1D) is an autoimmune condition that requires lifelong insulin therapy for survival, regular blood glucose monitoring, dietary management, and ongoing clinical follow-up (1). Without insulin, T1D is fatal within days to weeks, making it among the most immediately life-threatening non-communicable diseases (NCDs) when care is disrupted (2, 3). In stable healthcare environments, the management of T1D already presents formidable challenges; in humanitarian settings, these challenges are profoundly magnified.

The global burden of NCDs in humanitarian emergencies has received increasing recognition over the last decade or so (4, 5). Research thus far has documented the scale of this challenge, demonstrating that diabetes care is both inadequately resourced and historically neglected in humanitarian responses (6, 7). At the programmatic level, the inclusion of T1D, and NCDs more broadly, in humanitarian responses has been hindered by a lack of context-adapted guidance, the absence of standardised NCD indicators in emergency data collection and surveillance systems (7). At the operational level, barriers to continuity of T1D care include health system destruction, supply chain disruption, cold chain failure, loss of clinical records, the absence of diabetes-specific emergency protocols, and a lack of humanitarian actors' experience and capacity (7). A recent narrative review found that glycaemic management is consistently suboptimal among youth with T1D in humanitarian crisis settings, yet dedicated research on this population remains scarce (8).

Children and adolescents with T1D are uniquely vulnerable during crises as they are entirely dependent on exogenous insulin for survival (7, 9, 10). T1D management intersects with their developmental needs in ways that compound vulnerability: younger children cannot self-administer insulin, recognise hypoglycaemic symptoms, or communicate distress reliably; adolescents face particular risks from the interaction of puberty-driven insulin resistance with erratic food supply (9, 11). Moreover, the burden of clinical decision-making, which typically falls on caregivers, is made more challenging as they navigate displacement, food insecurity, and psychological trauma. The long-term consequences of prolonged poor glycaemic control during childhood, including accelerated microvascular complications, growth impairment, and neurocognitive effects, mean that the damage inflicted during periods of disrupted care extends far beyond the crisis itself (8–10).

The Gaza Strip, home to approximately 2.2 million people, has endured decades of healthcare degradation under protracted blockade (10, 12). Since October 2023, armed conflict has precipitated a near-total collapse of the health system. By early 2025, only 16 out of Gaza’s 36 hospitals remained partially functional, and only 38% of primary healthcare centres were operational (13, 14), and the World Health Organization (WHO) verified over 664 attacks on healthcare facilities (15). Insulin has repeatedly reached critically low stock levels (16). The United Nations Office for the Coordination of Humanitarian

Affairs (OCHA) estimated that 71,000 people in Gaza were living with diabetes, including over 1,000 with T1D, while 350,000 individuals with chronic diseases were unable to access critical care (17). Famine has been confirmed across the territory, and the majority of the population has been internally displaced multiple times (18, 19).

Despite the crisis's magnitude, peer-reviewed evidence on T1D management in Gaza remains limited. A descriptive cross-sectional study of 29 children with T1D found that approximately 80% could not receive adequate care (16); another cross-sectional study of 278 patients documented substantial declines in access and adherence (20). However, quantitative data cannot illuminate the lived experiences of families, the clinical dilemmas facing providers, or the adaptive strategies emerging from daily struggle. This study was undertaken to generate qualitative evidence from both caregivers and healthcare providers managing T1D during the ongoing crisis, aiming to document experiences of accessing care, describe adaptive strategies, identify multilevel barriers and facilitators, and generate actionable recommendations.

Methods

This was a qualitative study using semi-structured interviews with 25 caregivers of young people living with T1D and 6 healthcare professionals living in Gaza during the ceasefire. The interviews were conducted and analysed using thematic analysis within a qualitative descriptive paradigm (21, 22). A hybrid deductive–inductive thematic approach was chosen: deductive coding ensured systematic coverage of a priori themes while the inductive approach enabled the capturing of emergent themes. Themes are clearly defined and supported by participants' quotations, with each quotation linked to a specific identifier (e.g., Patient 1, Patient 2) to maintain transparency. Coding was conducted by two researchers (MAS and AH), with regular team meetings to discuss coding decisions, resolve discrepancies, and refine themes. Analytic memos were maintained throughout to document interpretive decisions, evolving categories, and team discussions on how themes were developed and refined. This thematic descriptive orientation was selected over more interpretive approaches because the primary aim was to generate findings accessible to humanitarian actors and policymakers, rather than to develop theory (21, 23). The data were managed and analyzed using Nvivo software. Reporting follows COREQ guidelines (24); the completed COREQ checklist is provided as supplementary material [see Additional file 1].

Interviews were conducted by trained Diabetes Palestine data collectors (a female researcher with a diploma in health management led the interviews, and a male facilitator with a master's in clinical nutrition provided logistical support). Both data collectors were residents of Gaza during the conflict. Participants were contacted by a Diabetes Palestine officer using registry phone numbers; no prior relationship existed between the interviewers and participants.

Two participant groups were recruited. The primary participant group consisted of caregivers of young people with T1D aged 4–23 years (n = 25). A purposive maximum-variation sampling strategy was

employed, recruiting through Diabetes Palestine registries and clinic lists, clinician referrals, and community networks. From an identified pool of 94 potential participants, 25 were selected with the aim of maximising variation across age, gender, displacement status, living setting, and governorate; no formal stratification quotas were applied, reflecting the logistical constraints of conducting research in an active conflict setting. The target of 25 interviews was set a priori based on the resource constraints of the study setting. Inclusion criteria: residence in Gaza during the conflict, confirmed diagnosis of T1D, and willingness to participate. Exclusion criteria: presence of an acute complication at recruitment or inability to provide consent. No patient records, databases, or administrative data held by the Ministry of Health, UNRWA, or other international Non-Governmental Organisations (NGOs) were accessed for recruitment or analysis.

Healthcare providers (n = 6) were purposively selected from different service settings to represent a mix of care delivery contexts, including the Ministry of Health, UNRWA, and international NGOs. This smaller HCP cohort was intentionally selected to provide a contextual professional lens to the primary caregiver data, ensuring the study remained centered on the lived experiences of young people. HCPs were identified exclusively through professional networks and clinician referrals, and assured of the voluntary nature of participation. No institutional records or administrative data from employing organisations were accessed for recruitment. Those employed by the Ministry of Health, UNRWA, or other international NGOs participated voluntarily in their individual professional capacity, and their participation does not represent the official views or positions of their respective institutions.

For both groups, potential participants were approached via telephone using a trauma-sensitive script that distinguished research from clinical care, emphasised voluntariness, and stated that declining would not affect access to services. Participants were given time to consider after the first phone call and were then contacted for the interview at mutually convenient times. No incentives were offered.

