

# Setting up a nurse-led model of care for management of Hypertension and Diabetes Mellitus in a high HIV prevalence context in rural Zimbabwe: a descriptive study

**Marthe Marie Frieden** (✉ [marthefrieden@gmail.com](mailto:marthefrieden@gmail.com))

Medecins Sans Frontieres <https://orcid.org/0000-0002-4935-5254>

**Blessing Zamba**

Zimbabwe Ministry of Health and Child Care

**Nisbert Mukumbi**

Medecins sans Frontieres

**Patron Titsha Mafaune**

Zimbabwe Ministry of Health and Child Care

**Brian Makumbe**

Ministry of Health and Child Care

**Elizabeth Irungu**

Medecins Sans Frontieres

**Virginia Moneti**

MEDECINS SANS FRONTIERES

**Petros Isaakidis**

Medecins Sans Frontieres

**Daniela Garone**

Medecins Sans Frontieres

**Madhu Janina Prasai**

Medecins Sans Frontieres

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## Research article

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# Abstract

**Background** In light of the increasing burden of non-communicable diseases on health systems in low- and middle-income countries, particularly in Sub-Saharan Africa, context adapted cost effective service delivery models are now required as a matter of urgency. Multiple models have thus been trialled across Africa with varying degrees of success. Zimbabwe is a low-income country with unique socio-economic challenges but similar dual disease burden of infectious chronic diseases such as HIV and non-communicable diseases. We aim to describe the experience of setting up and organising a nurse-led Diabetes Mellitus (DM) and Hypertension (HTN) model of care in a rural context of a low-income country from July 2016 to June 2019.

**Methods** A descriptive study based on a conceptual framework successfully applied in the roll-out of antiretroviral therapy in Manicaland Province, Zimbabwe. Attempting to mirror the HIV experience, we describe the key enablers in the design and implementation of the model: decentralization of services, integration of care, simplification of management guidelines, mentoring and task-sharing, provision of affordable medicines, quality assured laboratory support, patient empowerment, a dedicated monitoring and evaluation system, and a robust referral system.

**Results** 11 out of 51 health facilities were selected in Chipinge district, of which nine were primary health care (PHC) clinics and two were hospitals. DM/HTN services were set up and integrated into the general out-patient department or pre-existing HIV clinics. In one hospital, an integrated chronic care clinic was established. Through structured intensive mentoring, including simplified protocols, nurses in seven PHC facilities and one hospital developed sufficient knowledge and skills to diagnose, initiate treatment and monitor DM/HTN patients. Overall, more than 3000 patients were registered in a dedicated recording system and offered education. Free medication with differentiated periodic refills and regular monitoring of blood pressure and/or blood glucose with the use of glycosylated haemoglobin were provided.

**Conclusion** Our experience shows that it is feasible to implement nurse-led decentralized integrated DM/HTN care in a high HIV prevalence rural, low-income context. Developing a context-adapted efficient model of care is a dynamic process.

## Introduction

The epidemic of Non Communicable Diseases (NCDs) in Sub-Saharan Africa (SSA), mainly cardiovascular diseases (CVD), cancer, diabetes mellitus (DM) and chronic lung disease, and its impact on existing health systems is increasingly being reported [1, 2]. The 'Global Burden of Disease study' identified hypertension (HTN), smoking, and diabetes mellitus (DM) as the leading risk factors for early death and disability globally [1]. In Zimbabwe, the overall pooled prevalence of HTN was 30% between 1997 and 2010 [3], while the prevalence of DM has been increasing significantly over the past three decades from 0.44% in 1980 to 5.7% in 2013 [4]. This additional load of patients with chronic conditions adds up to the burden of HIV that remains a continuing challenge towards efficient healthcare. Zimbabwe has a high HIV prevalence of 14% among adults 15 to 64 years [5]. Significant strides in the HIV program have resulted in a slow decline in HIV new infections, but increasing numbers of people are living longer with HIV and need lifelong chronic care [6].

These care recipients face a higher Antiretroviral Therapy (ART) related risk of developing metabolic syndrome, and HIV itself is a risk factor for developing DM and CVD [7]. Fourteen per cent of people living with HIV (PLHIV) currently suffer from at least one NCD, and this figure is expected to double by 2035 which will render patient management more complex [8].

