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QUALITY OF DIABETES CARE FOR PEOPLE WITH TYPE 2 DIABETES IN A PRIVATE FAMILY MEDICINE TRAINING FACILITY IN ACCRA, GHANA: A CLINICAL AUDIT.

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MSc DIABETES

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Abstract

Background

Type 2 diabetes is a chronic progressive metabolic disease with increasing prevalence worldwide. The burden of T2DM in Africa is enormous. The higher prevalence of undiagnosed diabetes, poor glycaemic control, and weak healthcare systems contribute to this burden. This audit assessed the quality of diabetes care in a premiere private medical facility in Ghana using processes of care and intermediate outcomes of care.

Methods

This clinical audit assessed diabetes care from 1st August 2022 to 31st October 2022 across specific sites of Nyaho Healthcare Limited(NHL). Electronic medical records of people living with diabetes seen within this period were reviewed for documentation of specific processes of care and intermediate outcomes of care over a 15-month period(1st August 2021 – 31st October 2022).

Results

111 patients(mean age 56.7years; 48.6% female) were identified in total. Of the total, the majority(76.6%(n=85) were seen in the main hospital and family physicians/medical officers delivered care to 48.6%(n=54) of the patients. Blood pressure and smoking history documentation were highly achieved (100%, n=111 and 91%, n=101 respectively) while foot surveillance, BMI and UACR were the least achieved (7.2%, n=8, 9.9% and 9.9%, n=11). None of the 111 patients achieved all nine processes of care during the period. The glycaemic target of HbA1c ≤ 7% was achieved by 38.7% (36 out of 93) across NHL. Only 20.4%(19 out of 93) achieved blood pressure ≤140/80mmHg, HbA1c≤7% and statin use according to their most recent records.

Conclusion

The quality of care for people with T2DM in this family medicine training facility was suboptimal during the audit period. Intermediate outcomes of care were better achieved in this facility. This emphasizes the need for more dedicated efforts and resources towards improving diabetes care in this facility.

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Abbreviations

ACEi - Angiotensin-Converting Enzyme (ACE) Inhibitors
ACCORD - Action to Control Cardiovascular Risk in Diabetes
ADVANCE - Action in Diabetes And Vascular Disease-Preterax And Diamicron Controlled Evaluation
ARB -Angiotensin Receptor Blockers
ASCVD – Atherosclerotic Cardiovascular Disease
BMI - Body Mass Index
BP – Blood Pressure
COVID – 19 - Coronavirus Disease 2019
DCR - Diabetes Collaborative Registry
DM – Diabetes Mellitus
DSMES - Diabetes Self-Management Education and Support
DQIP - Diabetes Quality Improvement Project
eGFR - Estimated Glomerular Filtration Rate
EMR – Electronic Medical Record
FP - Family Physician
GAIA - Global Alphabet Strategy Implementation
GDP - Gross Domestic Product
GLA - Glucose-Lowering Agents
GLP-1 RA - Glucagon-Like Peptide-1 Receptor Agonists
GUIDANCE - Guidelines Adherence to Enhance Care
Hba1c – Glycated Haemoglobin
HQIP - Healthcare Quality Improvement Partnership (HQIP)
IDF – International Diabetes Federation
IOC – Intermediate Outcomes of Care
IQR - Interquartile Ranges
KDIGO - Kidney Disease: Improving Global Outcomes
LDL – Low-Density Lipoprotein
LMIC – Low- And Middle-Income Countries
MO – Medical Officer
NDA - National Diabetes Audit
NHS - National Health Service
NICE – National Institute for Health and Care Excellence
NMC – Nyaho Medical Centre
NHL -Nyaho Healthcare Limited
OPD - Outpatient Department
POC – Process of Care
PLWD – Person(People) Living with Diabetes
P/S – Physician Specialist
QoC - - Quality of Care
QOF - Quality and Outcome Framework
SBGM – Self Blood Glucose Monitoring
SD – Standard Deviations
SDG – Sustainable Development Goals
SGLT2i - Sodium/Glucose Cotransporter-2 Inhibitors

THE% - Total Health Expenditure Percentage Per Capita
T2DM – Type 2 Diabetes Mellitus
UACR - Urine Albumin Creatinine Ratio
UK – United Kingdom
UN - United Nations
USA – United States of America.
WC - Waist Circumference
WHO - World Health Organization

Chapter 1: Introduction and background

To fulfil the requirements of the MSc Diabetes program at the University of Leicester, the author conducted an audit of diabetes care over a 15-month period. This was done across Nyaho Healthcare Limited(NHL) which conducts over 100,000 outpatient consultations annually. The scope of this audit was limited to persons with type 2 diabetes mellitus who received care across 3 sites of NHL and focused on their achievement of processes of care and intermediate outcomes of care within the audit period. This chapter describes the background, diabetes care in Ghana and Nyaho Healthcare Limited. It also covers the rationale, aims and objectives of this audit.

1.1 Background information

Type 2 Diabetes Mellitus(T2DM) is a chronic progressive metabolic disease characterized by hyperglycaemia and damage to end organs over time if poorly managed. Globally, the prevalence of T2DM among adults in 2021 was 537 million, and in the African region, it was 24 million (1). Diabetes is the fastest-growing health crisis (2) in recent times after COVID-19 and the highest rise in prevalence(160%) by 2045 will occur in sub-Saharan Africa if current trends persisted (1). The Global Burden of Disease Study 2019 showed that the largest increase in risk exposure from 2010 to 2019 was for high fasting plasma glucose, high BMI, etc. (3) and these together with other risk factors may be driving the increasing prevalence of T2DM(4). Over 70% of people living with Diabetes live in low and middle-income countries(LMIC) (1). About 50% of people living with diabetes(PLWD) in the Africa region (1) are undiagnosed and contribute to a bigger burden of complications. The burden of comorbidities and complications of diabetes has been shown to be significantly higher in Africa (5–7), contributing to poor outcomes on the continent.

Type 2 diabetes mellitus is associated with an increased risk for all-cause mortality, cardiovascular, and renal mortalities (8–10) and this risk is higher in middle-income countries (11). T2DM is a major contributor to poor quality of life, morbidity, and mortality through its associated complications.

About 10% of global healthcare expenditure is spent on T2DM and associated complications (12). However, in the Africa region, only 1.2% of its cumulative gross domestic product was spent on Diabetes Mellitus(DM) in 2015 (13). The impact and cost of diabetes are projected to increase, significantly affecting low- and middle-income countries (13) and this calls for concerted multistakeholder efforts towards improving diabetes care.

