MSF experiences of providing multidisciplinary primary level NCD care for Syrian refugees and the host population in Jordan: an implementation study guided by the RE-AIM framework

Éimhín Ansbro (✉ eimhin.ansbro@lshtm.ac.uk)
London School of Hygiene and Tropical Medicine Faculty of Public Health and Policy
https://orcid.org/0000-0002-2291-1652

Tobias Homan
Medecins Sans Frontieres Operational Centre Amsterdam

Jamil Quasim
Medecins Sans Frontieres Operational Centre Amsterdam

Karla Bil
Medecins Sans Frontieres Operational Centre Amsterdam

Mohammed Rasoul Tarawneh
Jordan Ministry of Health

Bayard Roberts
London School of Hygiene and Tropical Medicine Centre for Global Chronic Conditions

Pablo Perel
London School of Hygiene and Tropical Medicine Centre for Global Chronic Conditions

Kiran Jobanputra
MSF UK

Research article

Keywords: non communicable disease, diabetes, hypertension, cardiovascular disease, humanitarian, conflict, effectiveness, refugee, Syria, Jordan, programme, RE-AIM, evaluation, implementation

Posted Date: February 11th, 2020

DOI: https://doi.org/10.21203/rs.2.23168/v1

Version of Record: A version of this preprint was published at BMC Health Services Research on April 26th, 2021. See the published version at https://doi.org/10.1186/s12913-021-06333-3.

Abstract

Background: Humanitarian actors have rapidly scaled-up NCD services in crisis-affected low-and-middle income countries, in response to the rising global NCD burden. Using the RE-AIM implementation framework, we evaluated a multidisciplinary, primary-level model of NCD care for Syrian refugees and vulnerable Jordanians in Irbid, Jordan. We examined the *Reach*, *Effectiveness*, *Adoption* and acceptance of the programme; the fidelity, adaptation and costs of *Implementation;* and its *Maintenance* over time.

Methods: This mixed methods, retrospective evaluation, undertaken in 2017, comprised secondary analysis of pre-existing cross-sectional household survey data; analysis of routine cohort data from January 2015 - December 2017; provider-perspective, descriptive costing analysis of total annual, per-patient and per-consultation costs for 2015-2017; clinical audit; medication adherence survey of 300 patients; and qualitative research. The latter involved thematic analysis of individual interviews with patients, staff and stakeholders and two focus group discussions with patients.

Results: The programme reached 5.9% of Syrian adults with NCDs in Irbid governorate. The cohort mean age was 54.7 years; 71% had multi-morbidity and 9.9% self-reported a disability. The programme was highly acceptable to patients, staff and stakeholders. Blood pressure and glycaemic control improved as the programme matured and within six months of patient enrolment (with a drop of 7mmHg and 26.8 mg/dL from baseline, respectively). Total costs increased in parallel with increased service complexity from INT$ 4,206,481 in 2015 to 6,739,438 in 2017. Clinical guidelines were reportedly usable and self-reported medication adherence was high. Individual and organisational challenges to programme implementation and maintenance included the impacts of war and the refugee experience on Syrian refugees' engagement; inadequate low-cost referral options; and operating in a regulated, middle-income country. Essential programme adaptations included refinement of health education and introduction of: mental health and psychosocial services, essential referral pathways, home visit services and a social worker role.

Conclusion: RE-AIM proved a valuable tool in evaluating a complex intervention in a protracted humanitarian crisis setting. This programme provided high quality, reliable, free, holistic NCD care and was highly acceptable to patients, providers and stakeholders. We propose that model simplification, cost reduction and use of technology could improve effectiveness and efficiency without reducing acceptability.

Background

In recent years, humanitarian actors have had to rapidly scale-up their NCD services in response to the rising burden of NCDs globally and the increasing number of humanitarian crises in middle-income countries with high NCD burdens (1,2). However, while there is strong evidence on cost-effective, primary care-based clinical management of NCDs in stable, high-income countries, there are limited available evidence, guidelines and tools to guide NCD interventions in low- and middle-income countries (LMICs) - particularly addressing the needs of those affected by humanitarian crises and forced displacement (3–

5). Similarly, there is sparse published literature comprehensively describing the implementation or evaluation of NCD care in humanitarian settings (6,7). In response the medical humanitarian nongovernmental organisation (NGO) Médecins sans Frontières has been working to develop NCD-specific guidelines and monitoring and evaluation tools for humanitarian settings.

Evaluation of interventions in humanitarian settings is fraught with complexity. Traditional experimental methods may be unfeasible or even unethical to implement due to target populations' vulnerability and the dynamic nature of humanitarian settings themselves, involving mobile populations, high staff turnover and volatile socio-political and security contexts (8). These contextual complexities are coupled with the limited capacity and funding available for research and evaluations in such settings. There is a clear need to develop robust evaluation strategies suitable for disaster settings that are rapid, pragmatic and impose minimal burden on implementing teams (9). The RE-AIM framework is a commonly used implementation research framework. It was designed to facilitate translation of research into practice by assessing five key domains: *reach, effectiveness, adoption, implementation,* and *maintenance* (Table 1), to improve the reporting of internal and external validity and of individual-level and organisational-level dimensions essential for successful programme implementation (10). It uses mixed methods to collect quantitative, qualitative, and costing data (11–13). RE-AIM has been used successfully for planning and evaluating interventions in both high-income and LMIC settings (14), but to the best of our knowledge, it has not yet been comprehensively applied to a humanitarian intervention.

The Syrian conflict, now in its ninth year continues to devastate the Syrian people. Since 2011, over 6.1 million Syrians have been internally displaced, while over 6.6 million have fled as refugees, mostly into surrounding countries (15). Syria's epidemiological transition means that NCDs have been responsible for more deaths than communicable diseases for several decades, causing 77% of mortality before the conflict (16,17). Jordan currently hosts almost 670,000 Syrian refugees registered with the United Nations High Commissioner for Refugees (UNHCR) and, globally, it ranks second only to Lebanon in the number of refugees it hosts relative to the national population (15,18).

The host country and humanitarian health systems have had to respond to the high NCD burden amongst the mostly urban-based Syrian refugee population (18–21). To tackle the rising NCD burden among its own population, Jordanian policy has aimed to strengthen NCD care at the primary level. At the time of this study, NCDs were diagnosed and monitored by family medicine specialists at comprehensive primary centres while medication refills were provided by non-specialist doctors at primary health centre level. Registered Syrian refugees were eligible to access Ministry of Health (MOH) primary care services but financial barriers (including user fees which have carried over time), complex care pathways and referral system, and limited health facility capacity have impeded their access to NCD care (22). There is ample evidence describe the burden, access issues and the broader health system response to Syrian refugees' NCD needs in Jordan but little is known about the content or quality of current NCD programming delivered either by the public health system or by humanitarian actors (22–25).

Since 2014, Médecins sans Frontières (MSF), a humanitarian medical organisation, has supported the Jordanian health system by providing multidisciplinary, primary level NCD care to Syrian refugees and the vulnerable host population in Irbid, north Jordan. In response to the urgent need for evidence to guide humanitarian actors in tackling NCDs in complex settings, we undertook a mixed methods evaluation of the MSF programme in order to learn lessons to improve the current care model and to inform the design of future NCD programmes in Jordan and humanitarian settings more broadly. Detailed analyses of certain evaluation components are reported in separate papers (26–28). The aim of this paper was to examine the *Reach*; *Effectiveness*; *Adoption* and acceptance of the programme to staff and patients; the fidelity, adaptation and costs of *Implementation;* and the *Maintenance* at patient- and programme-level over time using the RE-AIM implementation framework.

Methods

This retrospective mixed methods evaluation of the MSF NCD programme in Irbid, Jordan comprised secondary analysis of pre-existing cross-sectional household survey data (29), analysis of routine cohort data, a descriptive costing study, a clinical audit, a self-administered medication adherence survey and qualitative research (Table 1). It was undertaken in late 2017 and covered the study period December 2014 to December 2017. This paper draws together the findings from all methodologies under the RE-AIM framework.

Study setting

The study was conducted in Irbid, the second largest city in Jordan, located 30 minutes south of the Syrian border. Irbid governorate hosts over 165,000 mostly urban-based Syrian refugees (30). MSF commenced an NCD service within a Ministry of Health (MOH) primary care facility in Irbid in December 2014 serving non-camp dwelling Syrian refugees and in the vulnerable host community, in keeping with MSF and Jordanian policy. A second site was opened within a local NGO clinic in April 2016 and, in 2019, the two sites were amalgamated.

Intervention

This was a multi-disciplinary, vertical, primary care model, which used context-adapted clinical guidelines, generic medications in line with the World Health Organization (WHO) Essential Medicines list and task sharing. Eligibility for enrolment required both a medical and a social indication (Syrian refugee or vulnerable member of the Jordanian host population). Medical indications included: hypertension (HTN), established cardiovascular disease (CVD) [angina, myocardial infarction, ischaemic stroke, transient ischaemic attack, peripheral vascular disease, congestive heart failure], diabetes mellitus (DM) type I or II, chronic obstructive pulmonary disease (COPD), asthma or hypothyroidism). Vulnerability criteria included being a refugee, not being covered by Jordanian national health insurance (therefore necessitating co-payments to access MOH care) or being of low socioeconomic status. Enrolment criteria changed over time e.g. isolated hypothyroidism was removed and vulnerability criteria were adapted for ease of implementation. Enrolment was not limited by place of residence or age. Most patients presented with

established, self-reported diagnoses on enrolment; new diagnoses were made based on the MSF NCD guideline (31).