Interviews were conducted one month after the October 2025 ceasefire announcement. Despite the ceasefire, transportation infrastructure remained largely destroyed, and physical safety could not be guaranteed. All interviews were conducted via telephone to protect participants' safety. Informed verbal consent was obtained from all participants. Written consent was not sought because requiring travel for signatures would have exposed participants to physical risk, signing identifying documents posed security concerns, and verbal consent, audio-recorded and documented, is an established ethical method in conflict-affected research (25). The consent process covered voluntary participation, right to withdraw, non-impact on services, confidentiality, anonymised quotation, and the distinction between clinical care and research.

Interview duration was limited to approximately 30 minutes, reflecting the study's design as a rapid qualitative assessment intended to provide timely insights for humanitarian response. This brevity was also a core component of the study's trauma-sensitive approach, minimising the burden on participants who were experiencing ongoing stressors. Some participants had unstable cellular signals and the lack of reliable electricity meant participants had limited capacity to charge mobile devices. Consequently,

researchers prioritised high-impact questions to ensure data saturation within these logistical and ethical boundaries.

Two separate semi-structured interview guides were used [see Additional files 2 and 3]. The caregiver guide covered daily self-management, displacement, psychological and physical stressors, food shortages, access to supplies, insulin storage, glucose monitoring, coping strategies, support sources, and perceived gaps. The Patient Health Questionnaire-9 (PHQ-9) was also integrated into the caregiver guide. The PHQ-9 is a brief, nine-item, self-administered questionnaire that scores the standard diagnostic criteria for depression to reliably diagnose depressive disorders and measure their severity (26, 27). It was administered within the same interview session and completed by the caregiver on behalf of the young person, to serve three complementary purposes within this study. Firstly, it was used to characterise the psychological profile of the sample as part of participant description. Secondly, it functioned as an ethical safeguard, enabling the identification of participants experiencing acute psychological distress, who were subsequently referred to the mental health specialist at Diabetes Palestine or the Gaza Mental Health Programme's hotline (28). Thirdly, PHQ-9 scores informed the qualitative analytical process by providing contextual insight into participants' mental health status during coding and thematic development, facilitating comparisons across participants during matrix coding query, and enriching the interpretation of emergent themes. The HCP guide explored challenges in service delivery, changes in clinical practice, system-level disruptions, observed patient outcomes, and future priorities. All interviews were conducted in Arabic, transcribed by bilingual researchers with medical and public health backgrounds, and translated into English.

Caregiver and HCP interviews were analysed separately using the same hybrid deductive–inductive thematic approach facilitated by NVivo. An initial analytical framework organised into seven core domains served as the coding foundation; inductive refinement captured emergent patterns. HCP perspectives were used to contextualise and deepen understanding of the patterns identified in caregiver accounts. Major themes were substantiated by verbatim quotations linked to anonymised identifiers (Patient 1–25; HCP 1–6).

Ethics and administrative approval were obtained from the Research Committee of the Diabetes Palestine Association, which holds institutional authority over the medical records and care profiles of its registered patients and is therefore authorized to utilise patient data for medical research purposes [see Additional file 4]. All participants were registered patients of the Diabetes Palestine Association, whose clinical profiles, diabetes management records, and care histories are maintained by the Association as part of its ongoing care delivery activities. Copies of the Patient Data Use Authorization and the Ethical and Administrative Approval for this project are attached as supplementary documents. The study conformed to WHO ethical standards for research during public health emergencies (25). Key protections included trauma-informed interviewing, operationalised through the use of neutral, non-judgmental language, acknowledgment of distress with breaks offered as needed, the right to skip questions or withdraw at any time, and a structured debrief at the close of each interview, verbal consent

to protect safety, referral pathways for psychological distress, data de-identification, and do-no-harm dissemination principles (29, 30).

Results

Twenty-five caregiver interviews and six HCP interviews were completed. Among caregivers of younger patients, mothers were the most commonly identified interviewee (n = 18, 72%), followed by fathers (n = 7, 28%). Of the 25 young people whose caregivers were interviewed, the majority were male (n = 14, 56%); 11 (44%) were female. Twelve (48%) were aged ≥ 13 years, seven (28%) were 10–12, and six (24%) were 4–9. Most were diagnosed before the conflict (n = 17, 68%); eight (32%) during the conflict. Eighteen (72%) reported multiple displacements. Depressive symptoms were near-universal: 92% met criteria for at least mild depression on the PHQ-9, including severe depression in three patients (12%). The three participants with severe depression scores on the PHQ-9 were referred for psychosocial follow-up; further uptake of services and clinical outcomes following referral were beyond the scope of this study and could not be tracked by the research team.

The six HCPs represented different service settings: two from the Ministry of Health (head nurse, paediatric endocrinologist), two from UNRWA (family physician, NCD nurse), and two from international humanitarian organisations (field doctor, nutritionist).

Table 1
Participant Characteristics

Characteristic	**n (%)**
Caregiver interviews	**25**
Caregiver relationship to young person - mother	18 (72)
Caregiver relationship to young person - father	7 (28)
Male young people represented	14 (56)
Female young people represented	11 (44)
Age ≥ 13 years	12 (48)
Age 10–12 years	7 (28)
Age 4–9 years	6 (24)
Diagnosed before the conflict	17 (68)
Diagnosed during the conflict	8 (32)
Multiple displacements	18 (72)
Healthcare provider interviews	**6**

The final coding tree included six domains (access, supply continuity, daily self-care practice, coping and resilience, psychosocial outcomes, recommendations),

Theme 1: Access to Essential Diabetes Care

Caregivers described pervasive and systematic barriers to diabetes care. Nearly all reported critical insulin disruptions: stockouts at health facilities; self-imposed rationing due to limited supplies; increasing reliance on humanitarian aid and private pharmacies (often at a prohibitive cost); and informal community channels through which families shared or redistributed whatever was available. Multiple families experienced periods of time when they had no access to insulin. Routine management was severely compromised in those times, with several describing ICU admissions directly attributable to a lack of insulin. The scarcity context reshaped how families approached care, with some receiving clinical advice to reduce doses in response to food insecurity. One mother described the experience of using degraded insulin, due to cold chain infrastructure collapse and unreliable storage conditions:

"*Sometimes I feel like I'm giving her water and not insulin… I also had to throw away some pens because they stopped working and were damaged*" (Patient 11).

When public facilities ran out of insulin, families procured insulin privately at prohibitive cost:

"*We used to get our insulin pens from UNRWA, then switched to buying the pens at an expensive rate from private pharmacies to maintain her regimen*" (Patient 10, mother).