The Diabetes Quality Improvement Project(DQIP) established processes and intermediate outcome measures of care to guide the evaluation and monitoring of the diabetes care (14). These measures have been used by several bodies to assess the quality of diabetes. For example, in the United Kingdom, the National Diabetes Audit(NDA) reports on the achievement of these processes and intermediate outcome measures of care annually since 2003. Achievement of these measures has improved over the years but still varies across locations within the UK (15). The National Diabetes Audit focuses more on primary care and has demonstrated an improvement in the quality of diabetes care through the primary care

system. The Diabetes Collaborative Registry(DCR) also demonstrated significant differences in the achievement of quality metrics across locations and specialties, with cardiology clinics doing better with blood pressure control and endocrinology clinics with glycaemic control and foot examinations (16).

Persons living with diabetes receive care from all levels of care (primary, secondary, tertiary and quaternary) worldwide. Primary care has increasingly taken over most diabetes care (17) due to its accessibility, longitudinal nature and community orientation. A recent clinical audit showed the low capacity to deliver quality diabetes care in primary care clinics in South Africa (18) whilst another demonstrated the better quality of diabetes care and patient satisfaction in primary care than in hospitals in Qatar(19). Real-world evidence from developing countries demonstrates suboptimal glycaemic control which declined slightly over a 12-year period (2005-2017) even though there was an increasing proportion of PLWD with two or more HbA1c in the same period (20).

The United Nations(UN), as part of the sustainable development goals(SDG), has set a target to "reduce by one-third premature mortality from non-communicable diseases through prevention and treatment …" by 2030 (21). The World Health Organization(WHO), through the Global Diabetes Compact in response to the SDG, has therefore set targets to be achieved by 2030 to reduce the global burden of DM (22). The targets are 80, 80, 60 and 100 which implies that 80% of PLWD should be diagnosed, 80% of those diagnosed with diabetes should achieve good glycaemic and blood pressure control, 60% of people over 40% should be using statins and 100% of people with T1DM should have access to insulin and self-blood glucose monitoring(SBGM) (23,24). These targets are ambitious but achievable considering data from high-income countries, however in Africa considering that only about 48% of PLWD are diagnosed, 30% of PLWD in SSA have good glycaemic control and less than half have access to one HbA1c a year (13,25), this may be difficult.

1.2 Ghana

Ghana is a West African country with a population of 30.8 million according to the 2021 population census (26). The population is 50.7% female, 56.7% urban, 79.3% below 40 years old, 69.8% literate, and 73.9% own a smartphone (26). The International Diabetes Federation(IDF) 10th atlas estimates the prevalence of diabetes among adults in Ghana to be 2.0% in 2021 (1). However, a systematic review and meta-analysis published in 2019 estimated the prevalence of diabetes mellitus in Ghanaian adults to be 6.5% with age >40 years, obesity and family history as the most significant risk factors (27). The morbidity and mortality associated with Diabetes in Ghana are rising. Over the last three decades, admissions and mortalities from DM have increased significantly in Ghana (28). Diabetes has consistently been in the top 20 for outpatient department(OPD) attendance and inpatient admissions across many settings in Ghana (29).
About 68.8% of Ghanaians are covered by health insurance plans with coverage generally reducing from north to south (26). These health insurance plans are either national or commercial and all cover diabetes care to various degrees. The pharmaceutical industry is quite robust with the production of affordable biguanides and sulphonylureas and the

importation of many other drug classes to support diabetes care. However, due to the weak currency and tax systems, prices of disease-modifying drugs (SGLT2i and GLP 1RA) are extremely high and are currently not covered by national health insurance. Devices to aid self-management of diabetes are readily available and currently purchased out of pocket.

Diabetes care in Ghana is provided across all levels of our healthcare system through both specialised "Diabetes" clinics and non-specialised clinics. Currently, there are less than 40 trained endocrinologists or diabetologists leading the care of diabetes in Ghana with the majority of these in the southern part of the country. However, many other specialists, medical officers, physician assistants, dietitians and psychologists have received some training in diabetes and are contributing significantly to diabetes care in Ghana. There is currently no "structured diabetes self-management education" that meets standards; however, some patient education is usually provided in many "diabetes" clinics in different forms.

There is no national programme or guideline for the management of Diabetes in Ghana. The most recent Standard Treatment Guidelines has about 10 pages dedicated to Diabetes Mellitus, although helpful to the lower cadres of healthcare providers, this is inadequate in the context of international guidelines and evidence-based medicine.
The Diabetes Endocrine and Metabolic Society of Ghana is leading the advocacy agenda and is in the process of drafting the national guideline for diabetes care (30).

The quality of diabetes care in Ghana has not been researched and there is an urgent need to begin the assessment of the quality of care and identify key opportunities for improvement.

1.3 Nyaho Healthcare Limited

Nyaho Healthcare Limited(NHL) has been a leading healthcare provider in Ghana for over half a century. It started with the Nyaho Medical Centre(NMC/Airport Main) which was the first group private practice in Ghana and has been in operation since 1970 (31). NMC currently serves as the main hospital in the Airport Residential Area in the capital city of Accra and provides 24-hour outpatient, emergency, diagnostics, pharmacy and inpatient services with 55 beds. As part of the drive to become Africa’s most trusted name in healthcare, NHL adopted a hub-and-spoke business model which led to the establishment of its first satellite clinic(Accra Central Satellite/Octagon) in the central business district of Accra in November 2017.

Centre – Nyaho Medical Centre
Top Right – Airport Primary Care
Lower Right – Takoradi Primary Care
Top Left – Accra Central Satellite
Lower Left – Tema Primary Care
Figure 1. Pictorial view of the Nyaho Medical Centre and the various satellites as of December 2022. Reproduced from Nyaho Healthcare Limited website with permission(Appendix 1).

Subsequently, other satellite clinics have been established in Airport – in May 2021, Tema – in November 2021 and Takoradi – in August 2022 (Figure 1). All the facilities of NHL are in the southern part of Ghana (Figure 2) but serve populations from all over the country and are the preferred facilities for expatriates.

Figure 2. Map of Ghana showing the location of Nyaho Medical Centre and the various satellites as of December 2022(designated by H). Adapted from worldatlas.com (32).

Each satellite clinic has a permanent family physician(FP), a medical officer(MO) and other team members needed for the provision of comprehensive primary care services. In 2021, NHL recorded over 100,000 outpatient consultations and over 2,300 inpatient admissions from a patient pool of over 75,000. There are more than 70 specialists and consultants working across the hospital and its satellites, these include one endocrinologist, one nephrologist, four other physician specialists, one diabetologist in training, general surgeons, dietitian, ophthalmologists, clinical psychologists and a chronic disease educator who contribute to the provision of multidisciplinary care. The hospital has partnerships with several corporate organizations and insurance companies that pay for services for their beneficiaries. Only about 30% of services rendered by the NHL are paid for by cash.
Nyaho Medical Centre is a premiere private medical centre and the only private facility with accreditation to train family medicine residents in Ghana. Currently, there are 11 family medicine residents in the program and six family physicians who have been trained by the facility. Family medicine training leads the provision of primary care services across the NHL.