The multidisciplinary team initially included non-specialist doctors, nurses, health educators, pharmacy and reception staff, who provided appointment-based medical consultation, health education (HE) and behaviour change counselling, supported by a local management team and a coordination team in Amman. The service evolved to also incorporate individual- and group-based mental health and psychosocial support (MHPSS), social work, physiotherapy and a home visit team for house-bound patients, with the addition of counsellors, humanitarian liaison officer (HLO), home visit doctor and nurses, a physiotherapist and a specialist family medicine practitioner at each clinic site. Facility-based services were provided six days per week from 8 am to 2 pm, while the home visit service operated on six days within a ten-mile radius of the clinics. By 2017, the team had begun to introduce task sharing of stable patients' clinical reviews to nurses and to reduce their review frequency to 3-monthly with monthly medications pick-ups.

Study Design

For this evaluation, the RE-AIM domains were defined as follows: *Reach* was defined as coverage of the NCD service and its components to the intended target population. RE-AIM defines *Effectiveness* as the impact of an intervention on important outcomes, including potential negative effects, quality of life, and economic outcomes. Since this intervention evolved over time, we could not assess the effectiveness or cost-effectiveness of a specific intervention or strategy using a pre-post design and we did not have a comparator group. Therefore, we defined "effectiveness" as quality of care, examined by identifying trends in clinical outcomes and quality of care indicators; exploring perceived benefits, unintended consequences, behavioural outcomes and evaluating economic outcomes. *Adoption / acceptance* was explored as it related to the organisation, setting, staff and patients (including medication adherence), and consequent changes to behaviour and practice. *Implementation* of the NCD service was defined as the implementation of its components including guideline adherence and usability; adaptation of structures, processes and tools; and costs. *Maintenance* referred to the continued implementation of the NCD service and its components in patients, programme and the organisation over time. The specific indicators and methodologies used to operationalize these definitions are listed in Table 1.

Study participants, data collection and analysis

Household survey, retrospective cohort study and costing study: Programme coverage was determined using previously reported data from a Household Access and Utilisation Survey conducted by MSF in 2016. The survey data collection and analysis are described in detail elsewhere (29). For the cohort analysis, data analysis included data from all patients aged six years and over enrolled in MSF's NCD clinics with at least 2 visits, using files of patients admitted from December 2014 through to December 2017. Our analysis of trends in intermediate clinical outcomes [blood pressure (BP), fasting blood sugar (FBS) and glycosylated haemoglobin (HbA1c) control] focused on patients 18 years and older with hypertension and/or Type 2 Diabetes (28). Routine paper-based clinical data were collected by MSF data

clerks and entered into a bespoke password-protected Excel software database. Cohort data from both clinics were aggregated and analysed using RStudio v1.0.136 (RStudio, Boston, MA 02210, USA). Descriptive statistics explored patient demographics and process indicators. The analysis of clinical outcomes and retention in care are described elsewhere (28). A descriptive costing analysis from the provider perspective explored the annual total, per patient and per consultation costs for the Irbid NCD programme for 2015, 2016 and 2017. The analysis is described in detail in our companion paper (26). It included capital and recurrent costs incurred at Irbid clinic- and office-levels and a proportion of Amman coordination-level costs. Recurrent costs included human resources, medicines and equipment, building and vehicle costs, and training and supervision. We excluded direct or indirect patient-incurred costs.

Clinical audit: The clinical audit used a random selection of paper patient files from patients enrolled at least 12 months in the program. Data were collected in August 2017 by programme medical staff on a paper-based checklist, entered into a purpose-designed Excel spread-sheet and analysed using descriptive statistics.

Medication adherence survey: A convenience sample of consenting patients aged 18 or over attending either MSF clinic during a 2-week period in September 2017 was selected until 300 surveys were completed (Supplementary material S1). The 17-item adherence survey included demographic information and adapted pre-existing self-report medication adherence and beliefs measures, the Medication Adherence Report Scale-5 item (MARS-5) and the Beliefs About Medicines Questionnaire (BMQ). Two trained data collectors took written informed consent from patients, who self-filled the survey in Arabic. Data collectors assisted those with limited literacy. Paper data were held securely and were entered into a purpose-designed excel tool. Analysis included descriptive statistics and multivariate logistic regression.

Qualitative study: This involved two same-sex focus group discussions (FGDs) with eight Syrian adult patients each and forty individual semi-structured interviews (SSI): sixteen with adult Syrian and Jordanian patients, eighteen with MSF staff, and seven with key stakeholders (Supplementary material S2). Patients scheduled for medical review during a 2-week period were stratified by NCD diagnosis and then randomly selected by study staff to be invited to participate in an interview or FGD, held at times convenient to patients. Syrian and Jordanian patients were eligible for interviews, while programme staff recommended that Syrians alone were included in FGDs to avoid participants feeling inhibited by the presence of Jordanians. Additional patients were purposively selected from clinic waiting rooms to ensure both sexes, both main nationalities and those accessing each clinic location and specialised service element (MHPSS, HLO, Home Visit) were represented. MSF staff were purposively selected to represent a range of clinical, support and managerial staff, past and present. More medical staff than other staff cadres were selected to evaluate the acceptability and implementation of the MSF NCD guideline. Key stakeholders were selected to represent different levels of the MOH, other NGOs involved in delivering NCD care in north Jordan and a representative of the Syrian community.

Qualitative data were collected in August 2017. All invited participants agreed to participate and signed an informed consent form. We conducted individual patient interviews until data saturation was achieved, which resulted in a relatively small sample since we were interested in broader, over-arching themes rather than in fine-grained themes. The number of staff and stakeholder interviews were based on practical time limitations but theoretical saturation was felt to have been reached. A topic guide included introductory questions about the patient's NCD or the participant's role in relation to NCD care and questions relating to each domain of the RE-AIM framework. We focussed on specific components of NCD care (e.g. service provision, clinical consultation, medication prescription and adherence, health education, MHPSS and/or support from the HLO, home visit service). The English-language FGD and SSI topic guides are included as Supplementary material S3. All FGDs, patient interviews and three staff interviews were conducted in Arabic by two trained research assistants (HT, male, current HLO; SE, female, former HLO) at MSF clinics or in one patient's home. The remaining interviews were conducted in English by EA (female, public health researcher at LSHTM) at MSF premises, stakeholders' offices, or via Skype for former MSF staff. In each case, participant privacy was assured. Interviews were audio-recorded, translated and transcribed by a study team member with quality checks performed by a second team member. Patient interviews included nine male and seven female patients, of whom ten were Syrian and six were Jordanian. The majority (n=13) had two or more NCD diagnoses, three had attended MHPSS services, two attended the HLO and one was a home visit patient (Supplementary material S3).

Data were coded in NVivo11© and analysed by EA and a co-analyst using template analysis whereby a coding template was developed, based on an initial subset of data, then applied to further data and refined iteratively (32,33). This allows for an integrated approach employing both deductive and inductive coding. Deductive coding was framed around the *a priori* themes based on RE-AIM (10,11). Data were analysed by participant subset, i.e. patient, staff or stakeholder, and were checked with reflexive practice to mitigate against the insertion of preconceived assumptions. Themes were then related back to the research question and to existing literature. Negative cases or exceptions were examined to explore what set them apart. Both analysts reviewed the final template to enhance inter-rater reliability and analytic credibility. The findings are reported in accordance with the Consolidated Criteria for Reporting Qualitative Research checklist for transparency (34). Mental health and social suffering emerged as prominent, data-derived themes and have been reported in detail separately (27). The remaining themes are reported here. Qualitative and quantitative data from the various data sources were synthetized using the RE-AIM framework.

This study protocol was granted approval by the MSF Ethics Review Board and LSHTM Ethics Committee. Written authorisation to implement the study was obtained from the MOH of Jordan.

Results

The results are presented according to each RE-AIM domain and subdomain (Table 1). These have been somewhat reordered to facilitate logical presentation of the results.

Reach

According to the household access survey, it was estimated that over one fifth of adult Syrians in Irbid governorate had at least one self-reported relevant NCD (21.8% of 8041 surveyed adults aged 18 or over); applying this proportion to UNHCR-derived figures, 60,041 adult Syrian refugees >18 years resident in Irbid governorate in 2017 had an MSF-targeted NCD, of whom 5.9% (n=3531) were reached by the MSF programme (35).

Retrospective data from 5045 patients enrolled during the study period (3664 Syrians, 1365 Jordanians and 16 refugees of other origins) were analysed. The Irbid cohort represented a group of older patients [mean 54.7 years (SD 15.7)] with multi-morbidity and relatively high rates of self-reported disability (9.9%). The majority (59.8%) were women and 71% (n=3582) had two or more target NCD conditions, with hypertension (60.4%), type 2 diabetes (53.1%), cardiovascular disease (25.9%), hypothyroidism (7.6%) and asthma (7.0%) the most commonly treated conditions (Supplementary material S4). These findings are consistent with the household access survey, which reported a similar prevalence of target NCDs and higher prevalence of HTN and diabetes among women. However, this cohort had greater rates of NCD multi-morbidity compared to the adults with self-reported NCDs in the household survey (71% vs. 44.7%). NCD risk factors levels were high at enrolment with obesity levels of 62.6%, self-reported smoking rates of 22.7% and 37.2% self-reporting low or zero regular physical activity (Supplementary material S4).

By the end of the reporting period, only 24 patients had received a formal diagnosis of a comorbid mental health condition, while 154 patients attended individual counselling sessions and 66 group sessions were held in 2016, when recording began. The total number of patients reached by the MHPSS service was not captured by routine data, while qualitative data highlighted staffs' perceptions that an enormous burden of MHPSS needs was going undetected at the time of the study.