HCPs situated these individual experiences within a picture of total supply-chain failure, describing prolonged periods without even basic supplies and identifying border closures and infrastructure destruction as the structural drivers:

"There was a lack of medical resources, there were long periods of time where we didn't even have a single strip of paracetamol tablets in the clinic" (HCP 2).

Insulin shortages frequently occurred at the same time as loss of blood glucose monitoring equipment. Over half of caregivers described managing diabetes entirely without glycaemic data—a situation they termed "blind management." For some, this persisted for weeks; one family reported 45 consecutive days without test strips. Families adopted pragmatic workarounds: purchasing multiple glucometer models to match intermittently available strips, transitioning between insulin delivery systems and formulations as a forced adaptation to supply shortages, most notably, switching from insulin pens to vials and syringes, which was reported explicitly by nearly one-third of participants. One father described:

"When we lost access to pens, and my son was forced to switch to syringes and vials, it was difficult for us to convince him to accept this reality and adopt the new regimen" (Patient 1).

This reflects the predominance of vial-based supplies in humanitarian aid pipelines and the near-disappearance of pen formulations from both public facilities and private pharmacies. One mother

described that, in an effort to secure any kind of medical supplies for their child, her husband cycled through four glucometer brands as compatible strips appeared and disappeared. HCPs described the same phenomenon from the clinical side: patients arriving having lost all medical records, requiring providers to "*start from scratch*" (HCP 4).

Physical access to healthcare was profoundly compromised. Caregivers described clinic closures, active bombardment, forced displacement, transportation barriers, and severe financial hardship transforming routine care-seeking into a dangerous undertaking. One mother recounted:

"*I had to sell everything I own to cover my son's medical needs during the conflict*" (Patient 2, mother).

Another family's account captured the intersection of emergency and chronic condition management: the father was "*so worried about the child getting into DKA*" during an episode of gastroenteritis, yet no health centres or transportation were available. In another account, a family left behind insulin needles and medications during an emergency evacuation under bombardment—supplies they had obtained with great difficulty previously.

Insulin storage was universally identified as one of the most persistent logistical challenges. Without electricity, families were forced to improvise: submerging insulin in water bottles inside large water barrels, wrapping pens in wet cloth or damp baby diapers, using clay pots and ice-filled containers, and placing insulin outside tents at night during cooler temperatures. Some accessed refrigeration through ice cream vendors or paid use of commercial refrigerators at charging stations. Others relied on neighbours when this was possible, though one mother noted:

"We don't have electricity now. We place the insulin in water bottles inside large water barrels so it would be a bit cool" (Patient 23, mother).

Despite these efforts, significant quantities of insulin were rendered ineffective. HCPs summarised this challenge:

"*Even if patients got their insulin, they would not be able to store it properly due to total electricity cuts, meaning that it can be ineffective*" (HCP 3).

Repeated forced displacement fundamentally fragmented established treatment pathways. One family described 12–13 separate displacements, each severing provider relationships and disrupting medication supply:

"*We would be following up with a doctor in one area to manage his diabetes and then we were displaced to a different area, and then again and again*" (Patient 24, father).

While the precise etiology of type 1 diabetes is multifactorial and not fully understood, one caregiver attributed their child's new diagnosis directly to near-death exposure:

"The reason he got diabetes was fear. He is the eldest of his siblings, so when the incident happened [the bombing], he is the only one who was aware of what happened, and it scared him" (Patient 25, father).

Post-displacement conditions in tents or overcrowded shelters, characterised by compromised sanitation, nutritional inadequacy, and unsafe medication storage, were described as having a measurably adverse effect on health outcomes. Families with younger children (< 10 years) described particular difficulty, as these children were less able to communicate symptoms and required more intensive supervision across displacement episodes.

Theme 2: Quality and Continuity of Care

Caregivers expressed profound experiences of abandonment within the healthcare system, reporting the loss of structured care pathways that had previously facilitated safe management. One mother captured this isolation:

"*No one [helped]. A lot of the doctors we knew went to the south, very few people stayed in the north. We were isolated from the world, there were no clinics to go to*" (Patient 20).

Even when hospitals remained accessible, they were unable to provide insulin, conduct laboratory investigations, or deliver standard diabetes services. During one severe hypoglycaemic episode, a father found his child unresponsive in the night and depended on the chance availability of a neighbour to reach the hospital:

"*This was the most difficult experience I went through during the conflict*" (Patient 7).

HCPs characterised the transformation in more systemic terms:

"*The regular follow-ups, dietary management, and preventive measures shifted to emergency procedures and protocols with the main purpose of survival*" (HCP 6).

They described working "*in silos*" without continuity across settings (HCP 4), unable to track disease trends or patient numbers.

Against this collapse, individual healthcare professionals emerged as lifelines. Several families named specific physicians who provided guidance, diabetes education, and follow-up when formal systems had failed. From the provider side, this care was delivered at immense personal cost. HCPs described experiencing the same catastrophic environments as patients, namely, displacement, food insecurity, and unsafe conditions, while maintaining clinical duties:

"*We were not just healthcare professionals… we also lived through the thick of this conflict with everyone else*" (HCP 6).

Providers documented improvised solutions: rationing medications and reducing prescription durations to serve more patients, opening temporary medical points in community spaces, and establishing WhatsApp consultation groups for dose-adjustment guidance (HCP 1, HCP 2, HCP 4).

Theme 3: Daily Management and Self-Care Practices

Food insecurity was reported as one of the most disruptive challenges to diabetes management. The famine and absence of dietary diversity undermined glycaemic control through multiple pathways. Humanitarian aid rations consisted predominantly of rice and pasta:

"*This type of food is full of carbohydrates. It was always rice or pasta, which is not diabetes-friendly, but we had no other choice*" (Patient 10, mother).

The dangerous interplay between erratic meal availability and glycaemic stability was described with particular intensity by caregivers of adolescent patients, whose higher insulin requirements made them especially vulnerable. The most distressing accounts captured the impossible dilemma families faced when famine and insulin administration collided:

"*During the famine, we were reluctant to give our child insulin. If we did, we would not have the food or the treats to treat a low, and if we did not, we risk having hyperglycaemic episodes*" (Patient 16, father).

HCPs described this situation as "*nutritional chaos*" (HCP 4) - patients oscillating between starvation and surviving on foods that destabilised blood glucose.

Insulin administration was transformed from a clinically prescribed regimen into a contingency-driven practice. The range of adaptive behaviours documented across families was striking: extending insulin pens far beyond recommended durations ("*we had to ration insulin and try to get one insulin pen to last for 2 months*", Patient 4); stopping short-acting insulin entirely during famine ("*they would barely get a small meal per day*", Patient 11); adjusting doses based solely on food availability (Patient 25); encouraging physical activity as an informal glucose-lowering strategy ("*I kept asking my child to move around to help with her high blood sugar*", Patient 10); and restricting food intake to reduce insulin requirements (Patient 1). Mothers were predominantly responsible for these daily management decisions, while fathers' roles centred on obtaining supplies and managing financial resources.