Diabetes care across various settings is provided to persons living with diabetes by medical officers, family physicians and physician specialists routinely in the outpatient clinic with appropriate referrals to other members of the multidisciplinary team as needed. This care is available even on weekends and at night at the main hospital and on weekdays across all the satellite clinics. Each consultation is booked for 15 minutes and is not limited to a number of complaints. Even though medical officers(doctors who have completed a mandatory 2 years of housemanship training) are limited in knowledge and experience, there is always a specialist(doctors with 3 or more years of postgraduate training in specialties) in the clinic or reachable on phone to assist with care. In July 2022, a chronic disease clinic was established at the main hospital(NMC) to provide comprehensive care for people living with diabetes, hypertension or dyslipidemia. Consultation in the chronic disease clinic is usually booked for 30 minutes and delivered by a dedicated medical officer or family physician. PLWDs managed by the facility are scheduled for follow-up between 1 week to 3 months depending on their clinical needs. NHL provides a full spectrum of laboratory services that cover the needs of T2DM management and supports the services in satellite clinics. The pharmacy stocks at least 1 drug from each group of glucose-lowering agents(GLA) apart from the GLP-1 RA and a few persons who need that are given prescriptions to get that from other pharmacies in Accra. The medicines stocked include originator brands, combination oral glucose-lowering agents and generic drugs.

1.4 Rationale for the audit

A systematic review of the quality of diabetes care (1993-2012) in some LMICs indicates that auditing of diabetes care is quite low and the quality of care was low (33). Evidence for the benefits of treatment abounds and the quality of diabetes care provided to PLWD affects long-term outcomes.

Over the last 5 years, Diabetes Mellitus has been one of the top 10 reasons for outpatient (OPD) visits and admissions at the Nyaho Medical Centre (NMC) in Accra, Ghana as shown in Figure 3 below.

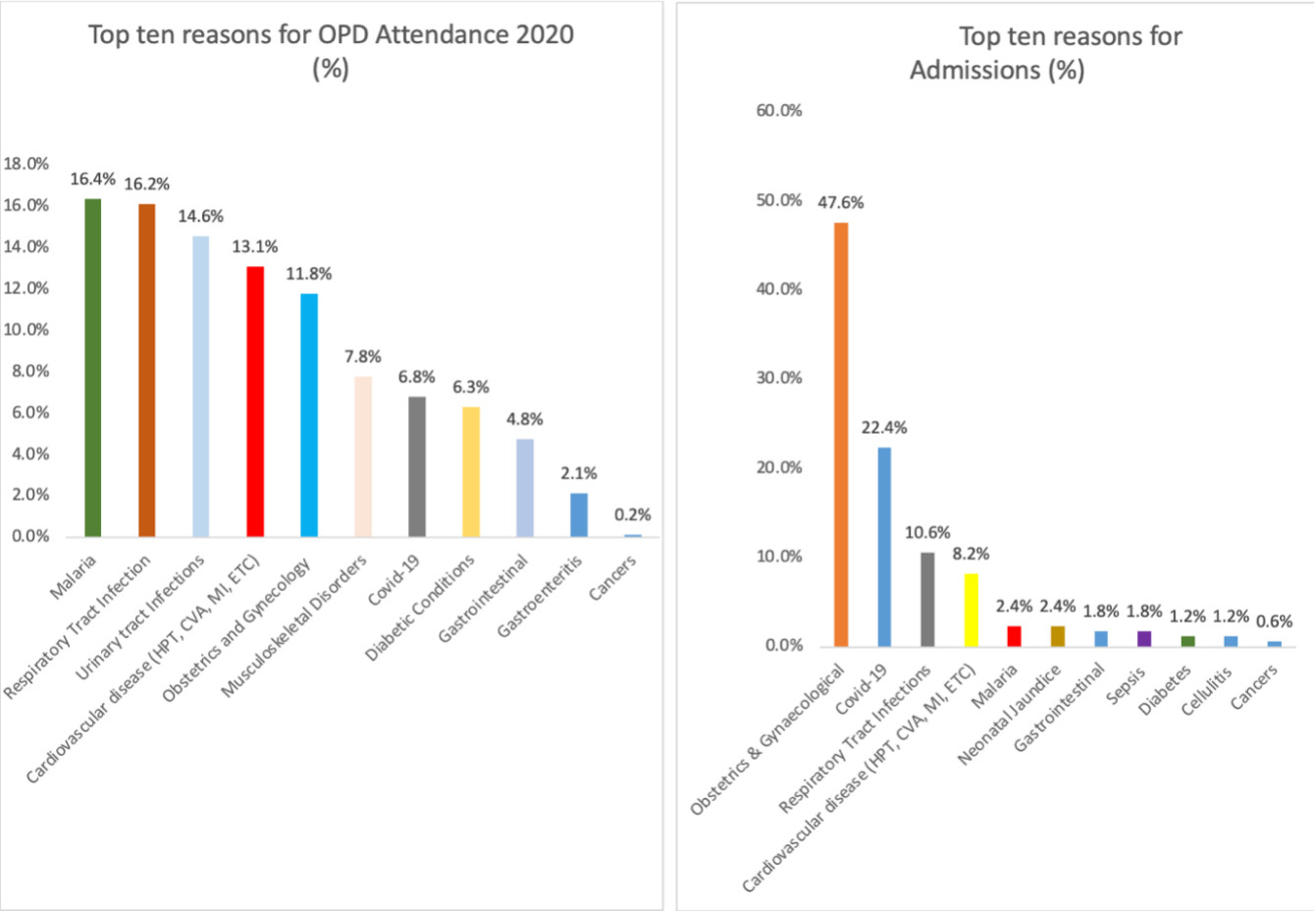


Figure 3. Top 10 reasons for OPD attendance and Inpatient admissions at Nyaho Medical Centre 2020. Reproduced from 2020 Annual Medical Report (34).

Unfortunately, very few efforts have been made to comprehensively measure the quality of diabetes care at the centre to guide consistent quality improvement. As part of the hospital's clinical effectiveness, certain metrics are monitored for the care of persons with diabetes and hypertension. Figure 4 shows the monthly trend of persons with diabetes with controlled blood sugars (HbA1c <7, or FBS<7) in primary care (34). With a target of 52%, primary care achieved a median of 60% control of Diabetes in 2020.