Adoption/acceptance

Accessibility/ acceptability: Our qualitative data showed that most patients considered the MSF clinics physically accessible, in terms of distance and convenience, availing of public, taxi or private transport. Syrian respondents, in particular, reported carefully balancing stretched household finances, spending on aspects of the service they valued and procuring preferred medications from multiple sources. They prioritised expenditure on transport costs for medical consultations over those for MHPSS, health education or laboratory visits. Patients generally appreciated the appointment system (which minimised long waits and prevented the perceived favouritism they experienced in the MOH system) and the SMS (short message service) reminders, but most perceived it as rigid, and inaccessible outside of prescribed appointment times. Staff strongly encouraged appointment adherence, achieving a 90% adherence rate.

Qualitative data confirmed that Syrian community members had limited access to alternative, affordable primary level NCD services in north Jordan. The MOH and a limited number of other NGOs provided such care but patients incurred co-payments or travel costs to attend, which many reported as unaffordable.

They coped by selectively forgoing medications, sharing with family or neighbours or purchasing from private pharmacies:

Syrian patient: *"If there is a family that can't bring medicine, we collect pills from here and here, so people help each other … because there is extra. So people give each other. I know a kid who takes insulin…I give people. I'm forced to help people."*

Staff perceived that most Jordanian patients, who made up 27.1% of the cohort, did not meet vulnerability inclusion criteria since they could access alternative services via national or military insurance. This was the case for all interviewed Jordanian patients.

Respondents perceived the referral pathway for NCD complications or other conditions, overseen by UNHCR and their local implementing partner, Jordan Health Aid Society (JHAS), as opaque, inaccessible, unaffordable and inadequate. UNHCR funded a limited number of referrals to MOH secondary or tertiary services via JHAS, who had a gatekeeper role, and whose decision-making process was seen as inconsistent and lacking clear criteria. MSF clinical staff also reported frustration at the lack of information returned to them post-referral. Stakeholders concurred regarding the complex and unsatisfactory nature of this referral pathway. MSF had successfully brokered agreements with other NGOs to meet some referral needs, e.g. interventional cardiology free-of-cost to patients, but this was often for a defined project period only and was limited by short-term funding cycles. MSF and other stakeholders' proposed solution was to encourage other international actors to provide funding and services to fill referral gaps.

Acceptance: Our qualitative data also showed that the programme was highly acceptable to patients, staff and stakeholders. Patients reported they received good quality care in a caring and respectful environment. They valued the free medications, regular laboratory and vital sign testing most highly. A female patient stated:

"*(MSF is) honestly caring about the patient, caring about his appointments even the medication availability. We have never come here and told us that the medication is not available. Their performance is great.*"

Multiple stakeholders believed the programme addressed an important health need among both Syrians and Jordanians and relieved a significant burden on the MOH.

Adoption/participation: There was good community awareness of the programme and a waiting list of over 200 patients to be enrolled. The main barrier to patient participation was the MSF-imposed cap on cohort size. Clinical staff were mainly Jordanian medical and paramedical university graduates, many with previous NGO experience. They were committed, proud to work for MSF and derived satisfaction from observing patients' improvements.

"I learned here how to see others problems… the disaster they are coming from…how we work here like a team or a family for the benefit of the patients; how you can give to the people…without taking, with

nothing in return." Clinical staff member.

There was low turnover among clinical cadres other than non-specialist doctors, who tended to resign after gaining several months' experience with MSF to pursue specialist training. This turnover was considered problematic by clinical supervisors, staff and patients who valued continuity of care. Some staff were dissatisfied with the perceived lack of promotion opportunities or job security (given the limited duration of MSF programmes), high workload and six-day working week.

The MSF NCD guideline was largely acceptable and usable by medical staff, who had adopted it particularly as a means to negotiate patient demands. In 2017, the guideline covered most clinical scenarios that doctors encountered, but it had limitations, including inadequate programmatic guidance (e.g. setting the limits as to what "stepped-up" primary care means i.e. "what components are included… that is not clear"; and predicting the numbers needing referral for screening and/or management of complications e.g. laser eye treatment for diabetic patients), perceived promotion of poly-pharmacy (since each condition was treated in a vertical manner) and there was limited guidance on complex, multi-morbid patients with renal impairment or frailty who may have benefited from "de-prescribing". In addition, clinical supervisors, who were generally of non-Jordanian origin, commented that some Jordanian doctors' felt the guideline limited their autonomy and offered "second-class" care since it recommended older, generic medications. Jordanian doctors also commented on the limited user-friendliness of the paper-based guideline and their preference for a digital application that could be accessed on their smart phones during consultations.

Patients were largely unaware of either the MHPSS or HLO services provided by MSF. Patient reluctance to attend and an initial distrust from the medical team in the MHPSS service influenced low referral rates, which were partially addressed through multidisciplinary staff training sessions, widening of referral rights to nurses and the introduction of psycho-education sessions aimed at patients in the waiting room.

Effectiveness

The retrospective analysis of routine data allowed exploration of clinical and quality indicators.

Clinical indicators: Among 4729 adult patients meeting our inclusion criteria (i.e. diagnosed with hypertension and/or Type II diabetes and enrolled during the study period), 2912 (61.6%) had hypertension and 2546 (53.8%) had type II diabetes, while 1530 (32.4%) had a dual diagnosis. From the programme perspective, BP decreased among patients with hypertension by 6.86 mmHg since the programme began, from a mean of 137.2 mmHg (95%CI: 134.7 to 139.7) to 131.2 mmHg (95%CI: 129.8 to 132.6) at 6 months, while mean fasting blood glucose similarly decreased from 173.2 mg/dL to 165 mg/dL after the first year of operation. HbA1c control improved markedly during the programme's life from a mean of 8.7% in month one to a mean consistently below the target of 8% and more than 60% of patients achieving control, after the first six months. From the patient perspective, the proportion achieving blood pressure control improved from a baseline of 63% to over 70% by month 6 post enrolment/new diagnosis. Among diabetic patients, there was a marked improvement in FBS level from

mean 187.5 mg/dL (95%CI: 184.0 to 190.9) at enrolment/new diagnosis to 160.7 (95%CI: 155.7 to 165.7) by six months and over 70% of patients with DM II achieved FBS targets by month four. These results and loss to follow up are elaborated on in our companion paper (28).

Quality indicators: Additional clinical outcome indicators and process indicators are presented in Table 2. At each health education session patients were asked to categorise their exercise level as active, inactive, moderately active, and moderately inactive but exercise was not otherwise quantified. Similarly, we could not determine whether smoking behaviour had changed since it was not quantified and patients' self-reported smoking behaviour change was only recorded relative to their previous visit. Attainment of certain process indicators was suboptimal e.g. statin prescribing, CVD risk scoring and performance of annual urinary protein testing in diabetic patients.

Perceived effectiveness: Qualitative data confirmed that both staff and patients perceived the programme as effective, while staff observed greater improvements and commitment among Jordanians versus Syrian patients. Patients reported feeling better after attending the programme, linking this both to physical improvements and to the reduced financial burden and worry around obtaining their medications.

Jordanian patient: *"(Since coming to) the clinic to be honest, I feel relieved and comfortable since the first day I came here, I felt the difference in my disease, before I used to take pills for diabetes and hypertension but nothing changed."*

Implementation

Fidelity of programme delivery: The indicators derived from our analysis of routine data that are related to fidelity of programme implementation are presented in Table 2. Our qualitative data highlighted the impact of war and the refugee experience was the key challenge to implementing and maintaining effective NCD care for the Syrian refugee population. This theme was explored in detail in our linked paper (27). Syrian patients' social suffering had profound implications for their ability to engage with the programme in terms of medication adherence, dietary and lifestyle advice, and affordability of access:

"The hypertension goes high not all the time but when I get sad and remember my sons in Syria and they tell me what happens with them I keep crying and crying then my hypertension goes high or goes down I don't know then I take a hypertension pill to settle down whenever I read some news about them," Syrian patient.

Space, patient transport costs and limited patient engagement were barriers to implementation of group MHPSS sessions. Clinicians and their clinical supervisors described a didactic and knowledge-based approach to individual patient education rather than the preferred patient-centred approach. Additional challenges encountered by the team around healthy living and behaviour change included: cultural dietary and exercise norms (high fat, high salt diet and low habituation to exercise for health or leisure) and acceptance of smoking (especially in men), the obesogenic environment (with highly available calorie

dense foods and lack of exercise options) and most patients' perception and expectation that medications would provide the necessary solutions.

Adaptations: The programme adapted dynamically to patient and programmatic needs. Staff learned to adapt health education messages to patients' literacy and education levels and their financial means and to involve family members as informal treatment supporters. Other essential components and adaptations to the programme included the initial introduction of MHPSS in response to significant identified mental health needs among Syrian patients; the introduction of the HLO social work role to address social and protection needs (although this was reportedly underutilised); and the expansion and reorientation of the MPHSS service to provide ad hoc psycho-education sessions, a targeted group 'living well' programme and peer-support groups. However, the team reported a lack of good quality onward referral options for patients requiring prescription of psychotropic medications or psychiatric input and management staff planned to train one family medicine specialist to address this need. The team also established essential referral pathways where possible and introduced and expanded the home visit service (to encompass a wider radius and more staff). Similarly, clearer admission criteria related to patient vulnerability were piloted and operationalized.

Costs: The total annual financial cost of the NCD programme from the provider perspective increased annually in parallel with greater patient volume, increased service complexity and the addition of specialist staff. It increased by 52% from INT$ 4,206,481 in 2015 to INT$ 6,400,611 in 2016 and by a further 5% to INT$ 6,739,438 in 2017. Per patient per year cost increased 23% from INT$ 1,424 (2015) to 1,751 (2016), and by 9% to 1,904 (2017), while cost per consultation increased from INT$ 209 to 253 (2015-2017). The major cost drivers were human resources (accounting for 38.9%-42.6% of total annual costs) and medications (34.8-43.2%). The costs are reported in detail in a related paper (26).

