
Article:
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Abstract

Objectives

The management of non-communicable chronic diseases such as diabetes mellitus is often poor in humanitarian crisis settings. Poor disease management can have serious long-term consequences. This review sought to identify studies that explored the effectiveness of interventions and the determinants that may improve the management of diabetes in the humanitarian context.

Study design

A systematic review was conducted of all types of studies that implemented diabetes programmes in humanitarian settings.

Methods

MEDLINE, Embase, CINAHL, and Web of Science were searched for relevant articles using multiple search terms for relevant studies published in English between 2000 and June 2020. Quality assessments, using valid tools, were conducted. A narrative synthesis of the findings was then performed.

Results

The search yielded 550 citations. After de-duplicating and screening, 19 studies were eligible for inclusion. Most studies were conducted in the Middle East (74%), Asia (16%) and Africa (10%). The interventions reported to improved diabetes care included mHealth tool, intensive lifestyle intervention, task-shifting, psychosocial support, distribution of glucometers, and comprehensive care. Insufficient drug supply, out-of-pocket cost, complexity of insulin therapy, and low adherence to guidelines were identified as barriers.

Conclusion

There is a paucity of evidence on optimal diabetes care in acute crisis and natural disaster settings. The review was constrained by the low quality of the studies included. Nevertheless, it is likely that mHealth can be feasibly utilised,

as educational SMS messages were cost-effective and electronic medical records can enhance disease monitoring. In addition, a multidisciplinary approach to care improves glycaemic control and is desirable due to the multifaceted nature of the disease and management required. Several key barriers were identified that need to be tackled. Overall, the evidence base for diabetes care in humanitarian settings remains sparse and further research is needed.

Introduction

Humanitarian crises are a significant global health challenge. Human-made disasters, such as conflict, contributed to the growing problem of forced migration that affected 79.5 million people in 2019 (1). Similarly, in 2019, 95 million people were affected by natural disasters (2). Most crises occur in low- and middle-income countries (LMICs) which host nearly four out of every five refugees (1). Weak healthcare systems in affected countries are already strained by surging care demands and limited resources that compromises their ability to deliver quality care during a crisis (3).

Even in the absence of humanitarian crises, many LMICs face a growing burden of non-communicable diseases (NCDs). Cardiovascular diseases (CVD), cancer, chronic respiratory diseases, and diabetes mellitus (DM), are escalating globally, and account for 71% of deaths worldwide (4). Almost 75% of all NCD deaths, and the majority of premature deaths (82%), occurred in LMICs (5). Several factors are driving the NCD epidemic in LMICs: increasingly sedentary lifestyles, greater consumption of alcohol and smoking, as well as altered eating habits with greater consumption of processed food, salt and sugar (6). Refugees are particularly at risk as they are more likely to settle in camps or poorer urban areas where living conditions are worse (7,8).

Globally, in 2019 approximately 463 million adults live with diabetes, 79% of whom live in LMICs (9). In 2019, an estimated 1.5 million deaths were directly caused by diabetes (10). Diabetes is of particular concern during humanitarian crises as around four million people with diabetes (PWD) are forcibly displaced due to disasters (11). One study shows that the prevalence of diabetes in Syrian refugees residing in Lebanon was 47% (12). Glycemic control was also inadequate during the war of Yemen, with an average HbA1c increase of 1.7% ($p<0.001$) from 7.7% to 9.4% reported, when comparing the same population before and during the war (13). Poor management of diabetes leads to serious long-term complications such as diabetic retinopathy, renal failure, peripheral neuropathy, diabetic foot ulcers and amputations (14).

The prevention and treatment of diabetes and its complications decreases morbidity and mortality (10), and depends on continuity of care. However, in humanitarian crises, continuity of care is compromised by the lack of testing and access to medications, and a lack of services with expertise in diabetes management (15). The monitoring of glucose levels can be problematic as glucometers and test strips are scarce (15). Access to insulin may also be inconsistent or unavailable which places insulin-treated PWDs at risk of life-threatening hyperglycaemia or diabetic ketoacidosis (14). Even when insulin is available, cold-chain issues threaten their efficacy (15).