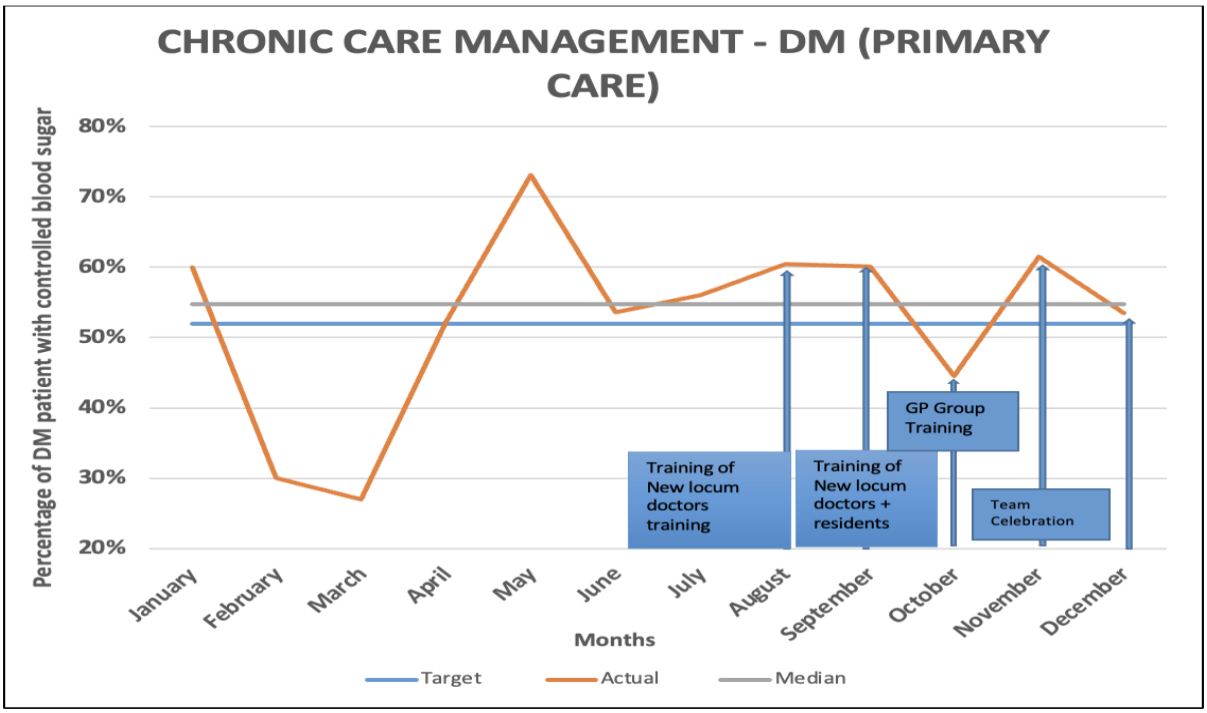


Figure 4. Monthly data on the percentage of DM patients with controlled blood sugars in primary care. Reproduced from 2020 Annual Medical Report (34).

Figure 5 below shows the monthly trend of persons with diabetes with controlled blood sugars (HbA1c <7, or FBS<7) under specialist care. With a target of 52%, specialist care achieved a median of 47% control of Diabetes in 2020.

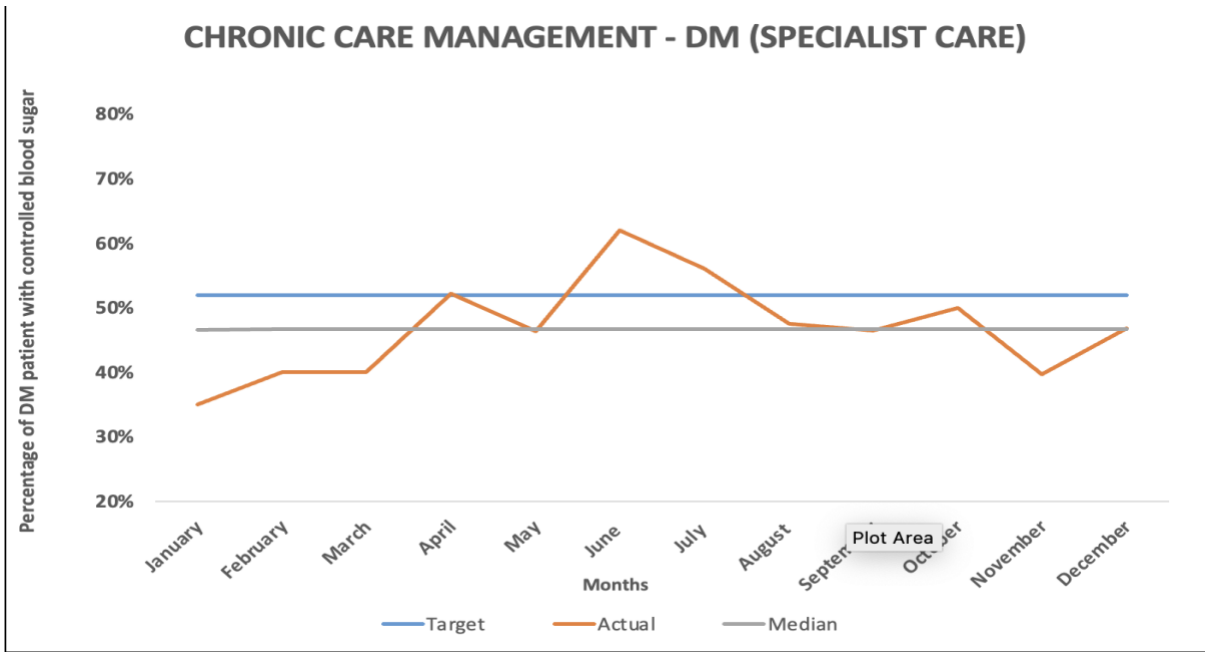


Figure 5. Monthly data on the percentage of DM patients with controlled blood sugars in specialist care. Reproduced from 2020 Annual Medical Report (34).

Figures 4 and 5 show some differences in the achievement of targets in both arms of care but this may not be significant as this data may have some confounders like case-mix etc.

Using an internationally accepted framework for assessing the quality of care at NHL helps to benchmark our practice and identify key opportunities to improve the service and diabetes outcomes. In the long term reduce the cost to the healthcare system and nation at large and hence the need for this audit.

1.5 Audit Question

Is the quality of diabetes care at Nyaho Healthcare Limited meeting the International Diabetes Federation (IDF) standards?

1.6 Study Aim and Objectives

The aim of this audit is to assess the quality of diabetes care at the Nyaho Medical Centre.

Objectives:

Primary –

1. To assess the quality of diabetes care at NHL using the International Diabetes Federation recommendations for primary care as the standard.

Secondary -

1. To compare the quality of care in the satellite clinics to that in the main hospital (NMC).
2. To compare the quality of diabetes care provided by general practitioners/family physicians to physician specialists (cardiologist/nephrologist and endocrinologist).

1.7.Organisation of the dissertation

This dissertation uses the principles of clinical audit to assess the quality of diabetes care across the NHL. It will consider only T2DM and exclude all other types. This audit will mainly focus on the achievement of processes and intermediate outcomes of care and not on any other dimensions of the quality of diabetes care

Chapter 2 (literature review) reports on the quality of diabetes care, IDF standards and reviews several works done across the world. Chapter 3 details the methodology and methods used in this audit, root cause analysis, change ideas and implementation plan. Chapter 4 reports the results of the audit. Chapter 5 discusses the findings from the audit, suggestions for future research and conclusions.