Gold standard management guidelines for NCDs are based on western models e.g. USA, where multidisciplinary teams offer specialized, resource-intensive, individualized care to patients with NCDs. These are poorly adapted for low- and middle-income countries (LMIC). The doctor/patient ratio in SSA is about nine times lower than in the USA [9], with most doctors concentrated in urban areas. Nurses are the frontline workers at the closest point of entry into the health system for primary health care (PHC) level. These facilities offer mostly maternal and child health services, treatment of acute infections, and Tuberculosis/HIV services through user-friendly pathways. The concepts of protocol simplification and standardization are among the key-enablers for the successful rollout of ART coverage. Although the principle of adapting

lessons learned from the HIV experience to set up nurse-led NCD programs is widely recognized [10], there are significant gaps with regards to practical implementation of a public health approach to the management of NCDs e.g. policies, standard operation procedures, affordable medications, lab consumables and community involvement [11]. To our knowledge, no nurse-led NCD care models have been trialled in Zimbabwe and thus in an effort to cover this “know-do gap”, we set out to develop a potential care model for a Zimbabwean rural context.

Médecins Sans Frontières (MSF) has been supporting the Ministry of Health and Child Care (MOH) in Zimbabwe since 2004 to successfully roll out antiretroviral therapy (ART) to PHC facilities. In 2016, MSF together with MOH agreed to pilot a context-adapted model of care to address the double burden of DM and/or HTN (DM/HTN) and HIV in Manicaland, leveraging lessons learned from the successful ART scale up program.

The aim of this study is to describe the experience of designing and implementing a nurse-led model for the care of patients with DM/HTN, in a rural, low resource, high HIV prevalence context, and discuss how the health system responded to it.

## Methodology

### General study setting

The study took place in Chipinge, one of the seven districts of Manicaland in Zimbabwe. It has a population of over 300,000 served by 51 health facilities [12]. Chipinge District Hospital (CDH) is the major referral hospital for the North and St Peter’s Mission Hospital (SPMH) for the South. Reliable figures on NCD prevalence in Chipinge district have not been documented.

### Conceptual framework

Our study implementation was based on a conceptual framework [Figure 1] developed by the authors by drawing from MSF’s experience on HIV care in different settings, including SSA and more specifically in Zimbabwe. We were also inspired by various publications describing successful strategies used in delivering HIV care across the entire health pyramid [13-15]. The mid-section of the framework illustrates the health system. Patients within the community can access their PHC facility for acute or chronic care, and maternal and child health services, where they are attended to by qualified nurses. Where the condition requires expertise, patients are referred to secondary or tertiary health care levels.

Once patients are stable, they are then referred back through the various levels down to PHC level. The left-hand column highlights the nine strategic key-enablers of a successful HIV program while the right-hand column mirrors the same strategies for the NCD program.

Figure 1: Conceptual framework

### Decentralization

According to the national policy, diagnosis of DM/HTN is under the responsibility of doctors at hospital level, while refills of selected NCD medications can be given at PHC level. Our design was to extend DM/HTN services to PHC level to include management by nurses, without compromising the delivery of existing services.

The site selection process within Chipinge was done together by MSF and MOH. First, we excluded clinics in urban settings and hospitals other than the referral sites. Then, using a quantitative and qualitative evaluation process, rural clinics were scored and ranked according to a set of inclusion and exclusion criteria described in table 1. We limited the

choice to a maximum of eleven sites in line with available resources. Patients were enrolled between July 2016 and June 2019.

*Table 1: Criteria for site selection in Chipinge District*

Inclusion criteria	Exclusion criteria
Larger size of population served	Number of nurses < 2 per clinic
Larger size of ART cohort	Driving time from district capital to health facility > 90 minutes (one-way)
Higher number of documented cases of NCDs	High turnover of human resources
Higher number of nurses/clinics	Proximity to other possible selected clinics
Stronger recommendation of MOH	Receiving support from other NGOs

### Integration

At PHC level, the approach was to introduce DM/HTN care within the on-going day-to-day outpatient department (OPD) services. Amongst the ART cohorts, patients with DM/HTN comorbidity would be identified, have their files merged and appointment dates synchronized. At secondary care level, Integrated Chronic Care Clinics (ICCC) were to be set up as a ‘one stop shop’ for patients with chronic disease i.e. patients presenting with HIV, DM/HTN or a combination of the two.

