

Systems Capacity To Conduct Non-Communicable Disease Focused Implementation Research In The Malawian Health Sector: A National Needs Assessment

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Abstract

Background: Non-communicable diseases (NCDs) are significant causes of morbidity and mortality in Malawi and are the second leading cause of deaths in adults after HIV and AIDS. The purpose of this assessment was to identify human, infrastructural and systems requirements in implementation research to support the response to the NCD epidemic in the Malawian health sector.

Methods: This national needs assessment was conducted using a concurrent triangulation mixed methods approach. Twenty-two health facilities providing tertiary (n =4), secondary (n =2) and primary (n = 16) care level were included in the assessment. Qualitative interviews with 72 participants from the health facilities, academic institutions, development partner organizations, Ministry of Health and the Central Medical Stores Trust from across the country were also conducted. Descriptive statistics were used to analyze the quantitative data from the facility assessment and thematic content analysis was done to identify themes from the qualitative data.

Results: The qualitative and quantitative findings were merged and categorized into five thematic areas. Theme 1: Record keeping and surveillance for NCDs – which showed a high incidence of hypertension and diabetes at the facilities. Theme 2: Availability of NCD services- 15 (68%) facilities had an NCD clinic available. NCD clinics were reported available at 75% of the tertiary facilities, 100% of secondary facilities and 63% of the primary facilities. Theme 3: Perceived needs for improving NCD care – where key informants highlighted the need for more human resources, drugs, guidelines and diagnostic technologies. Theme 4: Limited NCD focused implementation research engagement. This was due to lack of funding and limited number of researchers conducting NCD focused research. Theme 5: Opportunities for improving NCD focused implementation research. Opportunities were available through the growing interest and focus on NCDs by the government and development partners.

Conclusion: NCDs are a significant health burden in the Malawian healthcare services. A general lack of human, systems and material resources in the healthcare system negatively affects extent of coverage of NCD services and implementation research activities necessary for improving care.

Introduction

Non-communicable diseases (NCDs) are significant causes of morbidity and mortality in Malawi and are the second leading cause of deaths in adults after HIV and AIDS [1]. In Malawi, the reported prevalence of hypertension among adults ranges 15.8–32.9%, and for diabetes the range is 1.7–5.6% [2]. Over 75% of those with hypertension and 68% of those with diabetes are not aware that they have the disease [3]. Non-communicable chronic respiratory diseases are also common in Malawi. The prevalence of asthma, chronic obstructive pulmonary disease (COPD) and bronchiectasis among adolescents and adults is estimated to be 22.5% [4]. While it is important to have a clear understanding of the burden and risk factors for these conditions in order to design context specific interventions [5], needs assessment of the

extant services can inform the health system as to what is possible to deliver and what changes need to be made to allow for optimal care.

Despite the growing burden of NCDs, there is shortage of locally relevant research evidence and inadequate number of scientists to contribute to NCDs-focused implementation research in Malawi, although the situation is improving. Implementation research is the study of methods to promote systematic uptake of research findings and evidence based practices into routine practice [6]. Implementation research is necessary in global health because it addresses the challenges of the know-do gap in real-world settings and the practicalities of achieving national and global health goals. Unfortunately, in many low- and middle-income countries (LMIC), the national and local level responses to NCDs are based on evidence generated from elsewhere or adapted from that of communicable diseases. Much of the global policy recommendations are based on studies from high income countries or even when data comes from LMICs, studies are led by researchers from high-income countries [7, 8]. Therefore, the role of locally relevant NCD research to inform policy and practice is of paramount importance in LMIC.

Globally, the implementation of existing effective interventions for the prevention and control of NCDs is inadequate [8–10]. In order to address this gap, the World Health Organization (WHO) calls upon a multisectoral approach to support and facilitate research related to the prevention and control of NCDs, and its translation into practice, so as to enhance the knowledge base for national, regional and global action [8]. The WHO thus encourages needs-driven research to target diseases that disproportionately affect people in LMIC, including NCDs.

Implementation research needs to be prioritized as it has an important role of encouraging the successful uptake of evidence-based interventions for prevention and control of NCDs in the country [9–12]. The adoption of evidenced based interventions or policies for improving NCD care depends on the availability of resources and expertise within the healthcare system [4]. However, the capacity of the healthcare system and its local development partners to conduct implementation research in Malawi was not well understood. Therefore, establishing existent resources in public facilities, expertise from universities, and support from government and development partners was necessary. The Non-Communicable Disease Building Research Implementation, Translation and Expertise (NCD BRITE) Consortium funded by the National Heart, Lung and Blood Institute conducted a national needs assessment with an aim to identify human, infrastructural and systems required in implementation research to support the response to the NCD epidemic in Malawi. This assessment identified gaps and strengths in structures, systems, roles, workforce and technologies for NCDs, surveillance, planning, monitoring, policies and partnerships.

Methods

The needs assessment utilized a cross sectional design. A mixed methods approach was used, sequentially combining quantitative assessment of 22 facilities with detailed, 48 qualitative individual in-depth interviews, 13 key informants interviews and 3 focus group discussions with stakeholders from

health facilities, academic institutions, and partners of the NCD BRITE Consortium resulting in a QUANTAL study design. Data were collected between November 2019 and March 2020. The study protocol was approved by College of Medicine Research and Ethics Committee (reference number: P.07/19/2743) . Participation in the study was voluntary.

Study setting

The assessment had a national scope, and the study sites included Ministry of Health, public health facilities, universities, Central Medical Stores Trust and the NCD BRITE consortium partners (Lighthouse, Malawi Epidemiology and Intervention Research Unit (MEIRU), Malawi Liverpool Wellcome Trust, Partners in Health and University of North Carolina Project Malawi). These institutions were included in order to gain a deep understanding of specific organizations or policies, and perceptions regarding responses to NCDs in Malawi.

Administratively, Malawi is divided into 28 districts within three regions [13]. The public system in Malawi is designed in a three-tiered network of interlocking medical facilities. The third tier is a large network of health centers, dispensaries and village clinics woven throughout the country providing primary care services [14]. They serve as the first line of defense in the war against diseases. Their services are free and they are often the only medical facilities that many village people will see in their lifetimes. Usually, there are almost no doctors, a few nurses, clinical officers, clinical technicians and medical assistants at any of the primary care facilities [13].