The evidence on how to effectively manage diabetes in humanitarian emergencies is lacking (16). Current guidelines on diabetes management for humanitarian settings tend to focus on resource-limited settings rather than on crises settings (17,18). One review on NCD interventions in humanitarian contexts has been published (19), but only three studies on diabetes were included and were all based on the same interventions. Little has been published on the management of diabetic complications, or of the potential role of emerging technology to support condition management (20). This study therefore set out to identify studies that explored the effectiveness of interventions, as well as the determinants that may improve the management of diabetes in the humanitarian context.

Methods

A systematic narrative review was conducted to systematically examine the existing evidence and critically appraise relevant research (21). This approach was adopted due to the anticipated breadth of the topic and likely diversity of settings and interventions reported. Study selection and data extraction was done by the lead author (KS) and subsequently validated by the second author (AL). The review components are summarized in the PRISMA flow-diagram in Figure 1 (22).

Evidence from all types of studies published in full-text were examined, including qualitative studies to contextualise the findings and better understand the experience of affected populations (23). Editorials, commentaries, posters, conference abstracts, and student theses were excluded as the quality of evidence from these sources was regarded to be lower (24). Similarly, grey literature was excluded due to the risk of bias and the lack of peer-review (25,26).

This review included PWD in LMICs, regardless of age, affected by humanitarian crises, specifically refugees, internally displaced persons (IDPs), people who remained in affected areas, and host populations. Humanitarian crises were defined as settings where the health, safety or well-being of the population were threatened by human-made disasters and/or natural disasters. People who settled in high-income countries were excluded, as the healthcare would be substantially different.

All studies implementing health programmes involving diabetes management were eligible. To be eligible, the interventions need to have been assessed by one or more primary or secondary outcomes of interest in quantitative studies. The primary outcomes of interest were surrogate outcomes for diabetes management (i.e. glycaemic control) such as HbA1C, fasting blood sugar (FBS), random blood sugar (RBS), and post-prandial blood glucose (PPBG). Any other reported outcomes were evaluated as secondary outcomes. Inclusion/exclusion criteria are summarized in Table 1.

[Table 1. Inclusion/Exclusion criteria]

Inclusion	Exclusion
• Populations affected by humanitarian crises in LMICs • Refugees, IDPs or host communities in LMICs • Intervention programme related to diabetes detection/screening, prevention, treatment, health promotion, or qualitative studies that explored factors influencing	• Populations in high-income countries • No intervention programme for managing diabetes • Editorials, commentaries, posters, conference abstracts, and student theses

diabetes management from perspectives of patients and providers • Any study type • Articles in English	

A systematic search strategy was applied to identify all relevant studies. MEDLINE, Embase, CINAHL and Web of Science databases were searched for relevant published studies.

The inclusion period was 2000 to June 2020 in order to retrieve contemporary evidence. The study language was restricted to English. Additionally, reference lists of all studies were screened for any relevant studies missed by the search strategy. The search was conducted using a mix of free-text and relevant medical subject headings [MeSH and Emtree]. Keywords were then combined with "AND" and "OR" to identify relevant articles. The full search strategy is available in supplemental file 1.

Retrieved studies were filtered using the inclusion/exclusion criteria. After deduplication, retrieved studies were sequentially screened by title, abstracts and full-text reviews. An adapted data collection form, used in another similar study (19), was used. Relevant information (characteristics of the studies, interventions, outcomes, and other information) were extracted from each study and collated in a spreadsheet.