Maintenance

Individual level: The majority of patients enrolled during the study period (N= 5045) were retained in care for over six months (85.2%); one third of enrolled patients exited (including 12.5% cumulative loss to follow up and 2.6% deaths) (Table 3). Over half of adherence survey participants (N=300; 50.4%) were prescribed between four and six MSF-provided medications, while almost a quarter (24%) were prescribed over seven (Supplementary material S4B). The majority (60.4%) also took medications from another source. Most patients (89%; N=300) had very high self-reported medication adherence scores. While the majority of individual interview participants (especially Syrians) declared themselves "very committed" to taking medications, several described stopping, taking intermittently or sharing medications with those in need. Qualitative data confirmed that patients' medication adherence and behaviour change was facilitated by support from family and MSF staff.

Staff perceived that excellent patient-staff rapport; positive experiences of supervision, support and training; and good teamwork with colleagues assisted them with programme implementation. Challenges to maintenance from the staff perspective included: Syrian patients' war-related trauma, poor mental health and social suffering, as well as their poverty, lower education levels and perceived greater medical

complexity compared to Jordanians. Staff and patients both emphasised the negative impact of mental distress on adherence to medications and healthy living advice:

"As I was hearing the stories I thought…this man's problem is not that he's smoking too much. His problem is that he … experienced sexual violence, physical violence in prison in Syria… these two are linked." Clinical staff.

In addition, patients (of both nationalities) tended to visit multiple concurrent providers, which also complicated care delivery.

Organisational level: Qualitative data highlighted the importance placed by MSF on providing a good quality service that fulfilled its humanitarian remit. Multiple respondents emphasised the difficulties the programme encountered around the lack of adequate referral pathways:

"*The credibility of any service often depends on its ability to refer upwards, doesn't it? That is just as true for people with angina and coronary artery disease (as it is) for mental health,"*

Management staff.

Proposed task shifting of stable patients' medical reviews to nurses had occurred in a very limited manner because of lack of clarity generally on clinical activity and patient flow, lack of clear eligibility criteria, and reported resistance from patients and medical staff. In our related paper, we explored potential cost efficiencies that may be realised from reorganisation of medical consultation workflow, identifying the most important factors as frequency of review and proportion of patients categorised as stable, and therefore suitable for nurse review or longer doctor review intervals (26).

Contextual challenges to programme maintenance related to operating within the Government of Jordan regulatory environment, including: the requirement that medications must be locally purchased rather than imported; the lack of single focal point or set of regulations governing NGOs; and significant bureaucratic delays. Finally, there was perceived tension between the MSF team's desire to continually improve and add complexity to the programme and the need to consider long-term planning for the programme with a potential future handover. Several management staff discussed the need to engage with the MOH as the likely handover partner but pointed to the gulf between the current MSF and MOH models of NCD care.

Management staff referred to the internal debate within MSF as to whether NCDs fall under the remit of a humanitarian medical organisation:

"An NCD Programme is a relatively recent departure for the MSF and it is getting very close to the dividing line between humanitarian and development aid. So, what actually is MSF's direction here, I think, partly is driven by the general sense of the humanitarian community that NCDs are an epidemic and need to be dealt with, but I am not sure we have … view of how this should be managed..." Management staff.

Several of the interviewed MSF management staff, both at project and country coordination level, questioned the sustainability of the current Irbid model. They characterised MSF's usual approach as providing a relatively short-term solution to a health care gap identified in a vulnerable population, with the eventual aim to either hand over to other actors, to ensure adequate, alternative services are available or to close down if a specific crisis has passed. Several suggested that, in designing future NCD chronic interventions, MSF should engage more closely with the pre-existing health system in order to facilitate a future exit strategy, while one advocated for MSF to build on the HIV service model, by maximising task sharing and decentralisation of care to community level. However, experienced management staff also discussed the MSF rationale for maintaining a vertical programme in Irbid, given that it served as an opportunity to "learn by doing" and to understand the essential components required for NCD care. Participants also acknowledged that operating in the context of a middle-income country with established systems, regulations and policies required a different type of engagement and negotiation with authorities compared with other contexts where MSF has traditionally worked.

Discussion

This mixed methods evaluation, guided by the RE-AIM framework, of a complex intervention providing primary level NCD care in a humanitarian setting has helped to characterise the implementation strategies, challenges and adaptations undertaken by the programme. Lessons learned will help improve the current programme and may serve to inform scale-up of similar services in Jordan or in humanitarian settings more broadly. The key findings and lessons learned are discussed under each RE-AIM domain, below:

Reach and Access: The MSF NCD Programme reached approximately 5.9% of the adult Syrian population with self-reported NCD diagnoses in Irbid governorate in 2017, and NCD risk factors and prevalence among enrolled patients reflected those among broader regional and Syrian refugee populations in Jordan (23,24,36,37). As in previous studies, our study highlighted the significant group of Syrian patients who struggled to meet the costs of accessing NCD care provided by other actors (23,25,38,39). The MSF household access survey reported that, in 2016, almost one quarter of surveyed adults with self-reported NCDs described not seeking services when needed, the principle barrier being cost. Among those who did seek care, half attended NGOs (most necessitating no direct payment), while almost a third attended the public sector, of whom 68.8% made direct out-of-pocket payments, averaging 34 US dollars per episode (29).

Affordability and accessibility were likely to have been further impacted by the 2018 change in Jordanian government policy to significantly increase MOH co-payments for Syrian refugees to "foreigner" levels, which was reversed in 2019 (25). A 2018 qualitative study of Syrian refugees with NCDs living in north and central Jordan described their response to this policy change, reporting a shift from seeking care from the public to the NGO sector (except in the case of emergencies or conditions not covered by NGOs). Indeed, the narrow selection of services available from NGOs (including MSF) and the high cost of public care, meant that the study participants visited multiple providers in attempting to create comprehensive

NCD care for themselves, which they found “burdensome, not only financially but physically and emotionally” (25). Their finding that the burden of indirect costs (transport, lost work time) potentially outweighed the benefits of free NGO-provided care echoed those of our study. MSF and other humanitarian actors may consider providing the cost of transport, and evaluating its impact, to encourage patients to continue regularly attending their services. An alternative may be to design more patient-centred services appropriate to the setting, either by minimising the number of facility-based contacts through the use of technology or community workers/volunteers or by providing “one stop shop” comprehensive primary care at a single visit.

In addition, exploring ways to expand coverage of NCD services to vulnerable populations and potentially reduce the cost of NCD service delivery e.g. through decentralisation and task sharing to nurses, may be relevant for humanitarian actors and the MOH. Depending on the specific context, and within the bounds of patient, provider and political acceptability and regulatory restrictions, reach and access could be improved by decentralising aspects of care to community level e.g. treatment monitoring via outreach workers or using mobile phone or wearable technology; adherence or support groups led by community workers or peers; or community-based prevention and sensitisation activities (40). Community based healthy living interventions and social network or peer support groups for people with diabetes have been introduced within programmes operated by UNRWA (the UN Relief and Works Agency for Palestinian refugees), other NGOs and the MoH in Jordan (41–44). Some have reported positively impacting intermediate clinical outcomes, such as weight and blood glucose levels. However, cost effectiveness, sustainability, acceptability or user experiences were not formally examined. UNRWA have also task shared some treatment monitoring and patient education activities to nurses, while other international humanitarian NGOs are currently evaluating the potential role that community volunteers could play in NCD awareness raising, treatment support and monitoring at community level in Jordan (personal communication). The recently published HOPE4 trial also demonstrated the benefits of a community-based package of care for hypertension in a non-humanitarian setting involving algorithm-guided management by non-physician health workers, supported by mobile-health technology, use of fixed-dose combination therapies and treatment supporters (45). This approach or training of clinical nurse specialists, who play a key role in chronic disease management in other settings, may be of interest to the MOH in developing primary-level NCD care in Jordan (46–48).

The lack of accessible, affordable and consistent secondary and tertiary referral pathways for NCD complications or non-target conditions described in our study has been referred to previously in the literature (39,49). The increasing demand and dwindling international funding for humanitarian crises means that this is unlikely to improve in the near future (50). For future NCD programme design, we recommend attempting to secure essential referral pathways (e.g. ophthalmology, cardiology, nephrology) that are acceptable, accessible and affordable for patients but acknowledge that these may not exist, especially in low-income countries with constrained health systems. Therefore, future implementation research must maximise the quality of care delivered at primary care level to reduce acute exacerbations and complications while exploring innovative approaches to the diagnosis and management of NCD complications within primary care (51).

Effectiveness: The programme achieved good intermediate clinical outcomes (blood pressure and blood glucose control) and these parameters improved with length of stay in the programme and as the programme matured. These findings are elaborated on in the related cohort analysis paper (28). A key finding was the need to improve rates and appropriateness of statin prescribing, especially for secondary prevention of cardiovascular disease, echoing the findings of an earlier evaluation of the programme's CVD risk management (52). A review of the programme's CVD secondary prevention prescribing and risk scoring practices is recommended, and consideration of the introduction of fixed dose combination drugs to boost statin prescribing. However, it should be noted that while the programme attained good intermediate clinical outcomes, we know little about the prevalence or outcomes of major complications, such as heart failure, ischaemic heart disease and peripheral vascular disease. This is partly because they are difficult to measure at primary care level, requiring equipment and trained personnel, but also because of the limited low-cost referral options for patients to receive such diagnoses at hospital level in Jordan (39,51).