According to the healthcare system design, when a medical case is too critical for the primary care facility to handle, the patient is transferred to the tier two hospital also known as district hospitals. These facilities are centrally located in each of 28 districts of Malawi. The top tier (central hospital) is designed for patients to be referred to when problems cannot be resolved at either of the two lower levels. The top tier facilities have more advanced medical equipment, supplies and personnel and are in the major urban areas [13].

Sampling technique

The sampling for health facilities was first stratified by regions which included Northern region, Central region and Southern region of Malawi. Firstly, all the 5 tertiary level facilities (Mzuzu Central, Kamuzu Central, Zomba Central, Zomba Mental and Queen Elizabeth Central), were purposively selected covering all the three regions of Malawi. These facilities were included because they are the top tier hospitals designed for patients' referrals.

Secondly, one secondary level facility was selected from each of the region. After employing a simple random selection procedure, Nkhata Bay district hospital in the north, Ntcheu District hospital in the center and Mangochi district hospital in the south were picked for quantitative evaluation.

Lastly, 18 primary care facilities from the sampled districts were purposively selected in consultation with the respective DHOs. However, due to COVID 19 pandemic restrictions, we were not able to assess some of the health facilities in the northern region. Therefore, only 22 out of the 26 targeted health facilities were assessed. The facilities included in the assessment comprised of 4 tertiary, 2 secondary and 16 primary care facilities. Table 1 shows the profile of the health facilities that were included in the assessment.

Table 1: Characteristics of the participating facilities in the needs assessment

Variable		N (%)
Location	Urban	11 (50)
	Rural	11 (50)
Health facility category	Central hospital	4 (18.18)
	District hospital	2 (19.09)
	Health center	16 (72.73)

Study population

The assessment included a wide range of personnel from all the participating institutions as follows: NCD unit and research directors from MoH; research deans and lecturers from public university colleges; directors of NCD BRITE consortium partner institutions; regional managers at CMST, hospital directors (central hospital) / district directors of health and social services (district hospitals), nurses, physicians/clinical technicians/medical assistants, pharmacists, laboratory technologists/technicians, physiotherapists.

Sample size

Facility assessment information was obtained from 45 participants that comprised of hospital directors, medical doctors, clinical officers/technicians, medical assistants, nursing officers, human resource officers, pharmacists/pharmacy technicians, laboratory technicians, rehabilitation officers/technicians, and Health Management Information System (HMIS) officers. Another 77 participants from the various institutions participated in qualitative interviews. Among the qualitative interview participants, 13 key informant interviews were conducted with 2 participants from MoH; 2 participants from CMST; 5 participants from NCD BRITE consortium partner institutions and 4 research deans from public university colleges. Sixteen participants from the public university colleges participated in three focus group discussions. Forty-eight participants participated in individual indepth interview (20 participants from the central hospitals, 6 participants from district hospitals, and 22 participants from health centres). This sample size was determined purposefully for each category of the study participants. Qualitative

interviews were stopped after data saturation. The purposive sampling method allowed the investigators to select participants willing to provide information by virtue of their knowledge and experience in NCDs.

Data collection tools

Seven different data collection tools were developed to help assess the deeper issues regarding human and infrastructural capacity for NCD Response in Malawi from the various groups of participants that were targeted. An NCD health assessment tool was developed to help assess the human and infrastructural capacity needs for NCD Response in health facilities in Malawi. It was designed to extract the most current information available regarding health facilities and their capacity to manage NCDs.

The specific diseases of interest for this assessment included: diabetes, hypertension, and COPD/asthma. The medicines, technologies, and tools included in the assessment were based on the standards of WHO Package of essential non-communicable disease interventions [15]. Additional medicines, technologies, tools, and guidelines deemed essential by the NCD BRITE Consortium team were also considered.

In order to develop the comprehensive tool, a desk review of relevant literature was conducted to identify scientific papers, reports, and expert opinion for assessing health system capacity in NCDs. Subsequently, the NCD tool was developed based on this review and the WHO NCD monitoring framework [16]. The health facility tool covers the following sections: (A) Visit Information, (B) Health Facility Profile, (C) Human Resource and Skills Profile, (D) Facility-Based NCD Prevalence, (E) Clinics and Services, (F) Equipment, (G) Medicines & Sundries, (H) Laboratory, (I) Costs Related to NCDs, and (J) Referral System. For each of the categories, the WHO criteria for minimum requirements to conduct basic tests and procedures for early detection, diagnosis, treatment and monitoring of NCDs was used to determine facility capacity [17].

In addition, six interview guides were developed for each of the following groups: MoH unit directors; CMST regional managers; university researchers in NCDs; university colleges research deans; healthcare workers; and NCD BRITE consortium partners. All the data collection tools were developed after a comprehensive desk review of relevant literature conducted in April 2019. Scientific papers, reports, and expert opinion for assessing health system capacity in NCDs were identified. Some data collection tools were developed based on this review and the WHO NCD monitoring framework and the WHO conceptual framework that includes the six building blocks [18].

The data collection tool used at MoH covered the following sections (A) Public health infrastructure, partnerships and multisectoral collaboration for NCDs. (B) Status of NCD-relevant policies, strategies and action plans. (C) Workforce capacity building. (D) Health information systems, surveillance and surveys for NCDs (E) capacity for NCD early detection, treatment and care within the health system. Interview questions CMST managers were guided by WHO conceptual framework that include the six building blocks namely (A) service delivery, (B) health workforce, (C) information, (D) medical products, vaccines,

and technologies, (E) financing, and (F) leadership and governance. Key informant interview guide for colleges/universities included the following sections, (A) Background information, (B) NCDs implementation research, (C) human resources (D) facilities and infrastructure, and (E) partnerships and exchange. Focus group discussion interview guide questions for university faculty included: (A) Have you been involved in implementation research? (B) What do you think is the importance of implementation research? (C) Tell me whether this institution carries out implementation research and which areas the institution focuses on? Please explain if they include NCDs related implementation research? (D) What factors motivate you to be interested in NCDs focused implementation research? (E) In order to carry out NCDs implementation research you need various skills, Tell me what skills are needed to successfully carry out NCDs implementation research? What training have you undergone to be able to carry out implementation research? Did the training include research ethics?