[Table 2. Assessment tool]

Assessment tool	Study types
Newcastle-Ottawa Quality Assessment Scale (NOS) (27)	Cohort study, report
An adapted version of NOS (28)	Cross-sectional study
Cochrane collaboration's tool for 'risk of bias' (29)	Randomised control trial (RCT)
Risk of Bias in Non-randomised studies of intervention tool (ROBINS-I) (30)	Quasi-experimental study
Mixed Methods Appraisal Tool (MMAT) (31)	Mixed methods study
Critical Appraisal Skills Programme (CASP)	Qualitative study

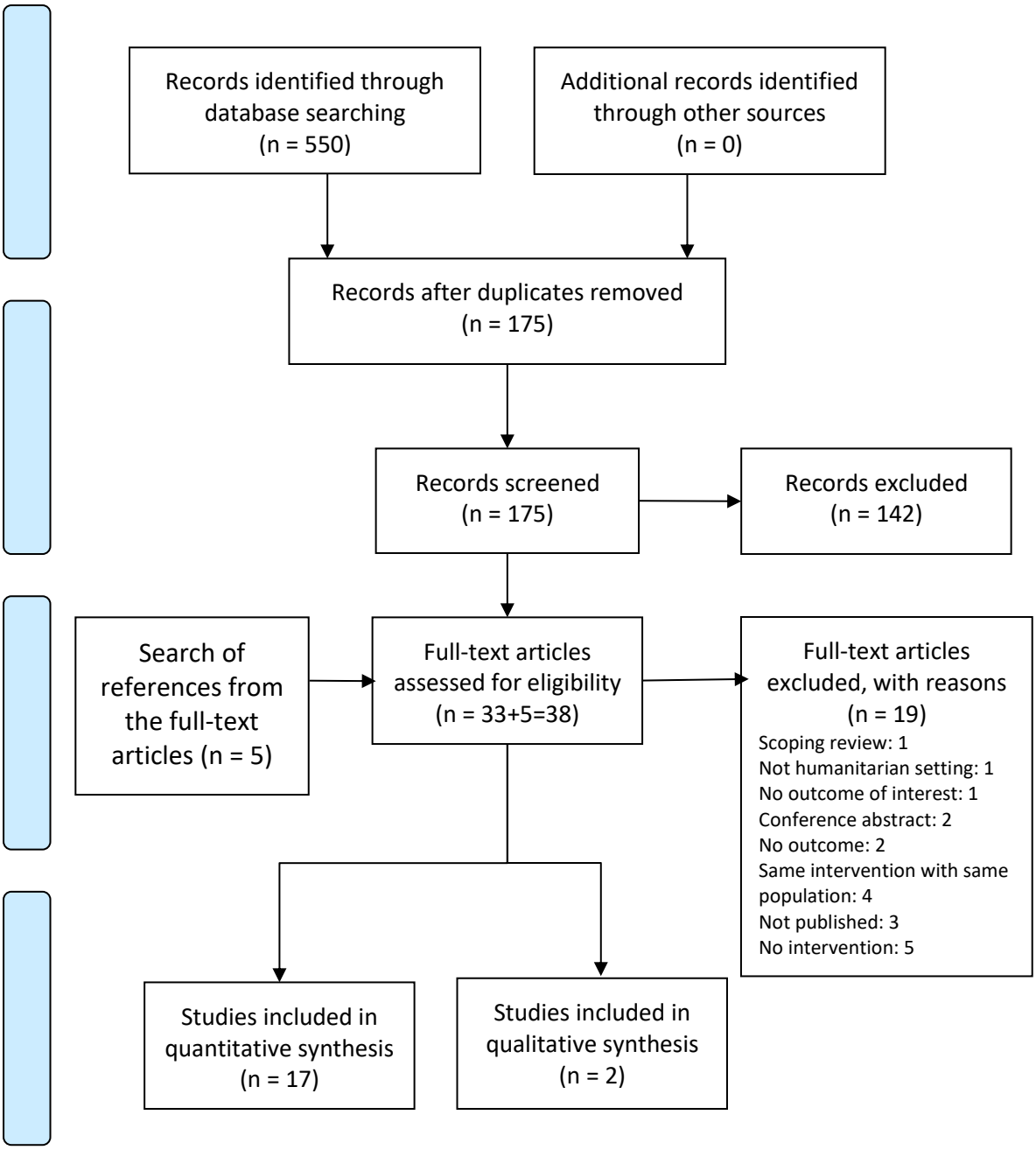
As different types of studies were included, multiple quality assessment tools were used (Table 2). All findings in the checklists were documented, providing conclusions on risk of bias in each study. All quantitative studies were assessed and categorised for their methodological quality according to the Oxford Centre for Evidence-Based Medicine (CEBM) criteria to ascertain the strength of recommendation (32).