### Simplification of guidelines

Learning from the ART program which used simplified clinical guidelines and treatment algorithms to ensure safe use at PHC, we intended to develop user-friendly standard operation procedures (SOPs) for the laboratory and the clinical management, adopted from evidence-based international guidelines and adapted to the context. This was intended to be a dynamic process involving regular reviews with technical support from internal and external specialists, and feedback from the actual users and recipients of the protocols.

### Mentoring and Task-sharing

On-the-job mentoring was our preferred strategy to achieve task-sharing of DM/HTN management between nurses and doctors. The mentors were provided by MSF in three categories: nurses, pharmacy technicians and doctors. The nurses were qualified Registered General Nurses (RGN, three-year diploma) trained on mentorship, with practical experience in mentoring HIV care. They underwent training in DM/HTN care using context-adapted guidelines and on-job training by MSF doctors. The doctors were general practitioners with significant experience in chronic disease management. Mentees under the MOHCC comprised of RGNs, Primary Care Nurses (18 months training), nurse aides and primary counsellors. A mentoring curriculum on organisation of services and DM/HTN care was developed linked to an evaluation grid to score competencies. Mentees would receive an initial theoretical training (one day), then, according to an established schedule, two mentoring teams visited the health facilities every one to two weeks. This on-the-job mentoring cycle was intended for three months, after which mentees would graduate and provide DM/HTN care with periodic on-

site and off-site decision support. In certain instances, an extra nurse would be added to the mentoring team to free the MOH nurse undergoing mentorship from her/his usual tasks. Mentoring involved (a) on-site group meetings with all MOH staff with case discussions and lectures on related topics, (b) side-by-side clinical decision support and/or counselling, (c) practical demonstrations on efficient service organization and pharmacy management practices. Review meetings were organized in clusters two times a year to analyse performance for a group of health facilities, and to exchange experience.

### **Equipment and quality assured laboratory support**

Equipment and laboratory support were facilitated by MSF including automated sphygmomanometers, and hand-held Glucometers (Glucoplus®) to quantify fasting blood sugar (FBS) or random blood sugar (RBS). Existing conventional laboratory-based biochemistry machines were to be used to measure creatinine, blood glucose and HbA1C respectively at hospital level. All HbA1C testing platforms were to be enrolled in a monthly External Quality Assurance (EQA) scheme. To ensure sample transport the existing integrated sample transport system was reinforced throughout the district.

### **Affordable medicines**

Choice of medications was a compromise between effectiveness, availability, affordability and user friendliness informed by the WHO essential drug list [16], the Zimbabwe national formulary [17] and international guidelines [18, 19]. To standardize treatment, medications were chosen, titrated upwards and different classes added step-wise in consecutive consultations based on clinical and laboratory results. Based on MSF principles, medicines and laboratory reagents were provided by MSF for free to all patients enrolled, with MOH contributing when available in their stocks. A component of advocacy was embedded in the pilot to lobby at facility, district, provincial, national and international levels for resource mobilization for DM/HTN medicines.

### **Patient empowerment**

This concept involved enabling patients to acquire the education and skills to understand and take responsibility for their own health. Individual and group counselling sessions for DM/HTN were to emphasise on knowledge about glycaemic and blood pressure (BP) control. An active decision not to prioritize defaulter tracing was taken as resources were scarce and we considered there was no public health danger contrary to contagious diseases such as HIV/TB. In the long run, we aim to differentiate services according to the needs of specific patient subgroups i.e. Differentiated Service Delivery (DSDs) models.

### **Dedicated monitoring and evaluation (M&E)**

On-site medical records inspired from the ART patient files were made available in all sites. The files accommodated both identification numbers for HIV and DM/HTN to enable health workers to identify patients with co-existent conditions and to synchronize appointments. We captured individualized patient information on Epidata version 4.6. A set of indicators for monitoring and evaluation, following the standard cohort approach used in HIV/TB control programs, were defined to measure service provision, case-enrolment, follow up, treatment results and retention in care. Data was collected and analysed quarterly with feedback to the sites for decision making. Internal evaluation support was provided bi-annually by an NCD technical referent.

### **Referral system**

The focus of this pilot was on decreasing referrals that could be avoided by capacitating nurses. Where the management of complex cases exceeded the limits of the care provider, context-adapted criteria were developed to timely identify these patients for consultation by a medical doctor on/off site.