All the data collection tools were piloted at the two health facilities that were not earmarked for the assessment prior to the actual data collection. There were no issues found with the tools other than typographic errors during the pilot. The final corrected and accepted tools were used for the final data collection

Data collection

Data were collected by the first author and two research assistants. These research assistants had prior training and experience in qualitative data collection, research ethics, data entry and analysis. Quantitative data were collected using a structured facility assessment checklist that had 10 sections. Heads of facilities and departments provided the data. Qualitative data were collected through in-depth interviews, key informant interviews and focus group discussions with university lecturers.

Data management and analysis

Completed questionnaires and records were entered into Microsoft Excel and exported into Stata Version 14 for cleaning and analysis. For all the analyses, the denominator used was the total number of sampled facilities (22). Descriptive statistics were presented as frequencies and percentages. Where necessary, the differences between categorical variables were tested using the Chi-square test of association with alpha level of 5%. The results are presented as tables and graphs.

Audio data from the key informant interview and focus group discussions were transcribed verbatim and analyzed using thematic content analysis. Deductive coding was used, to organize the existing infrastructure facilities and resources based on the WHO six thematic areas (service delivery, health workforce, information, medical products, vaccines, and technologies, financing, and leadership and governance) [18]. Initial coding was done by the first author, emergent themes were shared with the rest of the authors for discussions and refinement. Five thematic areas were agreed upon after discussions by all the authors.

Results

The qualitative and quantitative findings are merged and displayed jointly to support each other under the five thematic areas that emerged: (1) Record keeping and surveillance for NCDs; (2) availability of NCD services; (3) perceived needs for improving NCD care; (4) limited NCD focused implementation research engagement; (5) and opportunities for improving NCD focused implementation research.

Record keeping and surveillance for NCDs

The record keeping system in most of the facilities was not rigorous to detail the prevalence of NCDs or their risk factors. At the time of the assessment, 20/22 (91%) of the facilities did not have an NCD register for new cases, followups or admissions. The record keeping system however could not give facility disease prevalence because some patients were counted multiple times for each visit they made to the facility (for the same or different condition) in that year. We were also unable to obtain information on all cases seen in the past year for any other ailments to get a denominator for calculating the prevalence. Outpatient logging available from 19 (87%) of the facilities however showed that in the previous year, hypertension was the most common seen condition contributing 44.6% of the NCD cases we targeted, followed by diabetes at 37.7% (figure 1).

Although it was not possible to establish the prevalence of different NCDs from the available data, the healthcare workers perceived that NCDs were on the increase in the country and within their facilities' catchment areas. Lifestyle habits such as poor diet and sedentary life were some of the perceived contributing factors.

"I don't have the actual statistics, but I think cardiovascular problems [. . .] hypertension, are the biggest problem in Malawi. However, I realize that mental health problems are an emerging issue in the field of NCDs [. . .] hypertension it would be because of lifestyle, the food we eat. I have no data but I have the feeling people use quite a lot of salt in our setting. I think that contributes significantly to the incidence of hypertension" (Participant 36, central hospital director)

"At [this facility] we have a lot of hypertension patients, diabetes patients, cancer patients, and a few of sickle cell [. . .] I think a lot of it is because of the food we eat. Most the things we eat are genetically modified, so I think they are the major contributing factor" (participant 38, central hospital pharmacist).

Availability of NCD Services

We assessed availability of screening, diagnosis, management and rehabilitation services for NCDs at the primary, secondary and tertiary level health facilities. NCD services offered at the facilities varied depending on availability of human resources, equipment and medicines. Fifteen (68%) facilities indicated that they routine NCD clinics. Sixty-eight percent (68%) of the facilities had a joint NCD clinic which catered for clients with hypertension, diabetes, asthma and epilepsy. Cardiology and renal clinics

were only available at tertiary facilities. None of the facilities had a specific clinic for cardiology, asthma or COPD, however, clients with these conditions were reviewed at general medicine, chest or NCD clinics available at the facilities. Table 2 shows the availability of NCD services according to categories of the health facilities.

Table 2: Availability of NCD Clinics at primary, secondary and tertiary health facilities

Disease/condition	Central hospital N = 4	District Hospital N= 2	Health centre N = 16	Total N = 22
Diabetes	3 (75%)	2 (100%)	6 (38%)	11 (50%)
Hypertension	3 (75%)	2 (100%)	10 (63%)	15 (68%)
Cardiology	2 (50%)*	0 (0%)	0 (0%)	2 (9%)
Asthma/COPD	2 (50%)*	0 (0%)	2 (13%)#	4 (18%)
Renal	2 (50%)	0 (0%)	0 (0%)	2 (9%)

Key: *The clinic was part of general medicine or chest clinic; # The clinic was part of the joint NCD clinic

The services offered at these clinics included weight and blood pressure measurement, glucose checking (at diabetes clinics only) and medication refill. Monitoring for kidney function was not routinely done except for the renal clinic or in exceptional circumstances where renal problem was suspected. The participants observed that the NCD care services currently being offered were not adequate at all levels of care:

"All of us are just at curative level. So structures at community level are not there, that's my observation. We all seem to be running around doing curative care so to say. People have said, 'Prevention is better than cure', so preventive components, there isn't good structures out there [. . .] you find that someone will be having headache and they will just be taking Panadol. Without even going for just normal screening. But I cannot blame them. Because those structures, just for normal screening are not there [. . .] like going from house hold to house hold, like what is happening with HIV. I understand there are structures for people to go door to door testing people. I feel if there were those doors to door services to check blood sugar, hypertension in the home, it would help." (Participant 37, central hospital chief nursing officer)

"From my point of view, I think if we could be having a hypertension clinic [. . .] We should be advising the people how to avoid high blood pressure. We should also monitor their BPs (blood pressures). Because with some people when you tell them to come again next week to recheck their BP, that is someone who came today with a high BP and we are giving a follow up date, many don't come back. So perhaps if we were having BP clinics, they would know that on this particular day we refill our BP medications, so then everyone's BP can be checked and we'd be able to follow them all." (Participant 71, primary care facility medical assistant).