Finally, a descriptive narrative summary of studies was conducted. Further analysis was limited due to the diversity of methodologies, interventions studied, and outcome measures in the studies.

Results

The search yielded 550 citations. 375 duplicates were removed. 175 remaining citations were then screened by titles and abstracts, and 33 articles were eventually selected for full-text review. References from the 33 studies were examined and five studies not previously identified were added for full-text reviews. After full-text review, two qualitative studies and 17 quantitative studies were identified that fully met the criteria and were included for analysis. A summary table of the included studies is available in supplemental file 2.

[Figure 1. Flow diagram]



Settings

14 (74%) studies were conducted in the Middle East, three (16%) in Asia, and two (10%) in Africa. Eight different countries were involved: Jordan (33–35), Iraq (36), Lebanon (37–42), Syria (43), Palestine (Gaza strip, West Bank) (44), Democratic Republic of Congo (DRC) (45,46), Thailand (47,48), and Malaysia (49). Two studies (50,51) were conducted in multiple locations where the United Nations Relief and Works Agency (UNRWA) operated.

Populations

Palestinian populations were studied in almost half of the included studies (42%). Other population groups studied included Syrian refugees (26%), internally-displaced Congolese from the DRC (11%), minority ethnic populations from Myanmar (11%), Rohingya refugees from Myanmar (5%) and post-war Iraqi populations (5%). Most had fled from or been affected by armed conflicts (89%), or affected by religious and ethnic persecution (11%). Host communities were studied alongside displaced populations in seven studies (37%).

Study designs

A variety of study designs were included, most of which were observational studies, with six cohort studies (32%), four cross-sectional studies (21%), two qualitative studies (11%), two field reports (11%), and a mixed-methods study (5%). There were three quasi-experimental studies (16%), and one RCT (5%).

Risk of bias within studies

Quality assessment revealed bias to be a common weakness. Most studies lacked a comparator and had limited statistical analysis. Twelve observational studies assessed by the NOS and adapted NOS tools were mostly acceptable in demonstrating representativeness of the sample population, except for one (49) due to small sample size. However, there was a lack of comparability across the studies. In two articles (37,48), the losses to follow-up were inadequately described, and missing data were considerable in another study (42). Assessment outcomes were generally satisfactory based on the use of validated tools and documented medical records, except for two articles (37,47).

Two quasi-experimental studies (36,51) had moderate risk of bias but one (44) had serious risk of bias due to frequency of medical contacts in an intervention group that was often greater than the control group. The risk of bias for one RCT (40) was unclear due to missing data and insufficient information. This study had a high risk of attrition bias. In the mixed method study (41), statistical analysis and the tool used for outcome assessment were

not described. Two qualitative studies (35,45) assessed by the CASP tool were methodologically appropriate. However, the narrow sample and selective recruitment strategy hindered broader generalisability of findings. (Details of the quality assessments are provided in supplementary file 3.)

Facilitators identified

Table 3. Potential facilitators

Themes	**Interventions**
Education and awareness	mHealth tools; intensive lifestyle interventions; community-based activities
Self management	Provision of glucometer
Access to care	Task shifting in care
Integrated diabetes care	Mental health and psychosocial support, Multidisciplinary approach

The mHealth tool

The utilisation of mobile devices in health (mHealth) was prominent and reported in six studies. Two studies (36) (40) sent diabetes education-related messages targeting PWDs in Iraq's early post-war recovery period and Palestinian refugee camps. Both studies reported a significant decrease in HbA1c after the interventions. In one study, the mean knowledge score rose from 8.6 to 9.9 (p=0.002) out of 14, and was also deemed a cost-effective measure at only €0.065 (US$0.077) per text message (36). However, no significant changes were found in smoking habits and patients' attendance for annual foot examinations and eye check-ups (40).