## Results

### Decentralization, Mentorship and Task-sharing

Eleven out of 51 facilities comprising of nine rural PHC facilities and two referral hospitals were selected. Challenges for mentors were long travelling time to sites, high patient volume on arrival and chronic or relative human resource shortages. Seven out of nine PHC facilities reached dashboard indicators to diagnose, initiate treatment and monitor DM/HTN patients.

One out of two hospitals had established daily nurse-led DM/HTN services. Two PHC facilities and one hospital did not achieve autonomy in providing nurse-led DM/HTN care. By end of June 2019, more than 3000 ambulatory DM/HTN patients were enrolled.

### Integration

Integration of DM/HTN within the OPD was successful in eight PHC facilities. At one site, where there was a pre-existing separation of HIV and general OPD care, the natural tendency was to merge DM/HTN with HIV services. All sites offered consultations for HIV positive patients with DM/HTN by the same nurse at the same time. We managed to operationalize the ICCC concept only at SPMH. This was made possible by building additional infrastructure to the existing Opportunistic Infection (OI) clinic.

### Simplification/standardization of protocols

Context adapted standard protocols were in use across all sites. Any adult presenting at a health facility in Zimbabwe receives a blood pressure (BP) check, thereby automatically qualifying for enrolment if found to be hypertensive according to protocol. Among HIV patients annual screening for HTN is recommended [20]. For DM we adopted a health facility-based opportunistic screening approach according to risk factors. Treatment initiation threshold for patients with HTN-only was set at BP  $\geq 160/100$  in line with the WHO/ISH risk stratification [21] and standard MSF protocols. For diabetic patients with HTN, a lower threshold was chosen (BP  $\geq 140/90$ ). The goal of BP control was defined as BP  $< 140/90$  for patients  $< 65$  years, and BP  $< 150/90$  for patients  $\geq 65$  years. Those with self-reported conditions were enrolled and rescreened to confirm the diagnosis, if there was insufficient clinical or documentary evidence to support the accuracy of the initial diagnosis (Additional file 1). Diagnosis of DM was based upon a combination of two tests: glycosylated haemoglobin (HbA1c)  $\geq 6.5\%$  and a random blood sugar (RBS)  $\geq 11.1$  mmol/L, or a fasting blood sugar (FBS)  $\geq 7$  mmol/L. In the presence of severe symptoms of hyperglycaemia, a single high reading of blood glucose confirmed diagnosis. HbA1c targets were initially defined as  $< 8\%$  for  $< 65$  years, and  $< 9\%$  for  $\geq 65$  years. A unique target of  $< 8\%$  for all age-groups was set later within a rationale of simplification (Additional file 2).

### Patient Empowerment

Individual and group literacy/counselling sessions were offered. Three-monthly medication refills were set up for stable patients. At the time of writing this report, DSDs are emerging at community and health facility level.

### Laboratory

Initially the conventional laboratory-based platforms for HbA1c or creatinine were only available at the district hospital and there was high dependency on the sample transport system. The sample transport time was running two to three days from the farthest clinics, which could have interfered with the quality of the samples. The laboratory became overloaded and the result turnaround time was long. In 2018 point of care (POC) machines were provided for HbA1C (Fine Care®) and creatinine (Novastart®) measurement. More efficient guidelines for baseline and follow up testing to limit laboratory tests were worked out.

### **Dedicated M&E**

With specific and detailed patient records in place, nurses were able to quantify DM/HTN service demand and medication needs. The challenge was however incompleteness of data. A simplified chronic patient card was implemented in late 2018. We observed that minimizing the number of variables and storing the patient records close to the consultation area increased completeness of data.

## **Discussion**

### **Decentralisation**

This study describes the build-up of a nurse-led decentralized integrated model of care of DM/HTN in a rural high HIV prevalence context in Zimbabwe. Nurse-led models of care have been successfully implemented for NCD care throughout SSA [22-26]. In Zimbabwe, nurse-led chronic care experience has been drawn mainly from the HIV/ART scale up. Thus, responding to the call for context-adapted interventions to address the epidemic of NCDs, we set up this pilot to “learn by doing ” [27]and provide grass-root level lessons for program managers.