The participants also noted that inadequate health care funding influenced the implementation and coverage of NCD services. All the health facilities reported that they do receive lump sum funding for all the activities at the facility with no specific budget allocation for NCD care. The funding was thus perceived to be inadequate to cater for all needs at the facilities including NCD prevention and management interventions.

“The budget actually less than 20% goes to non-communicable diseases. Most of the money goes into communicable diseases. And mainly three diseases; malaria, TB, HIV. These hold almost 70% of the Ministry of Health budget. Only three diseases. And it’s also the emphasis for donors as well. So we are even discussing with donors to also open up for non-communicable diseases. They mostly focus on communicable diseases, because that’s where results are so fast. You convince who ever gave you the money that you have changed lives of these people, while non-communicable diseases the effect might happen in 40 years to come. And who will be there? When we buy drugs we just combine for the facility. But we are not really specific to say this money is for communicable, this money for non-communicable” (Participant 32, central hospital director)

Perceived needs for improving NCD care

Key informants cited staff shortages, the lack of capacity for junior staff to manage NCDs, shortage of drugs to treat NCDs and lack of adequate equipment to diagnose NCDs and provide follow up care for NCD clients.

a. Human resources

The common staff category of health care workers at the facilities were nursing and midwifery technicians (NMT), Health Surveillances Assistants (HSA), medical assistants and registered nurses and midwives (RNM). There were no medical specialists at primary or secondary care facilities. Many of the facilities did not have any nutritionists and radiology, laboratory or physiotherapy staff. Only 12 (0.5%) of the available healthcare workers from the sampled health facilities had attended an NCD management training in the last year. Figure 2 shows the percentage of facilities with different staff categories of health care workers.

Improving staff numbers and their capacity to manage NCDs was one of the needs that was highlighted by the key informants. It was only at the central hospitals where they had specialist nurses for different NCDs working in collaboration with medical team. NCD clinics at district hospitals and health centres were operated by clinical officers or medical assistants.

“The first need is the human resources. We have very few staff especially the clinicians” (Participant 55, central hospital medical officer).

“They [staff] are not enough, they are not well trained [. . .] it really affects the program because we want to reach out to many but like I have already said that in some of our Health Centers you find a clinician is

afraid to prescribe some of the drugs [. . .] doesn't know which drugs to give, to which type of let's say hypertension. The first line, second line [. . .] which one to give, they are confused and they are afraid to prescribe, so you can have the medication in the pharmacy but they will not order, or it will expire" (Participant 2, deputy district director of health and social services)

b. Management guidelines

Available guidelines at the facilities were the Malawi Standard Treatment Guidelines (MSTG) [19] and the College of Medicine, Medicine department clinical book (Blue book) [20]. Fifteen (73%) facilities reported having guidelines for the management of hypertension, diabetes, asthma and hyperlipicemia through the MSTG or the blue book. These guidelines were available as personal copies of the personel or facility copy. None of the facilities had management guidelines for alcohol or tobacco screening and treatment. The lack of NCD management guidelines at some of the facilities also affected client diagnosis and management.

"On my part, I have never seen any guidelines" (Participant 71, primary care facility medical assistant)

"For guidelines, we mostly use the Malawi Standard Treatment Guideline, because that's the one that the government recommends. But for some of us that have exposure to working in the central hospitals, we have access to the blue books for internal medicine. So when we are teaching people about hypertension or diabetes we usually consult those books." (Participant 22, district hospital senior medical officer)

c. Drug supply

At the time of the assessment, none of the facilities had all 20 types of medications (Table 3) vital for managing NCDs in Malawi. Only 7 (32%) facilities (all urban) had at least half of the essential medicines available. Thiazide diuretics were the most commonly found antihypertensive, available at 90% of the facilities. Biguanides were the most commonly available drugs for diabetes available at 73% of the facilities. Insulin was only available at secondary and tertiary facilities. Sustained release theophylline tablets were the most commonly found drugs for treatment of asthma available at 91% of the facilities. Salbutamol and steroid hailers were reported available at 64% and 32% of the facilities respectively. Statins (drugs used for lowering cholesterol in the body) were only available at one facility. Aspirin (drug used to lower risk of clot formation) was available at 64% of the facilities in 300mg tablets and was dispensed as quarter tablets. At all the facilities, drug stockouts were common and were attributed to nonavailability of the medicines from the CMST at the time of odering. Table 3 shows the number of facilities that had different types of drugs used for management of NCDs, and number of facilities reporting stock outs in the last quarter. The table also includes the minimum level of healthcare facility permitted to stock the drug, the therapeutic priority and procurement system code for the drugs according to the Malawi essential medicines list.

Table 3: Availability of NCD drugs at facilities

Class of drugs		Availability N (%)	Stock out in the last quarter N (%)	Expected level of availability*	Thrapeutic priority**	Procurement system code***
Anti-hypertensive drugs						
Thiazide diuretic (e.g. hydrochlorothiazide)		20 (91)	8 (37)	Secondary	Vital	A
Calcium channel blocker (e.g. Nifedipine)		13 (59)	7 (32)	Secondary	Vital	A
Beta-blocker (e.g. Propranolol)		12 (55)	7 (32)	Secondary	Vital	A
ACE inhibitor (e.g. Captopril)		9 (41)	5 (23)	Tertiary	Vital	B
Others (e.g. Methyldopa, Hydralazine, Magnesium Sulphate)		11 (50)	3 (14)	Secondary	Essential	A
Diabetic drugs						
Biguanides (e.g. Metformin)		16 (73)	6 (27)	Secondary	Vital	A
Sulfonylureas (e.g. Glibenclamide)		14 (64)	5 (23)	Secondary	Vital	A
Thiazolidinediones (e.g. Pioglitazone)		0 (0)				
Dipeptidyl peptidase-4 inhibitors		0 (0)				
Alpha-glucosidase inhibitors		0 (0)				
Insulin type available	Ultra short-acting	2 (9)	0 (0)			
	Short-acting	6 (27)	0 (0)	Secondary	Vital	A
	Intermediate	1(5)	0 (0)			
	Long-acting	5 (23)	0 (0)	Secondary	Vital	A
	Other insulin (Biphasic)	1 (5)	0 (0)			
Insulin syringes (e.g. U100)		5 (23)	4 (19)			
Asthma						
Short acting Beta2-agonists (salbutamol inhaler)		14 (64)	10 (45)	Primary	Vital	A