Implementation: The impact of the war and refugee experience proved the key challenge to implementing and maintaining effective NCD care in the Syrian refugee population. This had profound implications for Syrian patients' ability to engage with the programme in terms of medication adherence, dietary and lifestyle advice, and affordability of access. A key lesson learned was that it is vital to ensure that specific, culturally-relevant mental health and psychosocial support are included as an integral part of primary level NCD services in humanitarian settings. Learning around the adaptations made to address this may be transferable to other settings, including the development of MPHSS services and introduction of the HLO social work role and specific referral criteria. Further development was planned by MSF, including the introduction of depression screening, additional group sessions and prescription of psychotropic medications and these warrant further evaluation.

Staff identified the need to adapt health education messaging to patients' constrained circumstances and to make it more effective by taking a more patient-centred, solution-focused approach. While there is no universally accepted definition of patient-centred care, it is linked to the concept of holism, which seeks to ensure that individual's needs are met with respect and responsiveness by providers (30). Other core components include use of the biopsychosocial approach to care, addressing broader patient needs, including psychological, social and financial, and promoting active collaboration with patients and families (53,54). Such an approach may help to address patients' frustration with the "siloed" nature of the MSF programme and reduce the burden of attending multiple providers, as discussed above.

The MSF NCD guideline reportedly covered most clinical scenarios that doctors encountered, but it had limitations. In the next revision of the MSF NCD guideline, we suggest that the global cardiovascular risk assessment approach could be emphasised and the complexities associated with poly-pharmacy (and de-prescribing), multi-morbidity, frailty and palliation could be further developed.

Maintenance: Self-reported medication adherence was extremely high, possibly due to social desirability bias. It may need to be further elucidated, particularly as some patients and staff described both

intentional and unintentional non-adherent behaviours (55). In addition, it must be noted that patients' healthcare seeking behaviour and tendency to access multiple providers and medication sources potentially influenced both adherence and prescribing safety. Doctors, pharmacists and adherence supporters should be aware of this phenomenon and address it in adherence counselling. As in other settings, adopting the model of concordance, individualising a multi-faceted treatment support approach, joint decision making with patients and formally involving treatment supporters may prove valuable here (56).

Adaptations to the model, reporting mechanisms and indicators developed within the Jordan programme to reflect the needs of a chronic disease programme would also be applicable in similar humanitarian settings. A key lesson learned was the need for a fit-for-purpose and actionable information system and the need to establish informative indicators without overburdening staff with data collection. In terms of adapting the current programme model, we suggest that, where appropriate, an algorithm-driven approach e.g. using fixed dose combination antihypertensive drugs, may facilitate task shifting to nurses, reduce pill burden and logistics and pharmacy workload in specific settings (45,57). We also advocate for research into how new technologies could increase access to and quality of NCD programmes in humanitarian settings, particularly for mobile or dispersed populations, such as using wearable technology and home or community-based disease monitoring, tele-medicine and decision support tools for clinical staff, or diagnosis facilitated by artificial intelligence and mobile phone applications (51,58).

The Jordanian regulatory environment and bureaucracy were reportedly a barrier to maintaining the programme, particularly the requirement for MSF to locally purchase medications rather than import them, which significantly added to programme costs. Since the interviews took place, the Jordanian government has introduced an online system for humanitarian agencies to access governmental departments. However, planning for the maintenance of this and other NCD programmes will need to take account of the high costs of medicines and human resources. The cost savings routes proposed in our related paper may also be relevant to other settings, such as using context-adapted procurement approaches and adjusting care models to reduce the frequency of facility-based review (26).

The participants' references to the vertical nature of the current MSF service in Irbid, questioning its sustainability and emphasising the need for a viable exit strategy reflect the nature of medical humanitarian action, its motivations and modes of operation. The key motivation is to rapidly bring healthcare to vulnerable or marginalised populations. However, different settings and contexts may call for different approaches, which range from implementing short-term emergency services or longer-term vertical programmes (which may serve to anchor the organisation in a specific crisis setting, or act as a "proof of concept" or training programme) or indeed to programmes integrated within pre-existing health systems. Since today most conflicts are protracted and forced displacement is prolonged, humanitarian interventions often last decades and involve close interaction with national health systems (15,59). In the case of chronic NCD care, many humanitarian actors recognise that integration within the existing health system, ideally at primary care level, may be the optimal approach (60). Moreover, integrating such services may provide an opportunity for health system strengthening, particularly in contexts where

constrained health systems have historically focussed on episodic emergency or infectious disease care and have limited capacity to provide chronic disease care (1,40,61). However, this potential blurring of the lines between humanitarian action and development must be balanced with the goal of rapidly reaching the most marginalised and vulnerable populations and with operational priorities.

Experience of using RE-AIM: There is also a lack of evidence describing the effectiveness of NCD care models in humanitarian settings and several authors have called for improvements in the evaluation of humanitarian programmes and their impact (3,8,9,62–64). RE-AIM allowed us to explore the programme in depth, addressing multiple clinical and programmatic outcomes that are important from the implementing organisations' perspective. We addressed the less than comprehensive use of the RE-AIM tool reported in reviews by including qualitative and costing components (11). Our qualitative component extended beyond the more typical inclusion of participant surveys and FGDs to also include SSIs with patients, providers and stakeholders. This rich explanatory qualitative data supplemented quantitative and costing data to provide greater insight into what worked, for whom and why.

Our experience highlights the challenges in retrospectively evaluating programmes in humanitarian settings, which tend to be highly responsive to changing contexts, and in using routinely collected data. For example, it was not feasible for us to include a comparator group or use a quasi-experimental design, such as interrupted time series, given the dynamic and unique nature of the programme. Designing indicators for this evaluation has helped MSF and other humanitarian organisations to develop a set of shared indicators for on-going NCD programme evaluation. However, a number of our indicators could not be measured since planned adaptation of routine data collection had not occurred, or the evaluation itself uncovered issues around the usability of the data being collected (e.g. smoking recorded in relation to the previous consultation and not to baseline). We, therefore, emphasise the need to co-develop indicators with implementers when designing an evaluation, which is particularly relevant when using routine programmatic data. Our evaluation differed from many previous RE-AIM evaluations in that it examined an intervention at a single site rather than one implemented by different provider types or locations and so we could comment in only a limited way on *participation* as it has been traditionally used. However, we explored programme *implementation* and *maintenance* at multiple levels – patient, provider and management – along with comprehensively exploring *reach, effectiveness and adoption/acceptance* using several subdomains.

Strengths and limitations

To the best of our knowledge this is the first study to comprehensively describe a mixed-methods evaluation of an NCD service in a humanitarian setting guided by the RE-AIM framework. It builds on our previous use of the framework in the Democratic Republic of Congo (6,7). We have demonstrated that implementation research can be carried out in a humanitarian setting, while placing limited burden on the implementing staff and patients. As discussed, this was a comprehensive use of the framework, addressing each of the domains and including more extensive qualitative and costing analyses than are usually employed in the RE-AIM literature (11). As is typical of evaluations in humanitarian settings, this

retrospective study was limited to a single clinical programme and did not have a control group for comparison. The dynamic nature of the programme and context did not allow for quasi-experimental designs such as interrupted time series analysis. Social desirability bias may have influenced results of the qualitative data and of the self-report medication adherence survey, which was mainly administered by the data collectors rather than by patients as intended.

We recommend that future research should focus on elucidating programme impact, where possible, using methods such as causal inference frameworks, prospective interrupted time series analyses and should use longer study durations to examine hard outcomes, such as cardiac events and deaths. Further exploration of quality, utilising patient quality of life and satisfaction outcomes, would also be useful, as would patient-level costing studies, examining direct and indirect patient costs. As discussed, there is a need to design and evaluate streamlined NCD programme models in humanitarian settings, including elements such as task sharing, decentralisation to the community, reduced frequency of facility contact and use of fixed-dose combination drugs. Designing and evaluating novel ways to improve access to diagnosis and management of NCD complications at primary care level is also essential, which could include use of telemedicine, mobile technology or artificial intelligence-supported diagnosis or clinical decision tools.

Conclusion

RE-AIM has proven a valuable tool to guide the evaluation of a complex intervention in a protracted humanitarian crisis setting. The MSF programme was perceived as highly acceptable to patients, staff and stakeholders. It was accessible and affordable for the programme's cohort of enrolled patients, while achieving good clinical outcomes. However, the programme had limited reach and the current model was both costly and complex and therefore challenging for other actors to emulate or to translate to other, more financially constrained-settings. We propose that simplification of the care model, reduction of costs and use of technology could improve effectiveness and efficiency without reducing acceptability and may improve transferability to other settings.

Abbreviations

BP Blood Pressure

BMQ Beliefs About Medicines Questionnaire

COPD Chronic Obstructive Pulmonary Disease

CVD Cardiovascular Disease

DM Diabetes Mellitus

FBS Fasting blood sugar

FGD Focus Group Discussion

HbA1c Glycosylated haemoglobin

HE Health Education

HLO Humanitarian Liaison Officer

HTN Hypertension

INT$ International Dollars

JHAS Jordan Health Aid Society

LMIC Low- And Middle-Income Countries

MARS-5 Medication Adherence Report Scale-5 item

MENA Middle East and North Africa

MOH Ministry of Health

MSF Médecins sans Frontières

MHPSS Mental Health & Psychosocial Support

NCD Non-Communicable Disease

NGO Non-Governmental Organisation

RE-AIM Reach, Effectiveness, Adoption, Implementation and Maintenance

SMS Short Message Service

SSI Semi-Structured Interview

UNHCR United Nations High Commissioner for Refugees

UNRWA UN Relief and Works Agency for Palestinian Refugees

WHO World Health Organization

Declarations

Ethics approval and consent to participate: The Médecins sans Frontières Ethics Review Board, the London School of Hygiene and Tropical Medicine Ethical Review Committee [Reference 12239] and the Jordanian Ministry of Health granted ethical approval for conduct of this study.