Chapter 2: Literature review

The literature review aimed to understand, from a global perspective, the quality of diabetes care for persons living with T2DM and the performance measures used in assessing it. Additionally, the review aimed to identify quality improvements that have worked around the world. Specific guidelines for diabetes management in sub-Saharan Africa were reviewed and the International Diabetes Federation guidelines were identified and used for this audit.
A search was done in PubMed to identify relevant articles on quality of care, clinical audit in Type 2 diabetes, and Primary care. The following filters were used to narrow the search – Humans, English, Medline, Adults:19+ years and from 1996-2022. Appendix 2 details the Medical Subject Heading words(MeSH) and the search strategy used. The final search was done on 17th November 2022 and identified 619 articles which were subsequently reviewed by the author to identify the most relevant to this audit project. A similar search was done on Google scholar. Furthermore, references from relevant articles were screened for other helpful articles.

2.1 Background on quality of diabetes care measurement.

Diabetes is a chronic disease that usually presents with other lifestyle diseases like hypertension and hyperlipidemia, together causing the greatest morbidity and mortality of many, including premature deaths. Diabetes care is complex and multifaceted, requiring definite actions beyond glycaemic control like patient empowerment through diabetes self-management education and support(DSMES), control of other risk factors i.e., smoking, blood pressure, lipids, and screening for early detection of complications. With the complexities of care, the economic and public health burden of diabetes, there is an urgent need for standardized measures which are evidence-based, feasible, easy to monitor and modifiable.

Quality of care is defined by the Institute of Medicine as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” (35). According to Donabedian, quality of care is multidimensional i.e. structure, process and outcomes(36). These dimensions even though variable from patient, provider or payer perspectives enable the assessment of quality and provide opportunities for quality improvement.

The Diabetes Quality Improvement Project was the first national, multi-stakeholder expert group founded in 1997, that produced a comprehensive set of performance measures in the USA (14). After a rigorous process of reviewing the literature for possible metrics, consulting experts and evaluating chosen measures against available data, a final set of metrics were agreed upon. These measures were extensively tested, and peer-reviewed by over 100 researchers and organizations interested in diabetes performance management and changes made to produce the DQIP 1.0 set of measures as shown below(Table 1).

Table 1. Diabetes Quality Improvement Project (DQIP) 1.0 measure set

Accountability
From medical records or electronic data
HbA1c tested (annually)
Poor HbA1c control (HbA1c ≥ 9.5%)
Eye examination performed (high-risk annually, low -risk biennially)
Lipid profile performed (biennially)
Monitoring for diabetic nephropathy (high-risk annually, low -risk biennially)
Blood pressure controlled (<140/90mmHg)
Foot examination (annually)
From patient survey
Smoking cessation counseling (annually)
QI
From medical records or electronic data
Distribution of values for HbA1c (<7.0, 7.0-7.9, 8.0-8.9, 9.0-9.9, ≥ 10.0% or undocumented
Distribution of values for LDL cholesterol (<100, 100-129, 130-159, ≥ 160mg/dl or undocumented)
Distribution of values for blood pressure (<140, 141-159, 160-179, 180-209, ≥ 210 mmHg systolic; <90, 90-99, 100-109, 110-119, ≥120mmHg diastolic, or no value documented
From patient survey
Diabetes self-management and nutrition education
Interpersonal care

Adapted from The Diabetes Quality Improvement Project, Diabetes Care 2001 (14).

These measures were widely adopted, implemented in clinical practice, regularly reported on, and influenced payment for services and QI projects. In the USA, the Veterans Affairs department has been shown to have better diabetes care than other outfits and this may be due to the aggressive monitoring and quality improvement projects (37).

The Quality and Outcomes Framework(QOF) and National Diabetes Audit(NDA) have led to aggressive monitoring of diabetes care in the UK. The QOF is a system for the payment and performance management of general practitioners and goes beyond the quality of diabetes care to include other disease metrics (38). The NDA measures the quality of diabetes care against the NICE clinical standards across the United Kingdom(UK) since 2004 (39) using data from the QOF and other EMR systems.
NICE has subsequently identified the nine processes of care that every patient should receive at least once yearly (40,41) and three intermediate outcomes of care to be achieved by most patients to reduce cardiovascular mortalities. These were quite similar to the DQIP 1.0 measures in Table 1 above.

There seems to be some disconnect between achieving processes of care and outcomes of care (42). The annual review for persons with diabetes on its own does not seem to be as impactful as the achievement of the processes of care and intermediate outcomes of care (43).

Good quality of diabetes care is associated with a reduction in the risk of microvascular and macrovascular complications (44). In the USA and UK, there is good evidence to suggest that improvement in the achievement of processes of care and intermediate outcomes of care have led to significant declines in complications of diabetes (45). Research has shown diabetes, cardiovascular and all-cause admissions are strongly associated with achieving processes and intermediate outcomes of care (46).

Achievement of processes of care alone has not been strongly associated with better outcomes or quality of care (42,47). Improvement in the achievement of intermediate outcomes of care has been associated with reductions in complications among people living with diabetes (48–50).
Several measures have been used to improve the quality of diabetes care including audit and feedback, the use of registers, the use of checklists, and pay for performance, with many improving care (51). When such measures were withdrawn, the quality of care declined (51)

A systematic review of the quality of diabetes care (1993-2012) in some LMICs indicates that the quality of care is low and auditing and benchmarking diabetes care against guidelines is quite low also (52).

2.2 Guidelines for Africa.

The International Diabetes Federation(IDF) published clinical practice recommendations for managing T2DM in primary care settings in 2017 (53). The main purpose of the guidelines was to provide guidance to primary care providers involved in diabetes care worldwide. The authors included many experienced researchers and practitioners but unfortunately had only one person from the African region. After a thorough search and appraisal of English guidelines published before 2015, twelve guidelines were selected to answer 40 relevant questions for this clinical practice recommendation. The limitations of this publication are the usage of only English resources and the non-inclusion of the more current guidelines after 2015 considering the landmark changes in diabetes care, especially therapeutics since then. These clinical practice recommendations were specifically reviewed for statements on the nine processes of care and intermediate outcomes of care and documented in Tables 2 & 3.

Only two national guidelines for diabetes care in Africa were identified after a careful search by the author. These were the National Clinical Guidelines for Management of Diabetes Mellitus(Kenya) (54) and the Management of T2DM in Adults at Primary Care Level(South Africa) (55). The Kenyan guideline was written by a technical group of experts with support from relevant stakeholders and reviewed both local and international knowledge. This guideline, unlike others, covered many aspects of Diabetes care beyond T2DM and was published in 2010.
The South African guideline, published in 2014, focused mainly on T2DM management and included specific guidance on the organization of diabetes care. Unfortunately, neither the process of writing the guideline nor the technical group was described.