Anticholinergics (e.g. ipratropium bromide)	1 (5)	0 (0)			
Inhaler steroids (beclomethasone inhaler)	7 (32)	6 (27)	Tertiary	Vital	B
Oral steroids (e.g. oral predenisoole)	16 (73)	1 (5)	Secondary	Vital	A
Long acting inhaled beta2 agosnist (e.g. salmeterol, formterol)	3 (14)	2 (9)			
Sustained release theophylline tablets (e.g. aminophylline)	20 (91)	3 (14)	Primary	Vital	A
Leukotriene antagonists (e.g. monterlukast, zafirlukast)	0 (0)				
For other diseases					
Statins	1 (5)	0 (0)	Tertiary	Vital	A
Aspirin (300mg)	14 (64)	0 (0)	Primary	Vital	A

Key:

*Indicates the minimum level (primary, secondary or tertiary) of health facility at which the drug would normally be permitted for use. Exceptions are made when a prescriber with additional clinical expertise is available at a lower level facility. Arrangements can also be made for individual patients on maintenance treatment for chronic conditions to receive such treatment at a lower level facility [19].

** Drugs are categorized as vital, essential or non-essential. Vital drugs are potentially life saving, are a of major public health importance, and have significant withdrwal side-effects making regular supply mandatory. Essential drugs are effective against less ssevere but significant forms of illness. Non-essential drugs are those used for minor or self-limiting illnesses, have questionable efficacy, or have a highcost for a marginal therapeutic advantage [19].

***The drug procurement system has two codes, A and B. Code A is for drugs required for a large number of patients, routinely procured and stocked drugs at CMST. Code B is is for drugs required for a limited number of patients, not routinely procured and stocked by CMST. Payment for these drugs is made in advance by the ordering facility [19].

The key informants sited shortage of first line NCD drugs at health facilities as a major barrier to providing NCD care. Drug shortages were there due to stock outs of medicines at the central medical stores or delays in ordering drugs from the central medical stores. Drug ordering was the responsibility of the the facility and pharmacy in-charge. Eleven (50%) of the facilities reported that they do not get the

drugs they ask for while 17 (77%) reported that they do not get the quantities of the drugs they ask for. In addition, national guidelines on drug supply restricts availability of some drugs at primary care facilities.

“The drugs are available, but we do experience a lot of stock outs. For hypertension we do have hydrochlorothiazide. That one is available. We have beta blockers like propranolol. For calcium channel blockers like nifedipine we don't have but we do have it sometimes. For diabetes, metformin is available but glibenclamide is currently out of stock.” (Participant 43, district hospital pharmacist)

“We are the sole supplier of medicines and medical supplier to the public facilities. So if there is a stock out at a health facility there are a number of factors. Obviously number one is either we did not have at Central Medical Stores Trust, or the health facility did not order from us.” (Participant 17, Central Medical Stores Trust regional manager)

For diabetes, the medicine that we usually struggle with is the insulin. So if some patients require insulin, we are really not able to offer that service because according to policy, insulin is not stocked at health centers. (Participant 27, primary care facility medical officer)

d. Tests and procedures to detect, diagnose and monitor NCDs

Most facilities lacked basic equipment for diagnosing or managing NCDs. Only two facilities had equipment and capacity to conduct all six basic tests and procedures (Blood pressure, height, weight, glucose, blood lipids and urinalysis) recommended by WHO for early detection, diagnosis and monitoring of NCDs [17]. Twenty (91%) facilities had at least one digital sphygmomanometer that was functional and were able to conduct BP measurements. Nine (41%) facilities were checking weights at the adult outpatient department or NCD clinic. Only one facility (central hospital) had a spirometer, which is necessary equipment for making diagnosis of airflow limitation in asthma or COPD.

There was a statistically significant difference ($p < 0.05$) in the availability of medical imaging services according to health facility level. Many primary care facilities had limited capacity to conduct medical imaging services unlike the secondary or tertiary level facilities (Table 4).

Table 4: Availability of medical imaging services according to health facility level

Test	Central hospital N = 4	District Hospital N= 2	Health centre N = 16	Total N = 22
Ultrasound scanning	3 (75%)	2 (100%)	3 (19%)	8 (36%)
Echocardiogram	3 (75%)	0 (0%)	1 (6%)	4 (18%)
electrocardiogram	4 (100%)	1 (50%)	0(0%)	5 (23%)
x-ray	3 (75%)	2 (100%)	1(6%)	6 (27%)
Doppler ultrasound	3 (75%)	1 (50%)	3 (19%)	7 (32%)
computed tomograph scan	3 (75%)	0 (0%)	0 (0%)	3 (14%)

All facilities reported or had a laboratory. Four (18%) of the facilities used HSA's trained as laboratory assistants to conduct some tests. Eight (36%) of the laboratories had a functional centrifuge; 16 (73%) had a functional microscope. Only one central hospital laboratory was performing all the tests that were deemed necessary in diagnosis and monitoring for NCDs. Central and district hospitals had a more capacity for laboratory tests than the health centres. Table 5 shows the tests the laboratories were performing at the different levels of health facilities.

Table 5: Availability of laboratory tests at primary, secondary and tertiary facilities

TEST	Central HOSPITAL (N = 4)	District HOSPITAL (N = 2)	HEALTH CENTER (N = 16)	Total (N = 22)
Electrolytes (e.g. potassium)	3 (75%)	0 (0%)	1 (6%)	4 (18%)
Full blood count and differential	3 (75%)	2 (100%)	2 (13%)	7 (32%)
Full Urinalysis	3 (75%)	2 (100%)	4 (25%)	9 (41%)
Urine dipstick	3 (75%)	2 (100%)	8 (50%)	13 (59%)
Hb electrophoresis	2 (50%)	0 (0%)	3 (19%)	5 (23%)
HbA1c	1 (25%)	0 (0%)	1 (6%)	2 (9%)
Haemocult	2 (50%)	0 (0%)	2 (13%)	2 (18%)
Hemoglobin	3 (75%)	2 (100%)	6 (%)	11 (50%)
Lipid Profile	2 (50%)	0 (0%)	0 (0%)	2 (9%)
Liver Function Tests	3 (75%)	2 (100%)	1 (6%)	6 (27%)
Microalbuminuria	2 (50%)	0 (0%)	0 (0%)	2 (9%)
Random Blood Sugar	4 (100%)	2 (100%)	10 (63%)	16 (73%)
Glucometer	4 (100%)	2 (100%)	10 (63%)	16 (73%)
Automated analyzer	3 (75%)	2 (100%)	0 (0%)	5 (23%)
Renal Function Tests	3 (75%)	2 (100%)	1 (6%)	5 (27%)
Other available tests			HIV, MRDT, gene xpert, Cryptococcal antigen, CD4, Sputum microscopy, syphilis, HCG, Viral load, hormone tests (prostrate specific antigen)	