Consent for publication: Informed written consent to participate in the study and for publication was obtained from participants in the qualitative and medicine adherence components of the study. Consent was not sought from patients for use of their de-identified, routinely collected clinical data for the cohort analysis or clinical audit study components.

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request, with the permission of Médecins sans Frontières and under a data sharing agreement.

Competing interests: The authors declare they have no competing interests.

Funding: Médecins sans Frontières funded this work through a research fellowship grant awarded to EA. Several of the authors are employed by Médecins sans Frontières and were involved in study design, data collection, data interpretation and drafting of the manuscript.

Authors' contributions: EA, KJ, BR, PP, KB, MT were involved in conception and/or design of the study; EA and JQ collected the data and EA, KJ, BR, PP, JQ were involved in data interpretation; EA drafted the paper with contribution from KJ, BR, PP. All authors read and approved the final manuscript.

Acknowledgements: The authors gratefully acknowledge and extend our thanks to the staff and patients of the MSF Irbid NCD Programme who participated in the study, the MSF staff who supported and contributed to the study at headquarters, mission and field levels and the data collectors involved in clinical audit, qualitative and medication adherence survey data collection, especially Dr Sara Ellithy.

References

1. Jobanputra K, Boulle P, Roberts B, Perel P. Three Steps to Improve Management of Noncommunicable Diseases in Humanitarian Crises. PLOS Med [Internet]. 2016 Nov 8 [cited 2017 Nov 28];13(11):e1002180. Available from: http://dx.plos.org/10.1371/journal.pmed.1002180
2. Aebischer Perone S, Martinez E, Du Mortier S, Rossi R, Pahud M, Urbaniak V, et al. Non-communicable diseases in humanitarian settings: Ten essential questions. Confl Health [Internet]. 2017 [cited 2018 Apr 23];11(1):17. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28932259
3. Ruby A, Knight A, Perel P, Blanchet K, Roberts B. The Effectiveness of Interventions for Non-Communicable Diseases in Humanitarian Crises: A Systematic Review. Shimosawa T, editor. PLoS One [Internet]. 2015 Sep 25 [cited 2017 Nov 28];10(9):e0138303. Available from: http://dx.plos.org/10.1371/journal.pone.0138303
4. Miranda JJ, Kinra S, Casas JP, Davey Smith G, Ebrahim S. Non-communicable diseases in low- and middle-income countries: context, determinants and health policy. Trop Med Int Health [Internet]. 2008 Oct [cited 2016 Jun 25];13(10):1225–34. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18937743

5. Ebrahim S, Pearce N, Smeeth L, Casas JP, Jaffar S, Piot P. Tackling non-communicable diseases in low- and middle-income countries: is the evidence from high-income countries all we need? PLoS Med [Internet]. 2013 Jan 29 [cited 2016 Mar 26];10(1):e1001377. Available from: http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001377
6. 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 [Internet]. 2017 Jun 23 [cited 2017 Dec 3];17(1):431. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28645279
7. Ansbro ÉM, 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 [Internet]. 2019 Nov 24 [cited 2019 Dec 9];9(11):e030176. Available from: http://www.ncbi.nlm.nih.gov/pubmed/31767582
8. Blanchet K, Ramesh A, Frison S, Warren E, Hossain M, Smith J, et al. Evidence on public health interventions in humanitarian crises. Lancet (London, England) [Internet]. 2017 Nov 18 [cited 2019 Aug 9];390(10109):2287–96. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28602563
9. Buttenheim, Allison. Impact Evaluation In The Post-Disaster Setting: A Conceptual Discussion In The Context Of The 2005 Pakistan Earthquake. 3ie Publ [Internet]. 2009 Dec 15 [cited 2019 Apr 25]; Available from: https://ideas.repec.org/p/ris/iiierp/0000_000.html
10. Reach Effectiveness Adoption Implementation Maintenance (RE-AIM) | Virginia Tech [Internet]. [cited 2016 Apr 23]. Available from: http://www.re-aim.hnfe.vt.edu/
11. Harden SM, Gaglio B, Shoup JA, Kinney KA, Johnson SB, Brito F, et al. Fidelity to and comparative results across behavioral interventions evaluated through the RE-AIM framework: a systematic review. Syst Rev. 2015;4.
12. Gaglio B, Shoup JA, Glasgow RE. The RE-AIM Framework: A Systematic Review of Use Over Time. Am J Public Health [Internet]. 2013 Jun [cited 2019 Aug 23];103(6):e38–46. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23597377
13. Glasgow RE, Estabrooks PE. Pragmatic Applications of RE-AIM for Health Care Initiatives in Community and Clinical Settings. Prev Chronic Dis [Internet]. 2018 Jan 4 [cited 2019 Aug 21];15:170271. Available from: http://www.cdc.gov/pcd/issues/2018/17_0271.htm
14. Glasgow RE, Harden SM, Gaglio B, Rabin B, Smith ML, Porter GC, et al. RE-AIM Planning and Evaluation Framework: Adapting to New Science and Practice With a 20-Year Review. Front Public Heal [Internet]. 2019 Mar 29 [cited 2019 Aug 21];7:64. Available from: https://www.frontiersin.org/article/10.3389/fpubh.2019.00064/full
15. UNHCR. UNHCR Global Trends 2018 [Internet]. Geneva. 2019 [cited 2019 Jul 1]. Available from: https://www.unhcr.org/uk/statistics/unhcrstats/5d08d7ee7/unhcr-global-trends-2018.html
16. WHO. WHO | Noncommunicable diseases country profiles 2011 [Internet]. Geneva: World Health Organization; 2011 [cited 2016 Apr 23]. Available from: http://www.who.int/nmh/countries/2011/en/
17. WHO | Noncommunicable diseases country profiles 2018. WHO [Internet]. 2018 [cited 2019 Oct 7]; Available from: https://www.who.int/nmh/publications/ncd-profiles-2018/en/

18. UNHCR. Syria Regional Refugee Response - Jordan - Inter-agency Information Sharing Portal [Internet]. [cited 2016 Dec 16]. Available from: http://data.unhcr.org/syrianrefugees/country.php?id=107
19. IFRC. World Disasters Report 2012: Focus on Forced Migration and Displacement. [Internet]. Geneva; 2012. Available from: http://www.ifrcmedia.org/assets/pages/wdr2012/
20. UNHCR. Syria Regional Refugee Response - Regional Overview [Internet]. [cited 2016 Apr 23]. Available from: http://data.unhcr.org/syrianrefugees/regional.php
21. Doocy S, Lyles E, Akhu-Zaheya L, Oweis A, Al Ward N, Burton A. Health Service Utilization among Syrian Refugees with Chronic Health Conditions in Jordan. Wang Y, editor. PLoS One [Internet]. 2016 Apr 13 [cited 2016 Dec 21];11(4):e0150088. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27073930
22. Akik C, Ghattas H, Mesmar S, Rabkin M, El-Sadr WM, Fouad FM. Host country responses to non-communicable diseases amongst Syrian refugees: a review. Confl Health [Internet]. 2019 Dec 22 [cited 2019 Jul 5];13(1):8. Available from: https://conflictandhealth.biomedcentral.com/articles/10.1186/s13031-019-0192-2
23. Rehr M, Shoaib M, Ellithy S, Okour S, Ariti C, Ait-Bouziad I, et al. Prevalence of non-communicable diseases and access to care among non-camp Syrian refugees in northern Jordan. Confl Health. 2018 Jul;12.
24. Doocy S, Lyles E, Roberton T, Akhu-Zaheya L, Oweis A, Burnham G. Prevalence and care-seeking for chronic diseases among Syrian refugees in Jordan. BMC Public Health [Internet]. 2015 [cited 2016 Jun 18];15:1097. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26521231
25. McNatt ZZ, Freels PE, Chandler H, Fawad M, Qarmout S, Al-Oraibi AS, et al. “What’s happening in Syria even affects the rocks”: a qualitative study of the Syrian refugee experience accessing noncommunicable disease services in Jordan. Confl Health [Internet]. 2019 [cited 2019 Jul 10];13:26. Available from: http://www.ncbi.nlm.nih.gov/pubmed/31210780
26. Ansbro É, Garry S, Karir V, Reddy A, Jobanputra K, Fardous T, et al. Delivering a primary level NCD programme for Syrian refugees and the host population in Jordan: a descriptive costing study. Submitt Manuscr.
27. Maconick L, Ansbro ÉM, Ellithy S, Jobanputra K, Tarawneh M, Roberts B. “To die is better for me”, social suffering among Syrian refugees at an NCD clinic in Jordan: a qualitative study”. Submitt Manuscr.
28. Ansbro É, Homan T, Prieto-Merino D, Jobanputra K, Quasem J, Muhammad S, et al. Clinical outcomes in a primary level non-communicable disease programme for Syrian refugees and the host population in Jordan: a retrospective cohort analysis using routine data. Submitt Manuscr. 2019;
29. Rehr M, Shoaib M, Ellithy S, Okour S, Ariti C, Ait-Bouziad I, et al. Prevalence of non-communicable diseases and access to care among non-camp Syrian refugees in northern Jordan. Confl Health [Internet]. 2018 Dec 11 [cited 2018 Jul 19];12(1):33. Available from: https://conflictandhealth.biomedcentral.com/articles/10.1186/s13031-018-0168-7