We set up DM/HTN care integrated at PHC level from the onset in 9 PHC facilities, linked to 2 referral hospitals. By following this natural design of the health system, we promoted comprehensive patient centred care in line with WHO’s PHC care approach [28]. Active screening in the community was avoided as this has been shown not to be cost-effective [10, 29], and among concerns that it might overload health facilities with patients. Not aiming for coverage, we focussed on 11 out of 51 sites selected, while Labhardt et al. in Cameroon provided decentralized, protocol-driven care by non-physician clinicians of DM/HTN in almost all clinics (69/75) in eight districts [24]. Our approach resulted in an immediate overwhelming demand in some sites by attracting patients from outside the coverage area.

Overcrowding was not stated by Labhardt et al. who actually reported a low number of patients recruited per trained non-physician clinician.

An alternative approach would have been to offer services at hospital level first, as was done in Malawi, and then decentralize services to PHC level and downstream refer stable patients. The authors report setting up a Chronic Care Clinics in two hospitals, but they experienced high defaulter rates and a slow enrolment growth prompting them to decentralize services later to eleven health centres [30]. The downstream referral process per se has the potential of losing patients in between health facilities as was experienced in the ART program [31]. From patients’ perspective, there are advantages to downstream referral such as improved access to services, savings in transport and time. However, patients have also reported concerns such as less comprehensive care, loss of established relationship with hospital staff, loss of doctor-based care and perceived poor service at the clinic [32]. We believe that DM/HTN care should be offered primarily at PHC level.

### **Integration**

Our aim was to search for the 'best fit' model for each facility, from integration of DM/HTN care into existing outpatient services to the development of chronic care clinics integrated with HIV services (ICCC). At SMPH, the ICCC model shown to be effective in Malawi [30] flourished fully after adding more staff, building additional consultation rooms and optimizing the organization of existing services. These are key enablers for effective integration of DM/HTN into an existing health system [13, 33-35]. We observed that overcoming infrastructural constraints was the key factor in the success of the integration concept. At PHC level, multiple integration models have been documented with emphasis on HIV-NCD integration [13, 30, 36]. We saw different models emerging by allowing facilities to follow their natural evolution. One PHC facility merged its existing OI cohort with the incoming DM/HTN cohort into a clinic run by dedicated staff, away from the OPD. However, this model further stretched pre-existing human resource shortages and the coping threshold was reached when the cohort increased in size. In other health facilities, however, the OPD was the underlying platform in which chronic care was integrated in form of weekly or daily scheduled appointments for HIV and/or DM/HTN. This yielded acceptable results to both staff and patients without compromising existing services. Interestingly, in Malawi, integration of NCD care into the OPD was resisted [30]. Thus, one model does not fit all sites, and flexibility and context-adaptation are needed.

### **Mentoring and Task-shifting,**

Mentorship and coaching interventions, as components of health system strengthening strategies, have been shown to be effective in improving knowledge and clinical practice skills [25, 37]. Bearing in mind the key elements of clinical mentorship, which are local experienced mentors, standardized protocols for consultation and referral of patients, on-site and off-site decision support [38], our approach allowed a small, mobile team of mentors to set up services in multiple sites simultaneously, thereby accelerating the provision of DM/HTN services and standardizing practices across eleven sites. The step-wise on-the-job training emphasizing on knowledge, practical skills and behaviour allowed nurses to familiarize themselves with the complex management of patients with multiple diseases. We also mentored on key issues such as organization of patient flow and spreading of appointments of stable patients. In-service trainings as opposed to on-the-job mentoring tend to be disease-specific and do not usually offer this broad approach [39].

Mentorship empowered MOH nurses at seven PHC facilities and one hospital to be the primary care-givers at the front-line of our model. This is in agreement with what was described by Ndayisaba et al. in Rwanda where training and on-going mentoring empowered nurses to adhere to type 2 DM protocols [25], and in Kenya where follow up field mentorship contributed to nurses ability to manage stable patients with multiple NCDs [40].

However, the desired knowledge and competencies were achieved over a longer period than expected.