Both guidelines were reviewed for recommendations on the processes and intermediate outcomes of care. Interestingly, there were lots of similarities and few differences as shown in Tables 2 & 3 below.

Table 2. Process of care measures

Process Element	**IDF Guideline (2017)**	**Kenya Guideline (2010)**	**South Africa Guideline (2014)**
Blood Pressure(BP) Monitoring	Every visit	Every visit	Every visit
Body Mass Index(BMI)	Annually	Annually	Every 3 months
Tobacco screening and cessation counselling	Documented and measures to promote cessation	Documented and measures to promote cessation	Documented and measures to promote cessation
HbA1c	Twice a year	Twice a year	Every 3 months
Lipids	Annually	Annually, every 3-6 months if abnormal	Annually, every 3 months if abnormal
Urine Albumin Creatinine Ratio(UACR)	Annually	Annually, repeat and refer if abnormal	Annually, frequently if abnormal
Creatinine +/- eGFR	Annually	Annually, refer if abnormal	Annually, repeat in 3 months if abnormal
Retinal screening (Ophthalmology review)	Once every 1 -2 years, refer if abnormal	Annually, frequently if abnormal	Annually, frequently if abnormal
Foot risk surveillance	Annually	Annually, frequently if abnormal	Annually, frequently if abnormal

Table 3. Intermediate outcomes of care

Parameter	**IDF**	**Kenya Guidelines**	**SA Guidelines**
BP (mmHg)	130-140/80	130/80	140/80
HbA1c (%)	≤7/ 7.5-8*	≤7 / ≤8*	≤7 / ≤7.5*

Statin use/LDL target(mmol/l)	**/<2.6	statin use for raised LDL/<2.6	**/<2.5,

*Older persons, high risk, hypoglycaemic unaware, short life expectancy
**Statin use recommended for primary prevention(T2DM + ≥40years) or secondary prevention(T2DM + established cardiovascular disease)

2.3 Quality of diabetes care

Significant research has been done to assess the quality of diabetes care since the 1990s. The quality of diabetes care is usually measured using several processes of care and/or outcomes of care. The commonest used by far in the literature is the NICE nine processes of care and three intermediate outcomes of care measures.
Variations in the quality of care are well-documented across many healthcare settings and countries (56) with better quality more common in developed countries.

Many studies that have reviewed the quality of care for T2DM have demonstrated significant differences in the achievement of processes of care and intermediate outcomes (57,58). The processes of care usually seem to be more easily achievable, compared to the intermediate outcomes of care.

The processes of care include tests for early complications(microalbuminuria, serum creatinine, eye exam, and foot exam) and risk factor assessments (HbA1c, smoking, blood pressure, serum cholesterol, and weight/body mass index). The intermediate outcomes of care are specific targets of blood pressure, blood glucose and cholesterol that have been shown to be associated with favourable outcomes in many people living with diabetes.

2.3.1 Processes of care(POC)

<u>Blood pressure</u>
People with hypertension and T2DM are at a higher risk of cardiovascular disease – the leading cause of mortality worldwide. Blood pressure control has shown significant benefits in the reduction of macrovascular complications than glycaemic control. Blood pressure control has been shown in several landmark trials – ACCORD, ADVANCE to reduce the risk of cardiovascular and kidney diseases (59–61). More than half of people with T2DM have hypertension and therefore monitoring blood pressure guides actions.

<u>Weight/Body Mass Index</u>
Weight management has become essential in diabetes care. Measuring the weight, body mass index(BMI) and/or waist circumference(WC) is the basis of identifying possible overweight or obesity and guiding subsequent actions towards weight loss. Up to 90% of PLWD are overweight or obese (62), making the identification of abnormal weight a priority. Evidence from the DIRECT trial and several others (63–65) have demonstrated diabetes remission or better control of glycaemia and other metabolic parameters with significant weight loss (≥ 5% of body weight). Therefore, the weight/BMI/WC is an easy marker in

primary care to be used as a target and focus of patient empowerment and self-monitoring to improve outcomes.

Glycated Haemoglobin (HbA1c)

HbA1c is a measure of glucose control over the past 8-12 weeks and is keenly dependent on red blood cell turnover. In many of the landmark trials, high HbA1c was strongly associated with microvascular complications (66–69). Treating the HbA1c to a target has also been effective in reducing the risk of diabetes complications, especially microvascular (66,67,70). HbA1c is a quick and easy test to guide treatment intensification and reduce clinical inertia. HbA1c < 7% (53mmol/mol) has become the goal for many PLWD for a long time, recent guidelines however recommend a higher target for persons with multiple comorbidities, short life expectancy, increased risk of hypoglycaemia and frailty (71). Unfortunately, HbA1c is usually an average over a period and does not give a clear picture of daily glucose variability and hypoglycaemic episodes which may be more meaningful in certain populations. Continuous glucose monitoring has become the more acceptable means because of its accuracy, ease of use, range of data information and the possibility of reducing diabetes distress from complex regimens and multiple skin pricks.

Tobacco cessation

Smoking has been a long-standing public health challenge, even though it is a modifiable risk factor. Beyond the excessive risk of cancers, tobacco smoking is a significant risk factor for cardiovascular morbidity and mortality (72). Cessation of smoking for about 10-14 years has been associated with complete elimination of risk of coronary heart disease compared to non-smokers (73–75). Research suggests that multiple interventions including individual face-to-face counselling, telephone therapy and the use of medications are effective in promoting smoking cessation and the first step is taking a smoking history (76).

Lipids

As a chronic metabolic disease, T2DM is especially associated with dyslipidemia. This dyslipidemia is usually characterized by high small dense LDL, low HDL and high triglyceride concentrations (77). Cardiovascular disease is the leading cause of mortality among PLWD and dyslipidemia is a major contributor. The prevalence of dyslipidemia among adults (78), especially those with diabetes is high (79,80) and hence the need for screening to guide therapy.

UACR and Creatinine

Type 2 diabetes mellitus is the leading cause of end-stage renal disease in many developing countries (81). The rising prevalence of T2DM correlates with the prevalence of chronic kidney disease (82). The UACR is the best screening method for diabetic nephropathy and can be done easily with simple point-of-care testing. Serum creatinine is usually part of the kidney function test and is used in the calculation of the estimated glomerular filtration rate. According to Kidney Disease: Improving Global Outcomes (KDIGO), estimated glomerular filtration(eGFR) and UACR are needed to establish the diagnosis, stage the disease and guide therapy (83). A yearly UACR and serum creatinine are therefore essential in the care of people living with diabetes.

Retinal screening

Diabetes, apart from being the leading cause of preventable blindness, especially in the working population, is also strongly associated with cataracts, glaucoma, and other eye conditions (84). There are effective treatment modalities for diabetic eye disease and with its prevalence screening is cost-effective. Fundoscopy can be done in primary care settings by family physicians, some medical officers and ophthalmic nurses. In many healthcare settings, there is a pathway for referral to the ophthalmologist for annual reviews for PLWD. In some areas with low expertise, fundus photography and remote reporting are beginning to make impacts (85).