Water access constraints were consistently ranked alongside food and medical supplies as a primary daily challenge. Residence in tents represented a complete loss of the hygienic environment needed for safe injection and wound care:

"*We were living in a tent, and the basic necessities for a safe life were lacking. Caring for the child was extremely difficult*" (Patient 3, father).

The near-total absence of glucometers and test strips forced a reorientation of monitoring practice: families reduced testing from seven times to three times daily (Patient 20), reserved strips for acute

situations only (Patient 25), relied on children's self-reported symptoms and observable signs, and set hourly night-time alarms (Patient 7). Among adolescents, several had learned to recognise hypoglycaemic symptoms independently - an adaptive capacity less available to younger patients, whose parents described greater anxiety and reliance on behavioural cues. The burden of blind management was further amplified in children with special needs. Patient 17, who is deaf and has a congenital heart condition, was unable to communicate symptoms reliably, leaving his family entirely dependent on observable behavioural cues in the absence of monitoring equipment. Repeated displacement, food insecurity, and insulin rationing compounded this vulnerability, illustrating how disability intersects with conflict-related supply shortages to create disproportionate risk:

"Bombing was constant, and our child used to cry all the time. On top of that, he is deaf and suffers from a congenital heart disease, and it was really hard for him to express his feelings and needs" (Patient 17, father).

Theme 4: Health and Psychological Outcomes

Physical health consequences manifested through two pathways: direct traumatic injury and progressive clinical deterioration attributable to disrupted management. DKA and severe hypoglycaemia were the most frequently reported and feared acute complications. The primary mechanism was the precarious balance between available insulin and food. One father reported a blood glucose reading of 35 mg/dL (1.94 mmol/L) after his child took insulin without sufficient food (Patient 23). In the most severe case, a child was admitted to intensive care 12 times:

"*There was no food. She developed intestinal infections, an enlarged liver, and malnutrition… Her bones were showing through her skin; she was like a skeleton*" (Patient 19, mother).

Another caregiver described the impossible double-bind:

"*She would take insulin and there was no food. And if she didn't take insulin then her blood sugar would go up and go into DKA and she would go into a coma frequently*" (Patient 22, mother).

HCPs added a longer-term clinical perspective, describing patients returning after months or years of disrupted and inadequate treatment with kidney complications, visual impairment, and diabetic foot complications.

Caregivers described a pervasive environment of fear, grief, and social isolation affecting their children's psychological functioning. Direct trauma exposure precipitated acute stress responses. One caregiver recounted:

"*The child was so traumatised when he witnessed and lived the day the hospital was bombed and suffered from trembling, sweating, and hysteria due to fear*" (Patient 2, mother).

Significant behavioural changes were documented: anxiety, emotional lability, regressive behaviours, phobias, and difficulties integrating in displacement settings. The intersection of diabetes care with the traumatic context created additional psychosocial stressors, including social exclusion:

"*Once, she was with her friends, and I could see her sadness and how her heart was broken as they were eating sweets and chocolates, while she was unable to eat like other children [due to lack of insulin]*" (Patient 5, mother).

One account captured the extent of personality transformation:

"*Before the war, she was so energetic, always talking, making videos, full of life. During the war… she was withdrawn, weak, and slept all the time. She wouldn't even smile or laugh*" (Patient 19, mother).

Mothers described the emotional toll of this dual caregiving burden with particular intensity, often expressing guilt about their inability to meet their child's basic needs. Fathers' accounts tended to emphasise the stress of inadequate resources and the pressure of being unable to fulfil a caregiver role. HCPs added a further dimension: some patients had developed hopelessness and therapeutic nihilism:

"*Some of my patients felt hopeless and that there is no point in managing diabetes if resources are not available and death is almost certain*" (HCP 3).

Caregivers unanimously perceived a direct relationship between psychological distress and glycaemic instability. They described a compounding cycle in which conflict-related trauma destabilised blood glucose, which in turn amplified emotional distress:

"*It was impossible to maintain a stable blood glucose level because of how stressed she was all the time*" (Patient 11, mother).

Another mother described:

"*His psychological state deteriorated significantly during the displacement period due to leaving his home and familiar environment, and this greatly affected him physically in terms of his blood sugar levels*" (Patient 4).

Theme 5: Pillars of Support

The family unit, and specifically mothers, was identified as the primary source of support. A pattern across the data was the centrality of mothers as the day-to-day managers of insulin administration, dietary planning, symptom monitoring, and emotional support. Several mothers described prioritising food and resources for their child living with diabetes over their other children:

"*I had to give the most attention to the patient compared to her siblings, and I would give her more food than her siblings*" (Patient 22, mother).

For some families, survival was described as a collective endeavour:

"*Collective family support helped us immensely… our neighbours and extended family used to share their vegetables and food with us just to make sure that my child has what he needs to survive*" (Patient 2, mother).

Others were explicit that no external support was received:

"*[Only] our family [helped us]. Only the family and I can't mention or highlight any help or support that we got from organisations*" (Patient 12, mother).

The Haifa Association for Children with Diabetes was acknowledged by a subset of families, facilitating access to monitoring supplies and maintaining WhatsApp-based peer support- a digital model that providers also employed through phone consultations and messaging groups.

Theme 6: Recommendations and Future Needs

Caregivers' recommendations were organised around three domains: emergency preparedness (stockpiling supplies in accessible bags), psychological adaptation (attending to children's mental health throughout conflict), and active diabetes self-management education, particularly directed toward families whose children were diagnosed during the war. The most urgent material priority was uninterrupted access to insulin, alongside test strips, glucometers, and diabetes-appropriate food. These demands were embedded within a narrative of perceived neglect:

"*I would like to ask organisations and health providers to pay attention to children with diabetes in Gaza… They were neglected and forgotten during the conflict, and it was the families and their children who paid the price*" (Patient 4, mother).

Some families advocated for medical evacuation as the only viable solution. When reflecting on comprehensive needs, caregivers articulated a holistic vision that included facility reconstruction, laboratory testing (including HbA1c), psychological support, nutritional counselling, recreational programmes, caregiver education, and school-based care.

HCPs reinforced these priorities and contributed critical system-level recommendations largely absent from caregiver accounts: the development of national T1D registries to track this population across displacements; integration of diabetes into emergency preparedness protocols; continued provision of HbA1c testing; and targeted mental health support during medication shortages. As one provider articulated:

"*We need diabetes to be included in emergency preparedness and response protocols… We require guidance and support on how to manage diabetes in emergencies*" (HCP 6).