Challenges for mentors were long travelling time which decreased the daily mentorship coverage or high DM/HTN patient volume on arrival which limited the mentorship time. The general human resource (HR) shortages coupled with lack of dedicated core staff to be consistently mentored at times impeded nurses from completing a full mentoring cycle. These implementation challenges were also highlighted

by Manzi et al. [37]. To address the issue of staff shortages/high workload, we found that hiring additional staff on locum basis helped, as a temporary solution. When enough technical capacity was built, patient volume/workload was managed through spreading of appointments throughout the week. Three sites with the highest potential were given a more intensive mentorship schedule and developed as model sites. As the DM/HTN cohorts grow in size, and with the prevailing human resource constraints, facilities should look into redistribution of tasks, and task-shifting from nurses to lower level cadres and to expert patients to cope with the additional workload.



One hospital and 2 PHC facilities were not able to provide nurse-led DM/HTN services autonomously. While inadequate space and lack of HR may have contributed, we feel a major reason for this could be lack of clear program leadership and poor staff ownership of their additional duties. Resistance to take up NCD work, perceived as additional work, has been highlighted in India [41]. In our project, where good leaders emerged and staff were motivated and willing to be mentored, positive results were achieved, and the opposite is true. This too was stressed in Malawi where clear leadership and staff ownership was a key to the success of the project [30]. In real life, we found that such leadership and ownership does not always emerge and a question we remain with is: “what to do in such circumstances.” We recommend that policy makers and managers invest time and resources in identifying responsible leaders and motivating staff at all levels for NCD care. During site-selection willingness of the staff to be mentored might also need to be considered. Managers should guide the staff towards rationalizing the overall workload and restructuring workers’ schedules to accommodate NCD-related work [41].

### **Affordable versus free medicines**

Continuity in treatment is a determinant of morbidity and mortality in chronic disease management.

Unlike for ARVs, access to essential NCD medications is a global challenge albeit some on-going initiatives at various international levels to address this gap [42, 43]. According to 2018 MOH’s health sector resource mapping report, the largest funding gap by cost category was for medicines and commodities, and within this category, the percentage of budget allocation by the NCD program area was less than 2% compared to 71% for the HIV program. Although most of the medicines used in our program were on the Zimbabwean MOH standard Drug List, actual supply to PHC facilities was inconsistent, with frequent stock outs. In this case patients with DM/HTN had to buy medication or did not take it at all until it became available. A recent study conducted in Zimbabwe on utilization of health care and burden of Out Of Pocket (OOP) expenditure concludes that OOP expenditure of household members with NCDs could result in catastrophic health expenditure [39]. In addition, forecasting and quantification of NCD medication is a challenge as the real needs are not known. The mismatch between the demand for NCD medications and supply has been described in other LMIC [44]. Providing free medications in our pilot proved a pull factor attracting patients from neighbouring districts and provinces. The worsening economic situation beginning in late 2018 further exacerbated this problem. In Cameroon, to the contrary, medication was not provided for free, but the authors do not mention the impact of this policy on the project [24]. Alternative funding models to free care need to be considered. Labhardt et al. argue that non drug-related costs outweigh cost of medication in NCD care management and advocate for decentralization rather than drug subsidies [45]. We agree and envision extension of services to the community i.e. beyond PHC level to further reduce costs to patients and improve retention in care, such as simplified services adapted to clinical characteristics, context and different subpopulations. This was successful with the DSD concept in the HIV program [46]. More research should be done into the acceptability and cost-effectiveness of community-based NCD services. Choice of medications and laboratory investigations should adapt optimal gold standards according to cost-effectiveness. Treatment initiation thresholds and targets should be adapted to the local context, knowing that early initiation and tight treatment targets supported by the western guidelines may not be realistic or sustainable.

### **Quality assured lab support**

DM monitoring with HbA1c is a fairly new concept in SSA where there may be additional sources of error due to haemoglobinopathies or malaria [11], or high HIV prevalence [47, 48]. However, within our public health approach, periodic HbA1c measurement was a game-changer against the inconvenience of repeated blood sugar measurements and

the poor correlation of these with good glycaemic control. We found that the use of conventional laboratory machines for HbA1c requires adequate and motivated human resources to follow the quality control procedures as required. Performance improved after introduction of POC devices and we would therefore recommend, in a context with limited laboratory capacity, to invest in POC devices from the onset. The use of POCs also reduces reliance on a robust sample transport system. Furthermore, our protocols developed a context adapted reduced frequency of creatinine testing in the interest of sustainability and effective use of resources.