Foot risk surveillance

Foot complications are very common in people with diabetes (86). According to a recent metanalysis (87), the prevalence of diabetic foot ulcers is 6.3% globally, higher in males and people living with type 2 diabetes mellitus. Among PLWD, the lifetime incidence of a diabetic foot ulcer can be up to 25%. Many guidelines recommend annual foot exams to prevent and detect foot complications early. Unfortunately, only 2% of general practitioners complete the full foot exam and up to 29% do not do a foot exam at all (88). As foot risk surveillance is relatively easy to do and effective, it is an important POC measure for diabetes care.

2.3.2 Intermediate outcomes of care (IOC)

Atherosclerosis is the underlying mechanism for the development of macrovascular complications, this is usually exaggerated with any combination of hypertension, dyslipidemia and diabetes mellitus.
The Steno 2 trial was the first landmark trial to establish the benefits of multifactorial management of risk factors (89). Intermediate outcome measures provide evidence of achieving control of the key risk factors needed in diabetes care to significantly reduce the risk of macrovascular complications (90,91), cost of care and improve quality of life.

The problem with intermediate outcomes is the dichotomous nature of achievement of a specific threshold. Thus, the IOC measures do not account for benefits achieved over the spectrum of values or harm from extremes. The complexities of medicine and the abundance of evidence seem to suggest that individualized targets are more realistic, achievable and probably more beneficial in the long term (92–94).

As shown in Table 3 above, many guidelines have set different targets based on the evidence reviewed, but the similarities are obvious.

2.4 Review of key quality of diabetes care studies.

2.4.1 Global Alphabet Strategy Implementation Audit (GAIA)

The Global Alphabet Strategy Implementation Audit collected data from 52 diabetes outpatient clinics of secondary and tertiary centres across 32 countries, including Ghana

(58). The aim of this project was to audit diabetes care across the world and to assess the implementation of the Alphabet strategy in a low-resource setting. The audit was done by auditing the records of 100 patients over a nine-month period in each centre. Data collected included demographics, processes of care and achievement of intermediate outcomes of care. Quality and outcome framework(QOF) scores were generated from the data collected and showed some positive relationship with the gross domestic product(GDP) and total health expenditure percentage per capita(THE%). Achievement of all nine care processes ranged from 0 to 74% across the centres. The 2 cohorts from Ghana were in the bottom 14 compared to other centres, scoring 0% in the percentage of patients achieving all nine care processes. The alphabet strategy checklist was successfully implemented with some improvements in diabetes care. This audit is probably the largest assessment of diabetes care globally but unfortunately did not include primary care which attends to the majority of PLWD in many countries. GAIA also did not assess the achievement of IOC which has the greatest implication for the prevention of complications as there seems to be a disconnect between the achievement of POC and IOC.

Table 4. Recording of NICE nine key processes of care/ % of centre cohort

Serial no.	Country	QOF score	NICE 9	BMI*	Smoking*	BP*	TC*	Cr*	Microalb*	Urine prot*	HbA1c*	Eye* exam	Foot* exam
GRE2	Greece	90.14	60	**95**	*75*	**100**	**98**	**98**	**95**	**95**	**100**	**96**	**96**
JER	Jersey	87.52	74	**96**	**94**	**91**	**92**	**90**	*86*	54	**98**	**90**	**93**
FRA1	France	85.02	47	*87*	*78*	**97**	**94**	**93**	*83*	46	**95**	**94**	**92**
SPA2	Spain	81.65	6	**92**	8	**96**	**98**	*88*	61	6	**95**	*88*	*86*
IND10	India	80.56	0	**99**	**99**	**99**	**99**	49	0	**93**	0	**100**	**100**
ENG	England	78.95	3	60	**93**	**100**	*77*	**94**	10	4	**95**	69	*85*
FAL	Falklands	78.92	0	**98**	**94**	**98**	**98**	10	*84*	*88*	**90**	6	36
FRA2	France	77.19	63	**98**	**94**	**97**	**96**	**98**	59	*73*	**98**	**90**	**94**
AUS3	Australia	76.93	0	0	**90**	**96**	**98**	*84*	68	18	**100**	**100**	**100**
NOR	Norway	76.54	26	56	59	**100**	**98**	**100**	*84*	61	**99**	*84*	*83*
SPA1	Spain	72.44	16	*82*	66	*83*	*84*	*84*	62	28	*78*	55	41
AUS4	Australia	72.08	0	20	40	**95**	*86*	*72*	1	0	**94**	**100**	**98**
AUS2	Australia	68.30	4	31	35	*84*	*84*	66	20	2	**94**	55	54
GRE1	Greece	68.12	26	**92**	45	**100**	**100**	**100**	**99**	**99**	**100**	*77*	**90**
IND1	India	66.79	37	**98**	38	**93**	**100**	**98**	**97**	**98**	**99**	**95**	**95**
USA	USA	66.40	5	*77*	37	**95**	37	*78*	67	13	**97**	*88*	68
SAF1	South Africa	59.05	39	61	68	**99**	*88*	**97**	*86*	37	**97**	*84*	*88*
BAR	Barbados	54.46	0	68	**90**	**95**	*82*	7	0	17	*87*	**93**	*72*
IND8	India	53.48	0	45	6	**99**	*76*	**98**	46	*81*	57	*71*	*87*
IND7	India	50.74	1	**98**	46	**99**	22	*89*	0	*74*	2	**90**	**91**
MAL	Malaysia	48.31	2	26	51	**100**	*87*	*87*	19	59	61	65	66
IRE	Ireland	45.69	5	33	38	*71*	**93**	**94**	*82*	0	**93**	**96**	27
JAM	Jamaica	41.29	1	56	6	**97**	62	55	60	57	56	56	51
GUY	Guyana	37.74	0	0	5	**97**	31	42	1	5	0	0	0
WSA	Western Samoa	37.21	0	0	39	**97**	39	49	0	35	26	56	52
IND9	South Africa	36.59	0	10	*78*	**99**	40	*88*	10	9	51	40	63
SAF2	India	36.59	0	43	**90**	**100**	38	57	32	0	3	10	51
IND5	India	36.16	0	1	50	**95**	*80*	*79*	7	47	23	23	4
BAN	Bangladesh	35.71	0	**98**	**95**	**99**	10	14	65	3	8	0	0
ZIM	Zimbabwe	35.16	0	**100**	2	**100**	0	0	0	42	1	48	22
IND3	India	33.91	0	4	50	**100**	48	*86*	0	54	8	4	12
STK	St. Kitts	32.75	0	2	0	*81*	*76*	49	2	49	0	1	2
GHA	Ghana	32.42	0	**90**	**100**	**100**	5	21	2	6	1	22	8
PER	Peru	31.66	0	64	0	**90**	50	34	1	9	3	1	1
MAU	Mauritius	30.05	0	2	28	**96**	5	**93**	5	1	1	18	14
GRN	Grenada	29.26	0	1	*84*	**100**	19	*84*	10	6	0	13	3
IND4	India	29.20	0	*73*	**96**	**99**	*81*	27	1	0	6	**90**	69
IND2	India	27.11	0	0	0	**91**	0	49	4	4	0	4	2
SOL	Solomon Is	25.26	0	8	0	*74*	0	0	0	0	0	0	2
GHA2	Ghana	19.70	0	0	0	**100**	59	43	1	*80*	37	54	60
AUS1	Australia	19.66	0	60	*73*	17	48	39	18	0	47	29	41
IND6	India	17.27	0	0	3	**97**	13	19	20	15	0	1	0
EGY	Egypt	16.16	0	0	25	*86*	3	30	0	3	0	3	17
BEL	Belize	13.35	0	0	2	**98**	42	40	0	20	0	2	10
TON	Tonga	10.16	0	26	44	**96**	6	20	0	0	0	0	46