Discussion

This study provides the first qualitative investigation of paediatric T1D management in Gaza during the current crisis, centred on the lived experiences of caregivers and young people, and contextualised by frontline healthcare provider accounts. The findings reveal how interrupted insulin supply and enforced rationing, healthcare infrastructure destruction, repeated displacement, famine, and psychological trauma interweave to transform a manageable chronic condition into an immediate threat to survival.

The barriers to insulin access documented in this study extend the limited available findings from other conflict-affected settings. Experts have identified interruptions to insulin supply as the defining challenge in maintaining diabetes care in crises, with people living with T1D representing the most immediately vulnerable (7). Descriptive studies from Tigray and the Democratic Republic of Congo have documented a precipitous drop in access to care, a collapse in services, and a negative clinical impact of interrupted care (31–33). In Syria, for example, an increase in medical emergencies following an interruption in insulin supply was documented (3). The Lancet Series on diabetes in humanitarian crises identified insulin access as a defining challenge, noting that T1D patients represent the most immediately vulnerable subpopulation (6, 7, 34). This study builds on previous literature by capturing the granular, first-person dimensions of that disruption, adaptive strategies, and psychosocial consequences that emerge when families are left to manage a life-threatening chronic condition without institutional support.

The forced rationing of insulin raises profound ethical and legal concerns. International humanitarian law requires parties to armed conflict to ensure civilian access to essential medical care (35, 36). The 2019 Boston Declaration, signed by over 40 organisations, set a shared agenda to address the neglect of diabetes in humanitarian response (34); the 2023 Kraków framework identified seven unmet challenges, including coordination, healthcare access, data scarcity, and emergency preparedness (37). The findings of this study demonstrate that these challenges have materialised in their most extreme form in Gaza, where the destruction of hospitals, pharmaceutical warehouses, and health centres has systematically dismantled the infrastructure upon which T1D patients depend (38).

The diversity of improvised solutions - from damp diapers and clay pots to WhatsApp consultation groups and temporary medical points - illustrates both the resilience of affected populations and the inadequacy of current humanitarian response. Novo Nordisk’s stability testing confirmed that certain insulins can be safely stored without refrigeration for up to four weeks (39); clay pot cooling has been identified in humanitarian field experience as a viable low-cost method (40); polymer-based excipients show potential for insulin stabilisation under extreme temperatures (41). Yet, no information about these innovations reached the families in this study. The gap between available solutions and their deployment represents a critical failure in humanitarian knowledge sharing and logistics.

The forced transition from insulin pens to vials and syringes, reported by nearly one-third of participants, warrants specific attention in humanitarian programming. Insulin pens offer dosing precision, ease of use, and reduced infection risk, particularly for children and adolescents managing T1D (42); yet

humanitarian supply pipelines overwhelmingly prioritize vials, partly driven by donor and global procurement policies, such as WHO frameworks, that fund vial-based insulin exclusively (43). Donor agencies should revise procurement frameworks to include insulin pens and child-friendly delivery devices as standard items in NCD emergency kits. Pharmaceutical corporations must also be pressured to reduce the cost of insulin pens to facilitate their purchase by donor agencies.

The telemedicine innovations described by HCPs parallel the WhatsApp peer-support networks described by caregivers and recall pre-conflict models such as UNRWA's Microclinic Programme (44). These findings resonate with qualitative evidence from global experts identifying community-based models as promising for NCD care in humanitarian settings (45), and with recent reviews emphasising the need for context-specific, community-focussed and person-centred diabetes care adaptations across crisis phases (46, 47). Future research should systematically evaluate and scale these grassroots innovations.

The interplay between food insecurity and insulin management has significant clinical implications. The dilemma caregivers described - administering insulin without food risks fatal hypoglycaemia, while withholding it risks DKA - has been described conceptually (3, 10), but the present study provides the first detailed first-person accounts from within active famine. The adaptive behaviours documented (insulin rationing, physical activity as glucose-lowering substitute, stopping short-acting insulin during famine) carry substantial risks for acute metabolic complications. Current humanitarian nutrition programming does not account for insulin-dependent populations. Aid rations are typically high in simple carbohydrates, which exacerbate glycaemic instability. This gap has been identified but remains unaddressed (48).

The bidirectional relationship between stress and hyperglycaemia is consistent with evidence that chronic psychosocial stress worsens glycaemic control through neuroendocrine pathways (49, 50). This study extends these findings to the extreme of armed conflict, where the cycle is compounded by simultaneous material deprivation. The near-universal depression (92% on PHQ-9) and the therapeutic nihilism described by HCPs - patients abandoning management entirely - reinforce the urgency of integrating psychosocial support into humanitarian diabetes programming (51). The gendered burden, with mothers bearing the primary clinical and emotional load, suggests interventions should be designed to reach and support mothers specifically.

The trauma documented in this study warrants attention for its likely long-term clinical consequences, echoing established concerns regarding the developmental trajectory of young people affected by war (52) and the psychiatric vulnerabilities of young people with T1D (53). Caregivers described children who witnessed bombings and subsequently developed tremor, hysteria, and syncope—somatic manifestations consistent with trauma in conflict zones (54). Furthermore, reports of energetic children becoming withdrawn, alongside persistent phobias and regressive behaviours, align closely with recognized pediatric behavioral shifts in crisis settings (55, 56). Ultimately, this pattern of sustained

psychological distress occurring alongside prolonged periods of uncontrolled glycaemia carries significant implications for long-term health and metabolic outcomes (57).

Evidence from non-conflict paediatric T1D populations demonstrates that sustained hyperglycaemia during childhood and adolescence accelerates the development of microvascular complications, including retinopathy, nephropathy, and neuropathy, with risk increasing substantially for each year of poor control during these developmentally critical periods. The children in this study experienced months of disrupted management compounded by the physiological effects of chronic stress on insulin resistance and glucose variability. Although the full clinical burden will only become apparent in the years ahead, the accounts in this study suggest it will be substantial. The anecdotal observation of 12 intensive care admissions in a single child, the development of malnutrition and hepatomegaly, and the reports of preventable deaths during medication shortages all point toward a generation of children with T1D in Gaza who will carry the long-term consequences of this period of enforced care disruption—consequences that demand both immediate remedial clinical intervention and sustained investment in rehabilitation and follow-up once conditions permit. Moreover, they demand an urgent call for further research to systematically document longer-term outcomes.