The lack of basic equipment hindered on NCD care service provision as remarked by some of the key informants:

"For me equipment is the number one need. I know some may obviously say we need human resources. But even when you have all the human resource numbers you need, they can only do a little if they don't have the necessary equipment to diagnose or treat patients" (Participant 31, central hospital specialist physician)

“We need equipment, the basics. Things like BP cuffs, urine dipsticks, and glucometers [. . .]. Of course we can also have some point of care tests like creatinine.” (Participant 14, primary care facility medical officer)

“Like for hypertension, it’s still a challenge due to equipment, especially the BP machines. We don’t have enough. Actually I’d say we don’t have any at all. We usually have a problem with batteries. So when a patient comes, we just attend to what they are complaining of without checking the BP, which is not a good practice. Because people expect that when they come here, their BP should be checked” (Participant 67, primary care facility medical assistant)

Only one facility however had a strong laboratory capacity and was able to do all the tests listed in Table 4.

“We have improved the laboratory, so it is able to do most of the tests. Actually our laboratory was assessed internally by ministry of health and we have four stars [. . .] the laboratory is supposed to have five stars. We are remaining with one more star. So we have a very good laboratory. The best in Malawi.” (Participant 32, central hospital director)

Limited NCD focused implementation research engagement

Key informants from academic institutions, MoH and the NCD BRITE partner institutions perceived that there was limited engagement in NCD focused implementation research. One reason for such limitation was the lack of funding for research locally. The MoH’s NCD unit does not receive any specific funding for research. Additionally, more seasoned researchers were already grounded in other areas of health research other than NCDs.

“I think lack of national funding bodies. Government putting in money for research . . . because of that we depend on international donors, and competition is stiff at international level. So it’s only those who have made it, those who have a name who are able to compete. But those who are just coming up, it’s not easy. The unfortunate part is that those people who have already made it, already have their niche, so it would be very difficult for them to start looking at other areas, because they already established in their area.” (Participant 1, university college research dean).

Another reason for minimal engagement in implementation research was lack of awareness and expertise in implementation science among some of the faculty members.

“As for me, I haven’t been involved in implementation research. But to my understanding, I that a research may be conducted, then you implement” (Participant 2, FGD 1).

“ We have a research centre. But I am not sure whether that [implementation research] is done. They should be in a better position to answer” (Participant 1, FGD 1).

Opportunities for improving NCD focused implementation research

Opportunities for improving NCD care and NCD focused implementation research exist at national and institutional level. In trying to improve NCD care in Malawi, the MoH introduced an NCD unit to oversee planning and implementation of NCD services in the country. The MOH also launched a National NCD action plan with a goal of reducing preventable and avoidable NCDs morbidity and mortality [21]. NCDs are also prioritized in other national documents and policies related to health:

NCDs are included in the National Health Policy, and the National Health Sector Strategic plan also mentions about NCDs. And even other sectors also talk about NCDs. For example, when you talk about the research part of it, we have the National Health Research Agenda which also prioritises NCDs. (Participant 28, MOH, Research unit)

"As an NCD and mental health unit, our objective is to make sure to respond to issues to do with NCD in this country. Our job is to find the burden of the disease and respond on how we can do the awareness. We also have the responsibility to make sure that the facilities where the people go to have the required human resource, equipment and medication. So basically we coordinate issues to do with NCD in this country"(Participant 29, MOH NCD unit)

NCD BRITE partner institutions and organizations that previously had a focus on other health problems like HIV or maternal health have a growing interest in NCDs. Broadening the scope of focus to include NCD has come about due rising incidence of NCD comorbidities with HIV as well as NCD complications in maternal health. The partner institutions in NCD BRITE consortium offer opportunities for capacity building for young researchers in implementation science through mentorship and internship positions.

"[We are] an organization which has unquestionable experience in relation to research so we can provide mentorship of investigators interested in NCDs. We are an organization which can also provide internship position for young investigators interested in NCDs. We have several years of proven record in mentorship in implementing research including evaluation of interventions."(Participant 45, partner institution representative)

At the facility level, some improvements in human resource and diagnostic equipments has resulted in increased capacity to diagnose and treat NCDs.

The hospitals are also getting more prepared for these diseases. You know in the past were not getting busy to check for blood pressure, to check for sugar for patients, so it's also development of the health system. Whereby we are able to send the patient to the laboratory, we are able to assess the patient much more comprehensively than we were doing before. With the coming in of a larger number of specialists which we used not to have in the past. So diagnostics is getting better, as well as the affluence of the people. (Participant 32, central hospital director)

Discussion

This needs assessment revealed that capacity to conduct NCD focused implementation research was limited due to inadequate human resource, infrastructure and systems available in the Malawian health sector. The results suggest that although there is a perceived growing burden of NCDs in the health sector, screening, diagnosis, management and rehabilitation services for NCDs were insufficient especially at primary care facilities. Meanwhile, tertiary health facilities are more oriented towards acute care model which compromises health promotion for NCDs that require chronic care approach. The assessment also suggested that there was limited NCD focused implementation research engagement among faculty from public universities. This was a first national needs assessment on NCD focus implementation research in the country, triangulating methods and data sources. It is expected that the information obtained in this assessment will set the stage for future implementation research potential, guide policy options and identification of priority areas for support to promote NCD focused implementation research in Malawi which is an urgent need.