### **Monitoring and Evaluation (M&E)**

Inadequate documentation has been reported across many programs implemented in SSA, and this has a significant impact on resource mobilization and utilization [44]. Our project was no exception. As with TB or HIV programs, longitudinal monitoring of outcomes of patients with DM/HTN is essential to assess effectiveness of treatment [49]. To date standard indicators for NCD M&E do not exist, the project thus developed its own for context adapted monitoring.

## **Conclusion**

Our experience confirms that the strategies that were successful in implementing HIV programs can be adopted for the implementation of DM/HTN care within the same context. In particular, decentralization of services with a flexible integration approach is worthwhile considering. Structured mentoring of the nurses on technical knowledge and practice and on organizational aspects should be considered as a key enabler to implement this model. Managers should opt for POC devices for baseline assessment, monitoring of disease progression and evaluation of treatment response.

However, free medications, as with the ART program, are currently not feasible. Instead program managers may need to consider low cost medications provided closest to the patients. One strategy to overcome the distance-barrier would be to consider DSDs.

Overall the health system was receptive to nurse-led DM/HTN care. NCD specific leadership should be considered at provincial and district level to ensure ownership and on-going mentoring support and supervision. The effectiveness of this nurse-led model needs to be further analysed.

## **List Of Abbreviations**

ART: Antiretroviral Therapy; DM: Diabetes Mellitus; DSD: Differentiated Service Delivery; FBS: Fasting Blood Sugar; HbA1C: Glycosylated haemoglobin; HIV: Human Immunodeficiency Virus; HTN: Hypertension; ICC: Integrated Chronic Care Clinic; LMIC: Low- and Middle- Income Country; MOH: Ministry of Health and Child Care; MSF: Médecins Sans Frontières; NCD: Non-Communicable Diseases; NGO: Non-Governmental Organisation; OI: Opportunistic Infections; OOP: Out of Pocket; OPD: Outpatients Department; PHC: Primary Health Care; RBS: Random Blood Sugar; SSA: Sub-Saharan Africa; WHO: World Health Organisation.

## **Declarations**

### **Ethics approval and consent to participate**

The research was approved by the Medical Research Council of Zimbabwe (Approval number: MRCZ/E/2013), which waived requirements for informed consent as this research concerns analysis of programmatic design and implementation

and not of patient data. This research fulfilled the exemption criteria set by the Médecins Sans Frontières' Ethics Review Board for a posteriori analyses of routinely collected clinical data and thus did not require MSF ERB review.

**Consent for publication:** not applicable.

**Availability of data and material:** data sharing is not applicable to this article as no datasets were analysed during the current study.

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#### Author's contribution

MF, NM, PM, BM, DG, PI and MP provided the initial conception and design. MF and BZ structured and wrote the manuscript. NM, EI and VM provided analysis and interpretation from the implementer's perspective. All authors contributed to the interpretation and discussions. MP provided critical revision of the article. The final version of the manuscript was seen and approved by all authors.

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#### Author details

<sup>1</sup>Médecins Sans Frontières, Mutare, Zimbabwe ; <sup>2</sup>Ministry of Health and Child Care, Manicaland, Zimbabwe; <sup>3</sup>MSF Southern Africa Medical Unit, Cape town, South Africa ; <sup>4</sup>Médecins Sans Frontières , Brussels, Belgium  
Marthe Marie Frieden: [marthefrieden@gmail.com](mailto:marthefrieden@gmail.com) ; Blessing Zamba: [bzamba@me.com](mailto:bzamba@me.com) ; Nisbert Mukumbi: [MSFOCB-Chipinga-MD@brussels.msf.org](mailto:MSFOCB-Chipinga-MD@brussels.msf.org); Patron Titsha Mafaune: [ptmafaune@gmail.com](mailto:ptmafaune@gmail.com) ; Brian Makumbe: [brynmakumbe@yahoo.com](mailto:brynmakumbe@yahoo.com) ; Elizabeth Irungu: [elizabeth.w.irungu@gmail.com](mailto:elizabeth.w.irungu@gmail.com) ; Virginia Moneti: [virginia.moneti@gmail.com](mailto:virginia.moneti@gmail.com) ; Petros Isaakidis: [Petros.Isaakidis@joburg.msf.org](mailto:Petros.Isaakidis@joburg.msf.org) ; Daniela Garone: [danielagarone@gmail.com](mailto:danielagarone@gmail.com) ; Madhu Prasai: [mjprasai@hotmail.com](mailto:mjprasai@hotmail.com)