Strengths of this study include purposive maximum-variation sampling, the integration of both caregiver and health care provider perspectives, and data collection during an active crisis. Critically, this study prioritised giving voice to the individuals and families living through the conflict. Limitations include telephone-only interviews, shorter-than-ideal durations, inability to member-check transcripts, registry-based sampling that may miss unregistered families, and the small HCP sample. Despite these sample limitations, a post hoc review during the analysis confirmed that the deductive framework was fully covered across participants and that inductive themes were consistently illustrated. Nevertheless, we acknowledge that a larger sample might have yielded additional emergent dimensions. In addition, PHQ-9 scores were reported as an indicator of psychological distress, not as clinical diagnoses, and the measure has not been validated in this conflict-affected pediatric population. The high scores likely reflect both depressive symptoms and general traumatic stress. The findings are specific to Gaza, but the underlying mechanisms are likely relevant wherever insulin-dependent populations face healthcare system collapse.

Young people with T1D must be recognised as a high-priority population within humanitarian frameworks, with clear documentation of insulin supply chains, pre-positioning and dedicated supply lines for insulin, monitoring supplies, and diabetes-appropriate nutrition. Cold-chain solutions should be integrated into emergency response kits. Caregivers in this study were largely left to improvise under conditions for which they had no preparation. Structured family-level emergency planning should be standard practice in settings at risk of conflict or displacement. Equally important is targeted education for HCPs and families on switching between insulin formulations and delivery systems; adjusting dosing in the context of severe undernutrition and erratic food availability; and implementing safe alternative insulin storage methods.

Diabetes care packages must incorporate psychosocial support, caregiver education, and community-based peer networks, with attention to the gendered burden on mothers. These packages should not be conceived as acute-phase interventions alone. In settings such as Gaza, where the humanitarian situation is characterised by chronic emergency, high donor dependency, and fragile health, livelihood, and food systems, comprehensive disaster risk reduction preparedness and training must be embedded within diabetes programming as a core component rather than an afterthought. Digital health infrastructure should be prioritised for continuity across displacement. National T1D registries and diabetes-specific emergency preparedness protocols, as called for by HCPs in this study and by the international community (37, 46), represent critical systemic priorities. Future research needs to consider evaluation of the innovations documented here, investigate long-term outcomes for children whose management was disrupted, and develop evidence-based guidelines for insulin switching and cold-chain management in conflict settings.

Conclusions

Caregivers and healthcare providers in Gaza describe a crisis in which the failure of any single element—insulin supply, food availability, cold-chain integrity, healthcare access, psychological safety—precipitates life-threatening consequences for young people with T1D. The adaptive strategies documented attest to extraordinary resilience, while the accounts of DKA, hypoglycaemia, malnutrition, and psychological trauma underscore the fundamental inadequacy of current responses. The systematic disruption of access to essential diabetes care for a civilian population, particularly young people, raises serious concerns under international humanitarian law. Young people with T1D in conflict settings require comprehensive, sustained interventions addressing the full spectrum of their medical, nutritional, and psychosocial needs. The international community bears an urgent responsibility to act in Gaza and in all humanitarian emergencies.

Abbreviations

DKA
Diabetic ketoacidosis
HCP
Healthcare provider
NCD
Non-communicable disease
NGO
Non-Governmental Organisation
PHQ-9
Patient Health Questionnaire-9
T1D
Type 1 diabetes
UNRWA

United Nations Relief and Works Agency for Palestine Refugees in the Near East
WHO
World Health Organization

Declarations

Ethics approval and consent to participate

This study was reviewed and approved by the Research Committee of the Diabetes Palestine Association (Approval reference No: DPA/ETH/[2026]/[1]; approval date: [03/11/2025]). The committee is authorised to approve the use of patient data for medical research purposes. The study enrolled two groups of participants: registered patients of the Diabetes Palestine Association, whose clinical profiles, diabetes management records, and care histories are maintained by the Association as part of its ongoing care delivery activities; and healthcare providers engaged through professional networks. Participants were recruited exclusively through Diabetes Palestine registries and professional networks; no records, databases, or administrative data held by the Ministry of Health, UNRWA, or other INGOs were accessed for recruitment or analysis. Healthcare providers employed by those institutions participated voluntarily in their individual professional capacity, and their participation does not represent the official views or positions of their respective institutions. Verbal informed consent was obtained and audio-documented for all participants, as written consent procedures were considered unsafe and impractical in the study context. The consent process explicitly covered voluntary participation, the right to skip questions or withdraw at any time without consequence, non-impact on access to clinical services, data confidentiality, and anonymised quotation in publication.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Authors' information

This study was conducted with a commitment to meaningful engagement of people living with diabetes as researchers, not solely as study participants. Mohammed Seyam and Malak Nasr both live with type 1 diabetes and drew on their lived experience throughout the design, data interpretation, and writing of this manuscript, bringing a patient-researcher perspective to the analysis. Additionally, Baraa Alhendawi, Amro Hamada, and Mariam A. AbuSalah are healthcare professionals and researchers based in the Gaza Strip who have themselves lived through the crisis described in this study. Their first-hand understanding of the context was essential to the cultural appropriateness of the survey instrument and the

interpretation of findings. Éimhín Ansbro provided international methodological and editorial expertise from the London School of Hygiene and Tropical Medicine, where her research focuses on noncommunicable disease management in humanitarian and fragile settings.

Funding

Data collectors received an honorarium from Diabetes Palestine, paid through general support for Diabetes Palestine's projects in Gaza, provided by Healing Across the Divides (HATD). The funder had no role in the conceptualisation or design of the study, the data collection procedures, the analysis or interpretation of findings, the decision to publish, or the preparation of the manuscript. The views expressed in this article are those of the authors and do not necessarily reflect those of HATD or Diabetes Palestine.

Author Contribution

MS supervised the day-to-day study flow, contributed to thematic interpretation, and led the drafting of the manuscript. BA contributed to study design, developed the analytical framework, contributed to thematic interpretation, and drafting the Methods and Results sections. MN contributed to thematic interpretation, manuscript writing and editing, and reference management. MAS led the data analysis, including coding and thematic analysis, and drafted the Methods section. AH supported the data analysis, contributed to drafting the Results section, and reviewed the manuscript. EA provided senior methodological guidance and critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Acknowledgement

The authors are deeply grateful to the families and healthcare providers in Gaza who shared their experiences under extraordinarily difficult circumstances. We thank Diabetes Palestine and its staff for their support throughout this research, in particular Dr Ahmed Abu Halawa for his coordination and insights. We also thank Dr Norbert Goldfield (Healing Across the Divides) and Professor Lewis Kazis (Healing Across the Divides) for their thoughtful comments and review of the manuscript.

Availability of data and materials

De-identified qualitative data are not publicly available because of the risk of deductive identification in a small, conflict-affected population.