Khader et al. (33) evaluated two years of cumulative clinical outcomes in UNRWA primary health care centres (PHCCs) after implementing an electronic health system and cohort analysis for monitoring patients. Despite the fact 60% of patients were obese (BMI ≥ 30kg/m2), the patients showed generally good disease control. Khader et al (34) also found that failure to attend PHCCs was associated with male gender (OR 1.7 [95% CI 1.3-2.9], p

<0.001) and patients with poor diabetes control (OR 1.4 [95% CI 1.0-2.1], p=0.04).

Doocy et al.(38) applied an adapted standard guideline and an mHealth application successively to PWDs in Lebanon. Patients reported that interactions with health workers initially increased gradually during the guideline implementation phase but rose substantially after mHealth implementation. The proportion of patients whose diabetes was controlled also improved from 42.1% to 52.2% (p=0.09).

Trained community health workers (CHWs) who conducted community-based screening for diabetes using the mHealth-assisted netbook tool increased detection rates from 173.2 to 183.5 per 1000 as well as referrals to PHCCs for those living in refugee camps and rural areas of host communities (39). Referral compliance rates were better among refugees (73.5%) than those in rural areas (58.5%). Patient knowledge of the reasons for referral was statistically associated with appointment attendance (p=0.001).

Intensive lifestyle intervention

Abu Kishk et al. (51) conducted a diabetes campaign to reduce cardiometabolic risk factors. They introduced three activities: educational sessions, cooking, and physical activity classes. The decreases in general parameters, including weight loss (-2.6kg), waist circumference (-4cm), and BMI (-0.78kg/m^2), were significant. Changes were also observed in patients' behaviour and knowledge regarding healthy cooking and physical activities.

Community-based activities

Two studies conducted community-based activities to raise diabetes awareness. In Lebanon, trained refugee outreach volunteers (ROVs) provided monitoring of PWDs and screening of people at high risk of developing NCDs (37). The study reported that after two months, ROVs emerged as health leaders within their own settlement. One outreach awareness programme to raise knowledge in the community reported that patients became more engaged with their treatment and sought more advice on behaviour changes (68%) and medications (86%)(41).

Provision of glucometer

In one MSF programme (42), glucometers were given to patients on insulin. After six months of intervention, the average HbA1c level decreased significantly from 9.3% to 8.4% (p=0.022). In addition, patients in the study greatly appreciated having glucose monitors that enabled them to better self-manage at home (35).

Task shifting in care

Two studies utilised task-shifting for the management of PWDs in clinics. One study in a refugee camp setting provided nurse consultations to reduce waiting times for those PWDs with controlled diabetes or improving uncontrolled diabetes (42). No significant disadvantages in glycaemic control were reported. Another study examined periods of insecurity due to armed conflict in DRC where nurse-provided care was delivered with drug resupplies for 2 months (46). The study found glycaemic control was satisfactorily maintained during this period.

Mental health and psychosocial support (MHPSS)

Five studies mentioned psychosocial support but lacked objective measures of effect. One study (47) provided peer-to-peer group sessions with long-standing patients for the newly diagnosed. The other two programmes (44,46) implemented psychosocial support including clinician-moderated peer support and involvement of family or friends as supporters. In Lebanon, mental health services were delivered by psychologists in the same PHCC (42). One qualitative study reported bonding with other PWDs and family support through group-based psychosocial support encouraged patients to continue with their follow-up appointments and adhere to treatment (45). Family supports were especially important in dietary treatment.

Multidisciplinary approach

Multidisciplinary approaches involving multiple expertise and interventions at a primary health level were used in three studies. In a study of Syrian refugees in Lebanon (42), services including a package of education, health promotion which covered self-monitoring of blood glucose (SMBG), lifestyle habits, and greater diabetes awareness were integrated with mental health and clinical management were provided. This resulted in remarkable

improvement in the proportion of patients with controlled glucose levels, increasing from 29% to 61% ($p<0.001$) after 6 months. However, missing data was considerable in this study.

In another study, psychosocial support was integrated with education, lifestyle counselling on a context-adapted diet, and case management in the outpatient department (46). 60% of patients reportedly achieved glycaemic control after 9 months, but the baseline control rate was not reported.