30. Situation Syria Regional Refugee Response [Internet]. [cited 2018 Oct 11]. Available from: https://data2.unhcr.org/en/situations/syria/location/36
31. Jobanputra K. Non-communicable Diseases: Programmatic and clinical guidelines [Internet]. 2016. Available from: hdl.handle.net/10144/618783
32. Brooks J, McCluskey S, Turley E, King N. The Utility of Template Analysis in Qualitative Psychology Research. Qual Res Psychol [Internet]. 2015 Apr 3 [cited 2017 Nov 16];12(2):202–22. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27499705
33. Nowell LS, Norris JM, White DE, Moules NJ. Thematic Analysis. Int J Qual Methods [Internet]. 2017 Dec 2 [cited 2018 May 2];16(1):160940691773384. Available from: http://journals.sagepub.com/doi/10.1177/1609406917733847
34. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Heal Care [Internet]. 2007 Sep 16 [cited 2018 May 2];19(6):349–57. Available from: https://academic.oup.com/intqhc/article-lookup/doi/10.1093/intqhc/mzm042
35. UNHCR. Situation Syria Regional Refugee Response [Internet]. UNHCR. 2018 [cited 2018 Mar 22]. Available from: https://data2.unhcr.org/en/situations/syria/location/44
36. Rahim HFA, Sibai A, Khader Y, Hwalla N, Fadhil I, Alsiyabi H, et al. Non-communicable diseases in the Arab world. Lancet [Internet]. 2014 Jan [cited 2016 Jun 26];383(9914):356–67. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0140673613623831
37. Maziak W, Nakkash R, Bahelah R, Husseini A, Fanous N, Eissenberg T. Tobacco in the Arab world: old and new epidemics amidst policy paralysis. Health Policy Plan [Internet]. 2014 Sep 1 [cited 2018 May 4];29(6):784–94. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23958628
38. Doocy S, Lyles E, Roberton T, Akhu-Zaheya L, Oweis A, Burnham G. Prevalence and care-seeking for chronic diseases among Syrian refugees in Jordan. BMC Public Health [Internet]. 2015 [cited 2016 Jun 18];15:1097. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26521231
39. Akik, C; Ghattas, H; Mesmar, S; Rabkin, M; El-Sadr, WM; Fouad F. Host country responses to non-communicable diseases amongst Syrian refugees: A review. Confl Health. (in press).
40. Rabkin M, Zenebe M, Bruce K, Ahmed R, Koler A, Tadesse Y. Strengthening health systems for chronic care: leveraging HIV programs to support diabetes services in Ethiopia and Swaziland. J Trop Med. 2012;137460.
41. UNRWA and Microclinic International partner to fight diabetes epidemic among Palestine refugees | UNRWA [Internet]. [cited 2019 Sep 20]. Available from: https://www.unrwa.org/newsroom/press-releases/unrwa-and-microclinic-international-partner-fight-diabetes-epidemic-among
42. Zoughbie DE, Rushakoff JA, Watson KT, Bui N, Ireifij A, Farraj RS, et al. A social-network behavioral health program on sustained long-term body weight and glycemic outcomes: 2-year follow-up of a 4-month Microclinic Health Program in Jordan. Prev Med reports [Internet]. 2019 Mar [cited 2019 Sep 20];13:160–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30596007

43. Abu Kishk N, Shahin Y, Mitri J, Turki Y, Zeidan W, Seita A. Model to improve cardiometabolic risk factors in Palestine refugees with diabetes mellitus attending UNRWA health centers. BMJ Open Diabetes Res Care [Internet]. 2019 Aug 18 [cited 2019 Sep 20];7(1):e000624. Available from: http://drc.bmj.com/lookup/doi/10.1136/bmjdrc-2018-000624
44. Hyatt L. Tackling non-communicable disease among Syrian refugees and vulnerable host communities in Jordan. F Exch - Emerg Nutr Netw ENN [Internet]. 2017;(54):69–72. Available from: http://files.ennonline.net/attachments/2592/FEX-54-Web_FEB-2017-SHARE.pdf
45. Schwalm J-D, McCready T, Lopez-Jaramillo P, Yusoff K, Attaran A, Lamelas P, et al. A community-based comprehensive intervention to reduce cardiovascular risk in hypertension (HOPE 4): a cluster-randomised controlled trial. Lancet (London, England) [Internet]. 2019 Oct 5 [cited 2019 Oct 24];394(10205):1231–42. Available from: http://www.ncbi.nlm.nih.gov/pubmed/31488369
46. Murrells T, Ball J, Maben J, Ashworth M, Griffiths P. Nursing consultations and control of diabetes in general practice: a retrospective observational study. Br J Gen Pract [Internet]. 2015 Oct 1 [cited 2019 Sep 26];65(639):e642-8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26412840
47. Wilkinson J, Carryer J, Adams J. Evaluation of a diabetes nurse specialist prescribing project. J Clin Nurs [Internet]. 2014 Aug [cited 2019 Sep 26];23(15–16):2355–66. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24354543
48. Riordan F, McHugh SM, Murphy K, Barrett J, Kearney PM. The role of nurse specialists in the delivery of integrated diabetes care: a cross-sectional survey of diabetes nurse specialist services. BMJ Open [Internet]. 2017 Aug 11 [cited 2019 Sep 26];7(8):e015049. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28801394
49. Spiegel P, Khalifa A, Mateen FJ. Cancer in refugees in Jordan and Syria between 2009 and 2012: Challenges and the way forward in humanitarian emergencies. Vol. 15, The Lancet Oncology. 2014.
50. Spiegel PB. The humanitarian system is not just broke, but broken: recommendations for future humanitarian action. Lancet (London, England) [Internet]. 2017 Jun 7 [cited 2019 Dec 20];0(0). Available from: http://www.ncbi.nlm.nih.gov/pubmed/28602562
51. Ansbro É, Perel P. At the heart of the conflict. Heart [Internet]. 2019 Jun 1 [cited 2019 Jun 12];heartjnl-2019-315010. Available from: http://www.ncbi.nlm.nih.gov/pubmed/31154428
52. Collins DRJ, Jobanputra K, Frost T, Muhammed S, Ward A, Shafei AA, et al. Cardiovascular disease risk and prevention amongst Syrian refugees: mixed methods study of Médecins Sans Frontières programme in Jordan. Confl Health [Internet]. 2017 Dec 17 [cited 2017 Nov 27];11(1):14. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28725259
53. Stewart M. Towards a global definition of patient centred care. BMJ [Internet]. 2001 Feb 24 [cited 2018 Oct 12];322(7284):444–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11222407
54. Cloninger CR. Person-centred integrative care. J Eval Clin Pract [Internet]. 2011 Apr [cited 2018 Oct 12];17(2):371–2. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21087371
55. Horne R, Weinman J. Patients' beliefs about prescribed medicines and their role in adherence to treatment in chronic physical illness. J Psychosom Res [Internet]. 1999 Dec [cited 2017 Jan

16];47(6):555–67. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10661603

56. Nguyen T-M-U, La Caze A, Cottrell N, Organization WH, Sokol M, McGuigan K, et al. Validated adherence scales used in a measurement-guided medication management approach to target and tailor a medication adherence intervention: a randomised controlled trial. BMJ Open [Internet]. 2016 Nov 30 [cited 2017 Jan 9];6(11):e013375. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27903564
57. Huffman MD, Xavier D, Perel P. Uses of polypills for cardiovascular disease and evidence to date. Lancet (London, England) [Internet]. 2017 Mar 11 [cited 2018 May 21];389(10073):1055–65. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28290995
58. 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 [Internet]. 2019 Mar 13 [cited 2019 Apr 23];0(0). Available from: http://www.ncbi.nlm.nih.gov/pubmed/30878268
59. Spiegel PB, Checchi F, Colombo S, Paik E. Health-care needs of people affected by conflict: future trends and changing frameworks. Lancet (London, England) [Internet]. 2010 Jan 23 [cited 2018 May 5];375(9711):341–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20109961
60. Aebischer Perone S, Martinez E, Du Mortier S, Rossi R, Pahud M, Urbaniak V, et al. Non-communicable diseases in humanitarian settings: Ten essential questions. Confl Health. 2017 Sep;11.
61. Rabkin M, Fouad FM, El-Sadr WM. Addressing chronic diseases in protracted emergencies: Lessons from HIV for a new health imperative. Global Public Health. 2016.
62. Puri J, Aladysheva A, Iversen V, Ghorpade Y, Brück T. Can rigorous impact evaluations improve humanitarian assistance? J Dev Eff [Internet]. 2017 Oct 2 [cited 2019 Apr 24];9(4):519–42. Available from: https://www.tandfonline.com/doi/full/10.1080/19439342.2017.1388267
63. Blanchet K, Sistenich V, Ramesh A, Frison S, Warren E, Smith J, et al. An evidence review of research on health interventions in humanitarian crises. An Evid Rev Res Heal Interv Humanit Cris. 2015;266-pp.
64. 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;8587(19):30082–8.