References

1. Diabetes* ADAPPCf. 1. Improving Care and Promoting Health in Populations: Standards of Care in Diabetes—2026. Diabetes Care. 2025;49(Supplement_1):S13-S26.
2. Beshyah SA. Diabetes Care in Conflict Zones: Time for Action Is Long Overdue. Journal of Diabetes and Endocrine Practice. 2022;05(01):002–4.
3. Khan Y, Albache N, Almasri I, Gabbay RA. The Management of Diabetes in Conflict Settings: Focus on the Syrian Crisis. Diabetes Spectrum. 2019;32(3):264-9.
4. Asgary R, Garland V, Ro V, Stribling JC, Waldman R. A systematic review of effective strategies for chronic disease management in humanitarian settings; opportunities and challenges. Prev Med. 2022;161:107154.
5. Ngaruiya C, Bernstein R, Leff R, Wallace L, Agrawal P, Selvam A, et al. Systematic review on chronic non-communicable disease in disaster settings. BMC Public Health. 2022;22(1):1234.
6. Kehlenbrink S, Smith J, Ansbro É, Fuhr DC, Cheung A, Ratnayake R, et al. The burden of diabetes and use of diabetes care in humanitarian crises in low-income and middle-income countries. Lancet Diabetes Endocrinol. 2019;7(8):638 – 47.
7. Boulle P, Kehlenbrink S, Smith J, Beran D, Jobanputra K. Challenges associated with providing diabetes care in humanitarian settings. Lancet Diabetes Endocrinol. 2019;7(8):648 – 56.
8. James S, Jabakhanji SB, Mehta R, McCaffrey J, Mairghani M, Bhatia D, et al. The status of care for youth with type 1 diabetes within and coming from humanitarian crises settings: a narrative review. Conflict and Health. 2025;19(1):2.
9. Craig ME, Codner E, Mahmud FH, Marcovecchio ML, DiMeglio LA, Priyambada L, et al. ISPAD Clinical Practice Consensus Guidelines 2022: Editorial. Pediatr Diabetes. 2022;23(8):1157-9.
10. AlSamhori ARF, AlSamhori JF, Al-Deffaie AF, Alhadidi LAS, Khoury M, Bader NS, et al. Diabetes in the Shadow of Conflict: Understanding and Addressing the Crisis in Gaza. JAPA Academy Journal. 2025;3(1):69–74.
11. American Diabetes Association Professional Practice C, ElSayed NA, Aleppo G, Bannuru RR, Bruemmer D, Collins BS, et al. 14. Children and Adolescents: Standards of Care in Diabetes—2024. Diabetes Care. 2024;47:S258-S81.
12. Abidi S. Humanitarian concerns in conflict zones: Case study of gaza strip and west bank. Int J Res Appl Sci Eng Technol. 2024;12(3):946 – 52.
13. Peeperkorn R. Dr. Rik Peeperkorn, Representative for WHO occupied Palestinian territory remarks at the meeting of the United Nations Security Council on the situation of the health system in Gaza – 3 January 2025 Cairo: World Health Organization Regional Office for the Eastern Mediterranean; 2025 [Available from: https://www.emro.who.int/opt/news/dr-rik-peeperkorn-representative-for-who-occupied-palestinian-territory-remarks-at-the-meeting-of-the-united-nations-security-council-on-the-situation-of-the-health-system-in-gaza-3-january-2025.html.
14. World Health Organization. The ceasefire in Gaza brings hope, but immense challenges lie ahead to restore the health system: World Health Organization; 2025 [updated 19 January 2025. Available

from: https://www.who.int/news/item/19-01-2025-the-ceasefire-in-gaza-brings-hope--but-immense-challenges-lie-ahead-to-restore-the-health-system.

15. World Health Organization. oPt Emergency Situation Update: Issue 53, 7 Oct 2023–8 Jan 2025. Cairo; 2025 8 January 2025. Contract No.: Issue 53.
16. Al-Roomi D, Srour M, Al-Amouri F, Badrasawi M. Exploratory study of the impact of war on management of type 1 diabetes mellitus among children in Gaza. Eastern Mediterranean Health Journal. 2025;31(2):109 – 15.
17. United Nations Office for the Coordination of Humanitarian Affairs. Humanitarian Situation Update #286: Gaza Strip: United Nations Office for the Coordination of Humanitarian Affairs; 2025 [updated 7 May 202512 Jun 2026]. Available from: https://www.ochaopt.org/content/humanitarian-situation-update-286-gaza-strip.
18. Faris M, Abutair AS, Elfarra RM, Barqawi NA, Firwana AM, Firwana RM, et al. Catastrophic famine in Gaza: Unprecedented levels of hunger post-October 7th. A real population-based study from the Gaza Strip. PLoS ONE. 2025;20(5):e0309854.
19. Hassoun A, Al-Muhannadi K, Hassan HF, Hamad A, Khwaldia K, Buheji M, et al. From acute food insecurity to famine: how the 2023/2024 war on Gaza has dramatically set back sustainable development goal 2 to end hunger. Frontiers in Sustainable Food Systems. 2024;Volume 8–2024.
20. Hejaz H. Effects of the October 2023 war on diabetes treatment and medication adherence in Gaza. 2025.
21. Braun V, Clarke V. One size fits all? What counts as quality practice in (reflexive) thematic analysis? Qualitative Research in Psychology. 2021;18(3):328 – 52.
22. Byrne D. A worked example of Braun and Clarke's approach to reflexive thematic analysis. Quality & Quantity. 2022;56(3):1391 – 412.
23. Nowell LS, Norris JM, White DE, Moules NJ. Thematic analysis: Striving to meet the trustworthiness criteria. International journal of qualitative methods. 2017;16(1):1609406917733847.
24. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. International Journal for Quality in Health Care. 2007;19(6):349 – 57.
25. World Health Organization. WHO guidance on research methods for health emergency and disaster risk management, revised 2022. Geneva: World Health Organization; 2022. 610 p.
26. Spitzer RL, Kroenke K, Williams JBW, Group atPHQPCS. Validation and Utility of a Self-report Version of PRIME-MDThe PHQ Primary Care Study. Jama. 1999;282(18):1737-44.
27. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606 – 13.
28. Grau-Del Valle C, Marco-Expósito JF, Bosch-Sierra N, Zaragoza-Villena B, Solá E, Montoya-Castilla I, et al. Effect of perceived stress, concern about hypoglycaemia and level of knowledge of management of the disease on glycaemic control in type 1 diabetes mellitus. Journal of Clinical Nursing. 2023;32(1–2):264 – 72.