A mobile clinic in Palestine (44) developed a diabetes comprehensive care model, consisting of diabetologist, nurses, and nutritionists, which delivered counselling on healthy lifestyle choices for patients and families, and community education for one year. The intervention group showed significant improvements in HbA1c levels compared to the control group (reduction from 9.5% to 8.3% vs. 9.2% to 9.1% respectively, $P<0.001$).

Barriers identified

Insufficient drug supply

Shortages of drug stocks were reported in three studies. These were due to issues with accessing prescribed drugs (43), blockage of supply routes due to armed violence (46), and a sudden rise in patient load (41). Blood glucose control worsened during the suspension of drug supplies but improved once service restarted (46). Medication shortages led to patient dissatisfaction which was the main reason for poor follow-up (41). Some patients made potentially harmful decisions like reducing the medication dose themselves to make drugs last longer (35).

Out-of-pocket cost

Services, including drugs, were usually free. However, some drugs were unavailable in the clinic, forcing the patients to buy their own. In the UNRWA PHC centres (50), patients had to pay for lipid-lowering medications; consequently, only half the patients (53.4%) were on the necessary drugs. Out-of-pocket costs, on transport expenses, and indirect costs, such as lost wages due to clinic attendance, were a burden for patients, leading to poor

follow-up (41,48). Out-of-pocket healthcare costs were the largest financial burden for Syrian refugees in Jordan when the host government increased the price of health services for refugees (35). Access to public sector healthcare became unaffordable, which meant refugees were dependent on non-governmental organisation (NGO) services (35). Although NGO facilities were accessible in terms of cost, they often provided limited services. Secondary services, such as advanced laboratory testing and medication, were usually inaccessible (35).

Complexity of insulin therapy

There were barriers to implementing insulin therapy due to the high cost of insulin, as well as auxiliary items such as syringes and needles, need for a cold chain (48,49) and extra storage measures for mobile clinic settings. The largest costs were for glucometers, strips and lancets (46). Patient education on correct insulin injection techniques was needed but language barriers was often a hindrance to implementation of insulin therapy (49).

Glucose control in patients on insulin tended to be sub-optimal. In the UNRWA clinics (50), SMBG was reported in only 66.2% of patients with Type 1 DM. The proportion of patients with good glycemic control (HbA1c ≤ 7%) was lowest in those on insulin alone (8.2%). In a programme in DRC (46), in the absence of home glucose monitoring, insulin doses were regulated by a single FBS measure and symptoms. Insulin was prescribed and stored in clay pots at home. When services were suspended due to stock shortages, glycaemic control was consistently poorer in patients on insulin (with and without oral hypoglycaemic agents(OHGs)) than those on OHGs alone, even after services resumed.

Low adherence to guidelines

Guidelines for the management were usually adapted from national protocols, NGOs, and international guidelines (Table 4). However, physician adherence to guidelines could be poor: one study (49) found that only 44.8% of physicians followed prescription guidelines. When guidelines were followed,

patient outcomes were good: 92.3% of patients treated according to the guideline achieved good glycaemic control.

In another study (50), only 22.6% of patients received scheduled lifestyle education sessions. This was associated with high prevalence of smoking (34.1% among males) and over 90% of patients were obese or overweight. Most patients interviewed struggled to adhere to dietary recommendations, as they were unaffordable and unavailable, which was a major obstacle (45).

Table 4. Examples of guidelines reported

	Study	Guidelines used
National guideline	Saito et al. (48)	Burmese border guidelines for Thailand-Myanmar border
	Tahir et al. (49)	Malaysian clinical practice guideline
	Doocy et al. (38)	National protocols and WHO/PEN(Package of essential noncommunicable) disease interventions for PHC in low-resource settings
International guidelines	Sibai et al. (41)	WHO/PEN guideline for low-resource settings
	Khader et al. (33)	UNRWA technical instruction (TI) guidelines for Palestine refugees
	Shahin et al. (50)	
	Khader et al. (34)	
NGO guidelines	Ansbro et al. (46)	Clinical guidelines adapted from Médecins Sans Frontières (MSF), WHO, and international guidelines
	Kayali et al. (42)	The draft MSF NCD guideline