This assessment showed that the shortage of adequately trained staff was one of the factors that affected NCD care service provision which has implications for conducting NCD focused implementation research. Although we were not able to establish vacancy rates for each cadre and facility, MoH records show a 45% vacancy rate for all health cadres across different levels of care in the Malawian public health sector [22]. Nursing and midwifery technicians, health assistant surveillants and medical assistant formed the majority of the healthcare workforce at the facilities. However, most of them lacked adequate training and experience in NCD management. In service trainings or workshops for NCD management were irregular and only afforded to accommodate a few individuals.

The assessment also revealed that facilities were not equipped with some medicines and equipment for management of NCDs due to finances, procurement and supply chain challenges. For instance, most of the facilities only had two or three of the six essential technologies for early detection, diagnosis and monitoring of NCD. That is BP, weight and height measurement. Lipid profiling, urinalysis and glucose testing were not widely available in most facilities. The findings agree with the WHO survey for national capacity for prevention and control of NCDs. The WHO survey also showed that most LMIC were lagging behind in efforts to address and respond to the growing burden of NCDs [17]. Similarly, the WHO survey also showed that most LMIC had less than half of the essential NCD medications on the WHO list unlike high income countries which had all the essential medications always available[17].

The present assessment also revealed a need for building capacity for local researchers to conduct NCD focused implementation research. Although there are a number of implementation research initiatives in the country, only a few focused on NCDs. Lack of expertise in implementation research and the lack of specific funding for NCD implementation research were some of the setbacks. Other studies have also shown that lack of expertise in implementation research and limited research funding for NCDs are common in sub-Saharan Africa [9, 10, 23, 24]. For the Malawian healthcare system to adequately respond to the growing burden of NCDs, there is need for conducting NCD focused studies along each of the

stages of the translation research spectrum. A strong research capacity is vital to bridging the knowledge practice gap and providing new evidence for policymaking in NCD care in the country [9, 10, 12].

Lack of funding for NCD care and research from government or donor agencies was perceived to be one of the contributing factors to the challenges with NCD care and research. Although many national documents and policies such as the National Health Policy [25], National Health Research Agenda [26] and the National Action Plan for the Prevention and Management of NCDs in Malawi [21] acknowledges that NCD significantly contribute towards the disease burden in the country, NCD funding is still limited. For instance, the current National Health Sector Strategic Plan for Malawi excludes NCDs from the Basic health care (BHC) package which is guide for free service provided in the public health sector. Instead NCDs are included in the Basic health care plus (BHC+), which is reserve list for inclusion in the BHC when finances permit [22]. Many low and middle income countries also struggle with funding for NCDs which affect both service delivery and research [10, 27, 28].

This assessment however highlighted some considerable strengths to build upon and opportunities to seize through the available resources, partnerships and linkages that exists. Strengths at the national level include the existence of a standard treatment guideline, dedicated clinical unit in the MOH, and tools for monitoring NCDs. Individual facilities also had some strengths in expertise, equipment or medication availability, which can be harnessed to initiate NCD focused implementation research. There is also emerging interest, motivation and opportunities and support from development partners to collaborate with public institutions to advance NCD focused implementation research. Leveraging resources through partnerships between academia, healthcare system and development partners helps to promote implementation research capacity especially in limited resource settings [23, 29, 30].

Strengths

The strength of this study is that it identified specific and local needs for NCD care and research as perceived by implementers in the Malawian public healthcare system, university researchers, health care system development partners and policy makers. Considering the broad spectrum of NCDs, gaps and strengths highlighted in literature from other countries were not wholly applicable in the Malawian setting. The needs assessment created a country profile for NCD services and research that identified needs, opportunities and priorities. This assessment promotes the effective use of resources for NCD implementation research by identifying existing infrastructure established for other purposes [10]. The findings from this assessment also informed initiatives to build implementation research capacity through mentoring programs for young researchers and workshops in NCD management for healthcare workers [31].

Weaknesses

One limitation of this study is that only public health facilities were included in the assessment. Understanding that close to 30 % of facilities in Malawi are not owned by the MoH, the needs at the nonpublic health facilities might have been missed yet a significant proportion of the population access health care services from these facilities.

Conclusions

NCDs are a significant health burden in the Malawian health care services. A general lack of resources in the healthcare system affects extent of coverage of NCD services and implementation research activities necessary for improving care. Improving number and capacity of human resource, drug supply and equipment at all levels of care, plus advancing NCD focused implementation research should be prioritized in efforts to address NCD care in the country. Tailored short course trainings for nurses, clinical technicians and medical assistants to fill knowledge gaps in NCD management is essential. Deliberate efforts should be put in place to ensure mentoring of junior researchers to improve their capacity to conduct implementation research, provision of adequate funding, and collaboration of the community, healthcare service providers, university researchers, development partners and policy makers to promote NCD focused implementation research.

Declarations

Ethics approval and consent to participate

Ethics approval to conduct this study was obtained from the College of Medicine Research ethics committee (study approval number- P.07/19/2743). All study methods were performed in accordance with the relevant guidelines and regulations. Permission to access each of the study sites was obtained from relevant authorities prior to commencement of data collection. Participation in the study was voluntary. All participants were given a copy of the study information sheet to read for them to understand the study aims and benefits and their rights as participants. The participants were assured that their participation in the study was anonymous and that confidentiality of all data shall be maintained by the researchers. The participants were also informed of their right to withdraw from the study at anytime without facing any repercussions from the study team or their employers. Participants gave a written consent that was dated and countersigned by the research assistant before being interviewed. All interviews were held in private. There was no risk in participating in this study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors report no relationships that could be construed as a conflict of interest.

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Authors' contributions

The first author wrote the first draft of the manuscript. All authors reviewed and contributed to content. All authors approved the final manuscript copy.