29. Sage M, Dietkus R. Trauma-Informed Interviewing Considerations and Approaches. Issues of Equity: Routledge; 2025. p. 106 – 12.
30. Westland H, Vervoort S, Kars M, Jaarsma T. Interviewing people on sensitive topics: challenges and strategies. European Journal of Cardiovascular Nursing. 2025;24(3):488 – 93.
31. Siraj E, Gebrekidan A, Haftu H, Hailu BY, Zenebe D, Gebremedhin M, et al. The effect of war and siege on children with diabetes admitted to Ayder Hospital in Mekelle, Tigray, Ethiopia. Diabetes Research and Clinical Practice. 2025;230.
32. Murphy A, Biringanine M, Roberts B, Stringer B, Perel P, Jobanputra K. Diabetes care in a complex humanitarian emergency setting: a qualitative evaluation. BMC Health Serv Res. 2017;17(1):431.
33. Ansbro É M, Biringanine M, Caleo G, Prieto-Merino D, Sadique Z, Perel P, et al. Management of diabetes and associated costs in a complex humanitarian setting in the Democratic Republic of Congo: a retrospective cohort study. BMJ Open. 2019;9(11):e030176.
34. Kehlenbrink S, Jaacks LM, Aebischer Perone S, Ansbro É, Ashbourne E, Atkinson C, et al. Diabetes in humanitarian crises: the Boston Declaration. Lancet Diabetes Endocrinol. 2019;7(8):590-2.
35. Rubenstein LS, Bittle MD. Responsibility for protection of medical workers and facilities in armed conflict. The Lancet. 2010;375(9711):329 – 40.
36. Minyailov NA. Legal Protection of the Civilian Health Care System in Conditions of Armed Conflict. DISMED. 2023(4):24 – 7.
37. Kehlenbrink S, Jobanputra K, Ansbro É, Besançon S, Boulle P, Bygrave H, et al. A framework for improving diabetes care in humanitarian emergencies. Lancet Diabetes Endocrinol. 2023;11(3):146-9.
38. Abuawad A, Griffiths M, Edwards GH, Eftekhari A, Al-Ebweini M, Al-Najar H, et al. The Ongoing Environmental Destruction and Degradation of Gaza: The Resulting Public Health Crisis. American Journal of Public Health. 2025;115(7):1053-61.
39. Rasmussen M, Hach M, Iwersen J, Anil G, Rosborg H, Larsen J, et al. The Human Insulin Thermal Solution project—a private sector initiative to address the thermostability of insulin. Lancet Diabetes Endocrinol. 2024;12(5):292-4.
40. Ogle GD, Abdullah M, Mason D, Januszewski AS, Besançon S. Insulin storage in hot climates without refrigeration: temperature reduction efficacy of clay pots and other techniques. Diabet Med. 2016;33(11):1544-53.
41. Maikawa CL, Mann JL, Kannan A, Meis CM, Grosskopf AK, Ou BS, et al. Engineering Insulin Cold Chain Resilience to Improve Global Access. Biomacromolecules. 2021;22(8):3386-95.
42. Al Hayek A, Al Dawish M. Patient-Reported Preference and Clinical Efficacy of Insulin Pen Devices With Safety Needles in Adolescents and Young Adults With Type 1 Diabetes: A Prospective Study. Cureus. 2021;13(4):e14555.
43. Beran D, Lazo-Porras M, Mba CM, Mbanya JC. A global perspective on the issue of access to insulin. Diabetologia. 2021;64(5):954 – 62.

44. Shahin YM, Kishk NA, Turki Y, Saleh S, Ding EL, Zoughbie DE, et al. Evaluation of the Microclinic social network model for Palestine refugees with diabetes at UNRWA health centers. Journal of Diabetes Mellitus. 2018;8(04):99–113.
45. Ansbro É, Issa R, Willis R, Blanchet K, Perel P, Roberts B. Chronic NCD care in crises: A qualitative study of global experts' perspectives on models of care for hypertension and diabetes in humanitarian settings. J Migr Health. 2022;5:100094.
46. Kehlenbrink S, Ansbro É, Besançon S, Hassan S, Roberts B, Jobanputra K. Strengthening Diabetes Care in Humanitarian Crises in Low- and Middle-income Settings. J Clin Endocrinol Metab. 2022;107(9):e3553-e61.
47. Kehlenbrink S, Jobanputra K, Reddy A, Boulle P, Gomber A, Nugent R, et al. Diabetes Care in Humanitarian Settings. Endocrinol Metab Clin North Am. 2023;52(4):603 – 15.
48. Seita A. UNRWA [Internet]: United Nations Relief and Works Agency for Palestine Refugees in the Near East. 2025. [13 April 2026]. Available from: https://www.unrwa.org/newsroom/blog/no-spoonful-sugar-%E2%80%93-gaza-has-become-killing-field.
49. Franc S, Bensaid S, Schaepelynck P, Orlando L, Lopes P, Charpentier G. Impact of chronic emotions and psychosocial stress on glycemic control in patients with type 1 diabetes. Heterogeneity of glycemic responses, biological mechanisms, and personalized medical treatment. Diabetes Metab. 2023;49(6):101486.
50. Herzer M, Hood KK. Anxiety symptoms in adolescents with type 1 diabetes: association with blood glucose monitoring and glycemic control. J Pediatr Psychol. 2010;35(4):415 – 25.
51. Maconick L, Ansbro É, Ellithy S, Jobanputra K, Tarawneh M, Roberts B. "To die is better for me", social suffering among Syrian refugees at a noncommunicable disease clinic in Jordan: a qualitative study. Confl Health. 2020;14:63.
52. Betancourt TS, Newnham EA, Layne CM, Kim S, Steinberg AM, Ellis H, et al. Trauma history and psychopathology in war-affected refugee children referred for trauma-related mental health services in the United States. J Trauma Stress. 2012;25(6):682 – 90.
53. Buchberger B, Huppertz H, Krabbe L, Lux B, Mattivi JT, Siafarikas A. Symptoms of depression and anxiety in youth with type 1 diabetes: A systematic review and meta-analysis. Psychoneuroendocrinology. 2016;70:70–84.
54. Somasundaram D. Collective trauma in northern Sri Lanka: a qualitative psychosocial-ecological study. Int J Ment Health Syst. 2007;1(1):5.
55. Feldman R, Vengrober A. Posttraumatic Stress Disorder in Infants and Young Children Exposed to War-Related Trauma. Journal of the American Academy of Child & Adolescent Psychiatry. 2011;50(7):645 – 58.
56. Bürgin D, Anagnostopoulos D, Vitiello B, Sukale T, Schmid M, Fegert JM. Impact of war and forced displacement on children's mental health-multilevel, needs-oriented, and trauma-informed approaches. Eur Child Adolesc Psychiatry. 2022;31(6):845 – 53.

57. Hagger V, Hendrieckx C, Sturt J, Skinner TC, Speight J. Diabetes Distress Among Adolescents with Type 1 Diabetes: a Systematic Review. Curr Diab Rep. 2016;16(1):9.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1.pdf
- Additionalfile2.pdf
- Additionalfile3.pdf
- Additionalfile4.pdf