Discussion

There is a paucity of evidence on diabetes care in acute crisis and natural disaster settings. All the studies in this review were conducted in relatively stable settings, either early in the recovery stage, in host countries, or in chronic crisis settings. The studies were disproportionately from the Middle East, with a few from Africa and Asia, and none from South America. Given the rising migration trends due to conflict globally, further studies are required from underrepresented regions. Furthermore, gestational diabetes and the management of diabetic patients with complications were not addressed in

any of the studies. The quality of evidence was also limited as most were observational studies without comparators, with a high risk of bias.

Nevertheless, the review identified a number of potentially useful interventions. Firstly, mHealth can be feasibly utilised to improve diabetes care in humanitarian settings. Educational SMS messages were a cost-effective intervention to increase knowledge. Electronic medical records also enabled better follow-up and monitoring of patients and may enhance providers' compliance with guidance (38). Whilst mHealth interventions seem to offer the promise of improved chronic disease management (52), there are practical challenges such as technical and networking issues, lack of electricity, language problems, and low literacy rate in low-resource settings (53).

Community-based interventions, empowerment of community health workers and group-based activities could improve patient engagement with their disease management (54–56). Task shifting is also recognised as an effective and affordable strategy in resource-poor settings (57) that could be feasible in crisis settings.

While many studies in this review focused on education as a key intervention, its effectiveness was difficult to measure or attribute due to the multi-component nature of programmes. Education alone may be insufficient and deliver mixed results (58,59). A multidisciplinary approach to care improves glycaemic control and is desirable due to the multifaceted nature of the disease and management required (60,61). A system whereby diabetes care is integrated within primary health care (PHC) could work in this setting, an approach that has been demonstrated for other chronic disease management (62,63). Although none of the included studies described the impact on mental health (e.g. depression, anxiety), the provision of psychosocial support was deemed to improve treatment adoption and adherence.

Diabetic control for patients on insulin was difficult due to issues with access and storage of insulin, as well as access to glucometers and other consumables. From a provider perspective, adherence to guidance tended to

be poor and the delivery of care was affected particularly by drug supply issues. Longer-term supply to patients to control their diabetes may make it feasible to increase compliance in such settings. Selectively providing longer durations of drug supply to stable patients seemed to have no harmful effect in terms of maintaining glycaemic control and patients benefited from the reduced frequency of follow-up.

The burden of healthcare cost was a challenge for PWDs, both in terms of direct as well as indirect costs (64–66). The reduction of out-of-pocket costs to patients to an affordable level is essential. Price reduction on procurement through humanitarian pricing models and usage of generic brands could be a possible solution as has been demonstrated for HIV/TB medications and diagnostics elsewhere (67,68).

In addition to the limitations outlined above, more rigorous analysis of the evidence base, such as through meta-analysis, was not possible due to the heterogeneity in interventions, outcomes, and study types. The review was constrained by the quality of the studies included, and the robustness of the methodologies employed by those studies. In addition, as multiple interventions were often combined in one study, it was not possible to determine the impact of individual components or interventions.

It is clear that the evidence for diabetes care in humanitarian settings remains sparse and further research is needed. In particular, research is required to address whether insulin therapy can be effectively delivered and if so how it is delivered. It would also be useful to ascertain what are the key components required for optimal glycaemic control that need to be prioritised, and which elements can be safely dispensed with. Much work still needs to be done to build the evidence base for non-communicable disease management in humanitarian crisis settings.

Author statements

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Ethical approval

This review did not require ethical approval since human participants and personal data were not involved, and only secondary data were used.

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Competing interests

The authors declare the following personal relationship which may be considered as potential competing interests; one of the authors who has been supervised this research is an editor of this journal.

Author's contributions

KS contributed to the literature research, data screening and extraction, analysis of the data and was the primary author in writing the manuscript. AL provided guidance in methods, reviewed and commented on the manuscript. All authors approved the final version.

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