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Figures

Proportion of NCD cases seen in the last three months

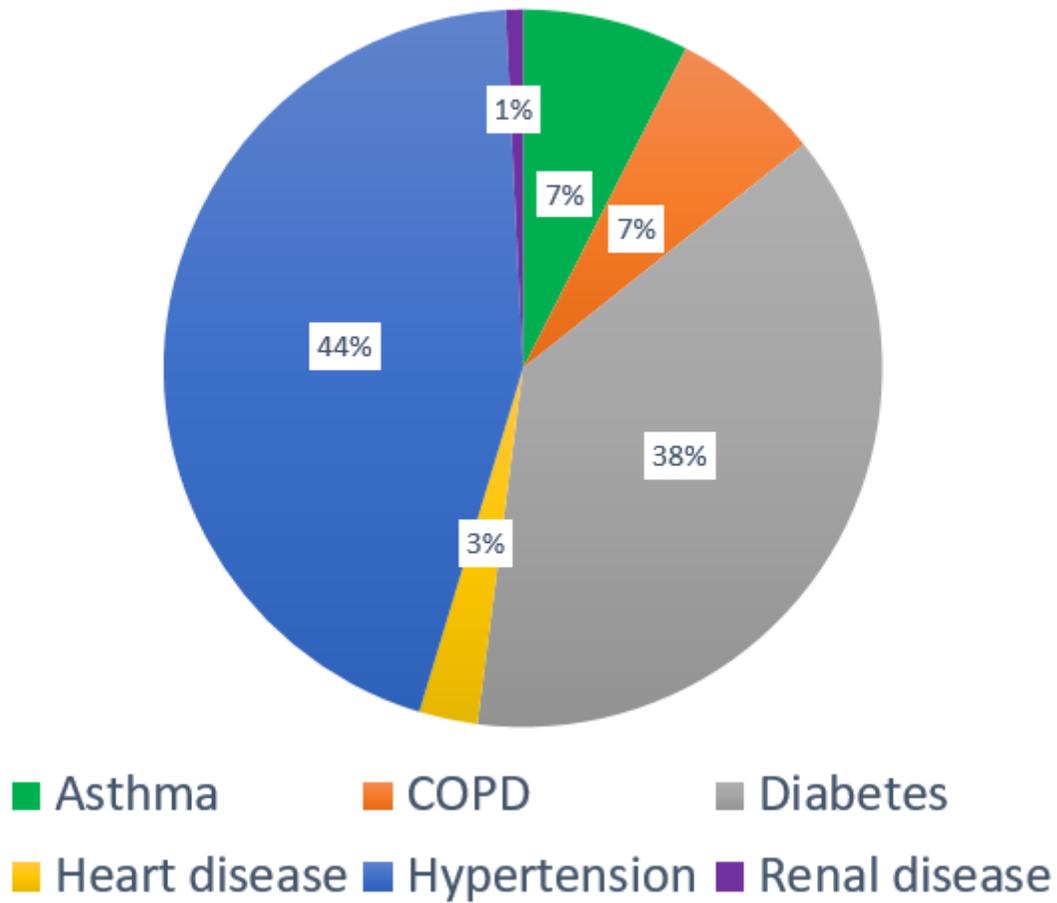


Figure 1

Proportion of NCD cases seen at the sampled facilities in the previous 12 months

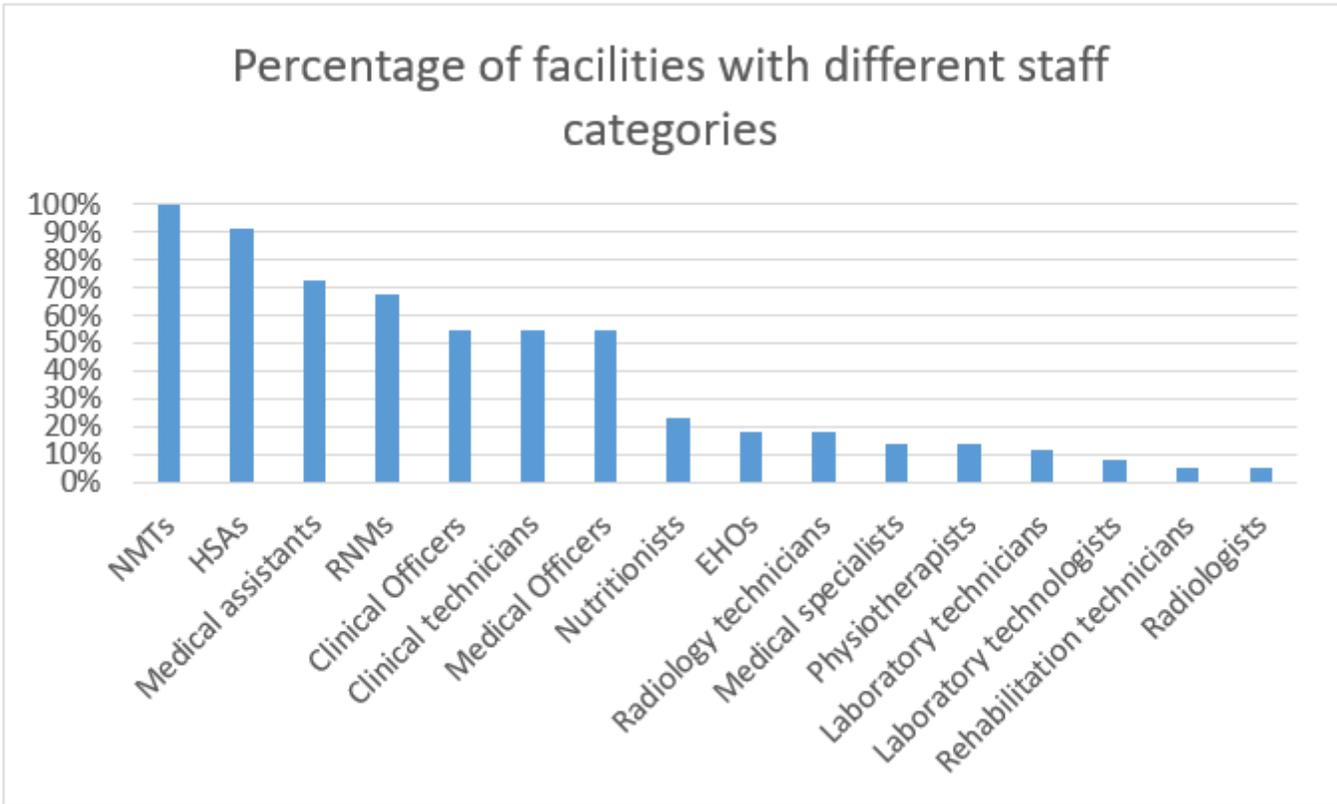


Figure 2

Percentage of facilities with different staff categories