Tables

Table 1. Main indicators and data method/source based on the RE-AIM domains

Objective / Domain (Questions)	Sub-Domain	Indicator	Methods (a methodology may feature under several headings)
Reach Does the programme reach its target population?	Coverage	Number people among the target population eligible for programme Number served by the programme Representativeness of those reached Prevalence of NCD and MH comorbidity; eligibility for MHPSS services; numbers referred/receiving care; representativeness of those reached	Existing MSF cross-sectional survey ^ Routine cohort data Qualitative data
“Effectiveness”/ Quality of Care What are the trends in clinical outcomes and quality indicators of the programme? What are the perceived benefits/unintended consequences from a patient and provider perspective?	Clinical Outcomes	No./% HTN patients with most recent BP <= 140/90, 6 & 12 months post enrolment and trend from baseline* No./% of DM patients with most recent BP <= 140/90, 6 & 12 months post enrolment and trend from baseline* No./% of patients with diabetes with last HbA1c < 8.0 % 6 & 12 months post enrolment and trend from baseline* No./% with cholesterol reduction >= 0.5 mmol/L from baseline at 6 and 12 months post enrolment No./% of patients with asthma / COPD free from exacerbations/ admissions in previous 6 months No./% of patients who report decreased/quitting smoking	Routine cohort data Qualitative data

		No./% of patients who report increased levels of exercise from baseline Trend in referrals to another facility for acute complications/specialist care	
	Quality Indicators	Proportion of referrals to other services that are appropriate per guideline No./% active¶ CVD patients prescribed a statin No./% active¶ CVD patients prescribed aspirin No./% active¶ CVD patients prescribed at least one anti-hypertensive No./% COPD/ asthma patients with inhaler technique check documented No./% appropriate clinical action taken based on clinical/ laboratory findings Trend in defaulters* as a proportion of active cohort during reporting period Description of cohort deaths (patient characteristics)	Clinical audit Routine cohort data
	Perceived Effectiveness	Patients' and providers' perspectives on effectiveness of programme components (clinical review, medications, HE, HLO, MHPSS, HV)	Qualitative data
Adoption/ acceptance	Accessibility/ acceptability	Duration and frequency of NCD service and components Staff (e.g. ratio of staff per patient)	Routine cohort data Qualitative data Self-report medication adherence questionnaire

		Structures and tools	
Is the MSF model of NCD care accessible and acceptable to patients, providers, organisation and community? Is the MSF NCD guideline acceptable to staff?		Treatment continuity/rupture Staff and patient perceptions of availability and accessibility / barriers to access of service components (clinical review, HE, HLO, MHPSS, HV) Staff perspectives on acceptability/usability of NCD guideline Key stakeholder views on acceptability/accessibility MSF NCD programme Self-reported medication adherence levels and medication beliefs	
	Adoption/participation	Description of intervention location, cadres of staff and qualifications; inclusion/exclusion criteria of staff/settings delivering service Sources & perception of information/support Experience of receiving and providing NCD care, use of clinical guideline How participation influenced patient/staff well-being and/or work practices	Routine cohort data Qualitative data
Implementation To what extent was the intervention delivered as intended?	Fidelity of programme delivery (Process Indicators; indicators in bold also reflect quality of medical care)	Extent to which clinical guideline delivered as intended: No./% of eligible patients with HTN with annual FBS performed during the reporting period No./% of eligible patients with diabetes that have had an annual foot check/ eye check performed during the reporting period	Clinical audit Routine cohort data

What are the facilitators and barriers to implementing the programme from a patient, provider and programmatic perspective? What are the essential components and adaptations necessary to delivering an NCD service in this setting? What are the start-up and incremental costs of delivering such a service?		No./% of DM patients that have micro-albuminuria or urinary protein testing during the reporting period No./% of DM patients on ACE inhibitor (ACEi) with creatinine testing during the reporting period No./% asthmatics and COPD with control review (spirometry or clinical) during the reporting period No./% of active cohort attending a health education session at last clinical visit within reporting period No. of MHPSS group sessions taking place monthly during reporting period No./% of referred patients attending MHPSS individual counselling sessions No./% of times when clinical action taken based on clinical or laboratory findings according to guideline	
	Adaptations	NCD care adaptations to the local setting (e.g. cultural adaptations; dietary and exercise, smoking advice) Programme adaptations related to humanitarian setting e.g. response to patients' psychosocial needs	Qualitative data
	Cost	Staff time Capital and recurrent implementation costs [#]	Qualitative data Medicine/supply/ staff costs[#] Staff time estimates[#]
		No./% patients active[¶] 6	Routine cohort data

Maintenance What are the challenges and facilitators for patients to remain in the programme? What are the costs involved in maintaining the programme? What are the programmatic challenges and adaptations made to maintain the programme?	Individual Level	months post enrolment * No. medications and daily pill count at last consultation Self-reported medication adherence rates and medication beliefs <u>Qualitative measure of individual-level maintenance:</u> · Key challenges in maintaining medical treatment (including medication concordance) · Key challenges in altering lifestyle (diet, exercise, smoking) · Key mental health/ psychosocial challenges · Types of support available and strengths and challenges of the support (health education, MHPSS, HLO, family and community support)	Clinical Audit Qualitative data Medicine/supply/staff costs[#] Staff time estimates Self-report medication adherence questionnaire
	Organisational Level	Measures of cost of maintenance[#] Institutionalisation of the programme/modifications made for maintenance Alignment with organisational mission	

Key: ACEi=angiotensin converting enzyme inhibitor; BP=blood pressure; COPD=chronic obstructive pulmonary disease; CVD=cardiovascular disease; FBS=fasting blood sugar; HLO=humanitarian liaison officer; HV= home visit; MHPSS=mental health and psychosocial support; NCD=non-communicable disease. ^ The methods and results pertaining to these indicators are reported in Rehr et al (29). * The methods and results pertaining to these indicators are reported in our linked paper (28). [#] The methods and results pertaining to these indicators are reported in our linked paper (26). [¶] Active patients referred to those that have continued to attend the service and have not exited (i.e. died, departed the area or defaulted (i.e. have not attended for more than 90 days since their last planned appointment)

Table 2. Effectiveness Indicator Results

a. Clinical Outcome Indicators	**Result or Comment**
No./% with ≥ reduction of 0.5 mmol/L in total cholesterol from enrolment to last visit, among those in the cohort at least 90 days	Among those with a cholesterol test who were in the cohort for at least 90 days (2585), 651 had ≥ reduction of 0.5 mmol/L in total cholesterol = 25.1%
No./% of patients with asthma free from exacerbations/ admissions in the previous 6 months	Among 382 patients with asthma, 25 recorded exacerbations in total during the study period.
No./% of patients who report decreased/quitting smoking within reporting period	Not available as self-reported smoking category (stopped, decreased, increased, resumed, unchanged) is only reported relative to the last appointment.
No./% of patients who report increased levels of exercise from baseline during reporting period	Per visit the category (active, inactive, moderately active, and moderately inactive) for activity behaviour was recorded. 3347 patients enrolled in the project at least 90 days had a first and last measurement. 610 (18.2%) had improved activity. 593 (17.7%) had worse activity. 2144 (64.1%) stayed stable. There was no significant improvement (chi sq =0.284, p=0.594).
Trend in recommended referrals to another facility for acute complications/specialist care, as a proportion of active cohort	Trend in referral by type of referral service and volume of referrals were analysed
b. Process Indicators	
Proportion of recommended referrals to other services that are appropriate as per guideline	Not tested
No./% of active patients with CVD* prescribed a statin during reporting period	N = 369 (25.8%)
No./% of patients with CVD* prescribed aspirin during reporting period	N = 717 (50.1%)
No./% of patients with CVD* prescribed at least one anti-hypertensive^ during reporting period	N = 1007 (70.4%)
No./% of patients with asthma# with inhaler technique check documented	N=48 (94%)
No./% of times when appropriate clinical action taken based on clinical or laboratory findings according to guideline (e.g. was a statin prescribed correctly according to CVD risk score documented in patient file?)	Among 130 randomly audited diabetic patient files, 100% had cholesterol ever checked and 73.8% (n=82) had a CVD risk score subsequently calculated. Of these, 65.9% had a statin correctly prescribed (or not prescribed) in accordance with the MSF guideline&.
Description of cohort deaths	2.6% (n=136) of enrolled patients died by the end of the study

	period. Deaths were determined by word of mouth and following a defaulter survey, which showed that deaths among exited∞ patients were significantly higher at 9.3% (139 of 1489 exited patients).

* 1431 patients with new or established CVD were ever enrolled during the study period

^ Including: any of amlodipine, atenolol, bisoprolol, enalapril, hydrochlorothiazide, valsartan; excluding: exclusively frusemide or spironolactone

#Among 51 asthma patients randomly selected for clinical audit

& Technically, the MSF guideline did not require cholesterol testing to be performed before calculating a CVD risk score, but qualitative data confirmed most clinicians waited for cholesterol results before calculating it.

∞ Exited patients refers to those that were known to have died, were lost to follow up despite efforts to trace them or who had informed the team that they would no longer be attending the MSF service.

Table 3. Implementation Indicator Results

Indicator	Result or comment
Number / % of eligible patients with HTN with annual FBS performed during the reporting period	Not available (not calculated)
Number/ % of DM patients* that have had an annual eye check performed during the reporting period	Annual^ fundoscopy documented OR referred for retinal screening in 50.8%
Number / % of DM patients* that have micro-albuminuria or urinary protein testing during the reporting period	Annual^ Albumin creatinine ratio checked in 83.8%
Number / % of DM patients* on ACE inhibitor with creatinine testing during the reporting period	Annual^ creatinine check in 98.5%
Number / % of active cohort attending a health education session at last clinical visit within reporting period	66.9%&
Number of MHPSS group sessions taking place monthly during reporting period	Average 5.5 per month in 2016 and 2017
Number/ % of referred patients attending MHPSS individual counselling sessions	Not available as numbers of internal MHPSS referrals made was not captured
Number/% of follow-up consultations performed by nurses	6% in 2017

*Among 130 randomly selected diabetic patients' charts analysed for the clinical audit

^ Annual referred to the 12 months preceding their most recent appointment

[&]Among patients active in 2017 (n= 4011)

Key: ACE=angiotensin-converting enzyme; FBS=fasting blood glucose; HTN=hypertension; MHPSS=mental health and psychosocial support;

Supplementary Files

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

- SupplementaryMaterialS4.docx
- SupplementaryMaterialS3.docx
- SupplementaryMaterialS2.docx
- SupplementaryMaterialS1.docx