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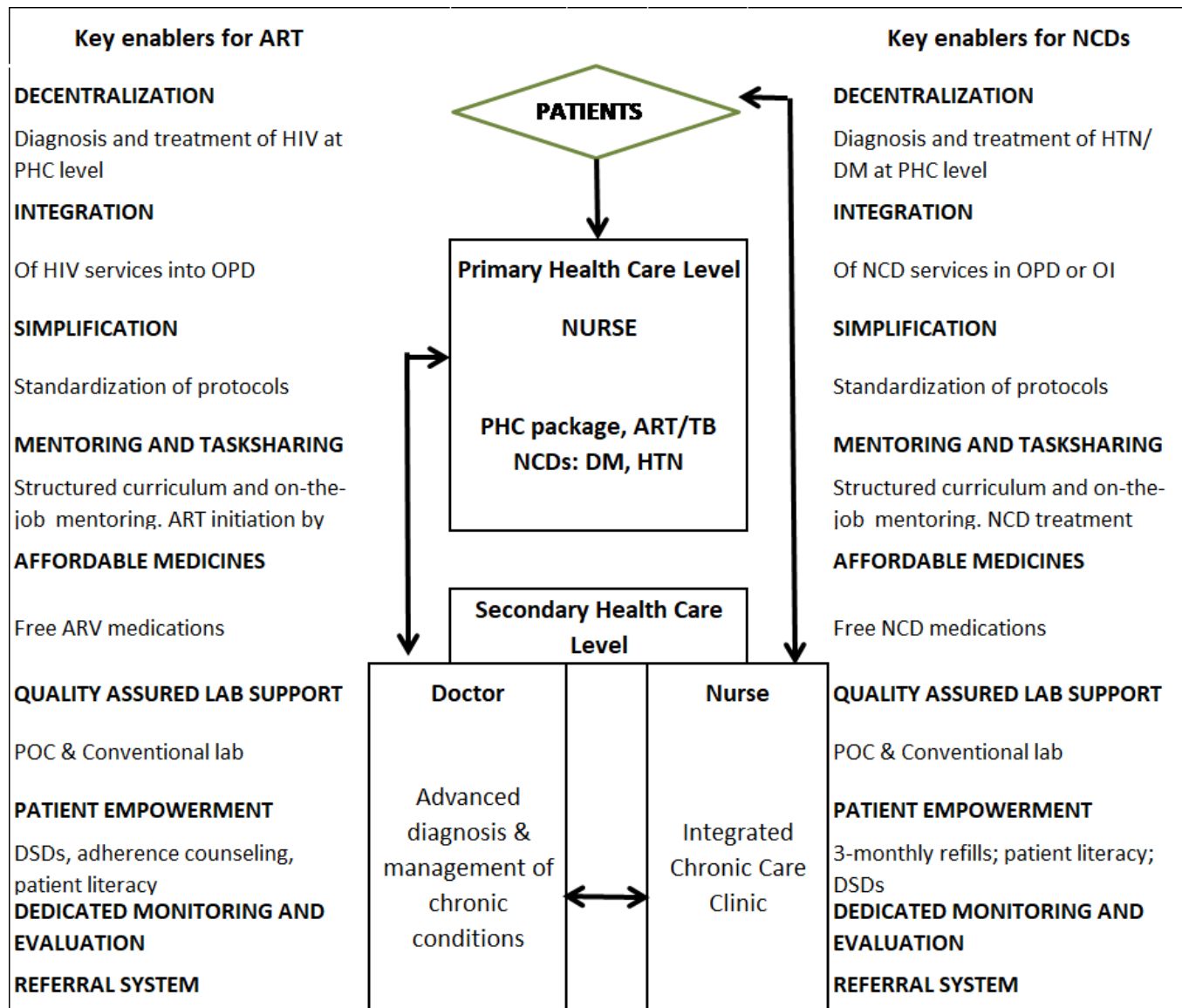
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## Figures



PHC=primary health care; OPD=outpatient department; OI=opportunistic infections; POC=point of care; DSDs=differentiated service delivery models

Figure 1

Conceptual framework