*Bold font >90; Italic font 70–89; Normal font <70.

- Bold > 90 ; Italic font 70-89; Normal font < 70

Reproduced from GAIA project (Global Alphabet Strategy Implementation Audit), BMC Health Services Research, 2014 (58).

2.4.2 Guidelines Adherence to Enhance Care Study (GUIDANCE)

GUIDANCE (Guidelines Adherence to Enhance Care) was a cross-sectional study using retrospective data from about 7597 patients in eight European countries (57). The study showed high adherence to some process measures – HbA1c (97.6%), and blood pressure(98.3%) but lower adherence in other measures – waist circumference(33.4%) and microalbuminuria assessment (59.4%), see Table 5 below.

Table 5. Process measures from patient records in the past 12 months

Process measure	Percentage (95% confidence limits) meeting criterion									Variation (%)*
	Belgium	France	Germany	Ireland	Italy	The Netherlands	Sweden	United Kingdom	Total sample	
From medical records										
HbA_{1c} checked	97.3 (96.3–98.3)	98.2 (97.4–99.0)	95.8 (94.6–97.1)	94.7 (93.3–96.2)	98.9 (98.2–99.5)	99.3 (98.8–99.8)	98.5 (97.5–99.5)	98.3 (97.5–99.1)	97.6 (97.3–98.0)	4.6
BP checked	97.8 (96.9–98.7)	99.2 (98.7–99.8)	98.9 (98.2–99.5)	94.1 (92.6–95.6)	99.1 (98.5–99.7)	99.3 (98.8–99.8)	99.5 (98.8–100)	99.1 (98.6–99.7)	98.3 (98.1–98.6)	5.4
Total cholesterol checked	98.0 (97.1–98.8)	90.2 (88.4–91.9)	84.9 (82.6–87.1)	92.6 (91.0–94.3)	97.6 (96.6–98.5)	98.8 (98.2–99.5)	88.5 (85.9–91.2)	93.9 (92.4–95.4)	93.4 (92.8–94.0)	13.9
HDL checked	97.3 (96.3–98.3)	88.7 (86.8–90.6)	60.3 (57.2–63.4)	90.5 (88.7–92.4)	97.0 (95.9–98.0)	98.9 (98.3–99.6)	70.9 (67.1–74.7)	77.1 (74.5–79.6)	86.1 (85.3–86.9)	38.6
LDL checked	95.2 (93.9–96.5)	87.9 (85.9–89.8)	66.9 (64.0–69.9)	86.9 (84.8–89.1)	74.8 (72.1–77.5)	96.8 (95.7–97.9)	63.5 (59.4–67.5)	74.4 (71.8–77.1)	82.0 (81.2–82.9)	33.3
Triglycerides (fasting) checked	96.4 (95.2–97.5)	89.5 (87.6–91.3)	74.7 (71.9–77.4)	85.3 (83.0–87.5)	96.6 (95.5–97.8)	98.4 (97.7–99.2)	74.0 (70.3–77.7)	89.1 (87.2–91.0)	89.0 (88.3–89.7)	24.4
Weight/BMI checked	91.9 (90.2–93.5)	97.1 (96.0–98.1)	94.9 (93.5–96.3)	86.9 (84.8–89.1)	99.0 (98.4–99.6)	99.0 (98.4–99.6)	94.7 (92.9–96.6)	98.9 (98.3–99.6)	95.4 (94.9–95.9)	12.1
Waist circumference checked	41.2 (38.2–44.2)	39.4 (36.4–42.3)	28.3 (25.4–31.1)	11.1 (9.1–13.0)	45.4 (42.3–48.5)	38.3 (35.3–41.3)	65.1 (61.1–69.1)	11.2 (9.3–13.2)	33.4 (32.3–34.4)	54.0
Serum creatinine checked	88.4 (86.5–90.4)	57.1 (54.1–60.1)	72.8 (70.0–75.6)	92.0 (90.3–93.7)	89.0 (87.1–91.0)	97.7 (96.8–98.7)	94.4 (92.4–96.3)	94.7 (93.3–96.0)	85.2 (84.4–86.0)	40.6
Microalbuminuria checked	26.7 (24.0–29.4)	66.4 (63.5–69.2)	26.8 (24.0–29.6)	58.1 (55.0–61.2)	60.9 (57.8–63.9)	90.3 (88.5–92.1)	75.6 (72.0–79.2)	76.1 (73.5–78.7)	59.4 (58.3–60.5)	63.6
Eyes checked	58.0 (55.0–60.9)	68.6 (65.8–71.4)	78.1 (75.5–80.7)	63.2 (60.1–66.2)	80.4 (77.9–82.9)	86.3 (84.2–88.4)	76.2 (72.6–79.7)	88.6 (86.6–90.5)	74.8 (73.8–75.8)	30.6
Foot pulses checked	67.4 (64.6–70.3)	79.6 (77.2–82.1)	81.8 (79.3–84.2)	67.8 (64.8–70.8)	51.7 (48.6–54.8)	89.4 (87.5–91.3)	65.8 (61.9–69.8)	77.1 (74.5–79.6)	73.1 (72.1–41.74.1)	37.7
Foot sensation checked	49.2 (46.2–52.3)	67.0 (64.1–69.8)	75.4 (72.7–78.1)	59.7 (56.6–62.8)	47.8 (44.6–50.9)	89.5 (87.6–91.4)	70.5 (66.7–74.4)	78.9 (76.4–81.4)	67.1 (66.0–68.2)	41.7
Patient reported										
Education received (group or individual)	95.7 (92.0–99.4)	96.4 (93.0–99.9)	92.6 (89.9– 95.3)	98.4 (96.6–100)	67.3 (61.5–73.1)	98.7 (97.4–100)	94.6 (90.0–99.2)	97.3 (94.4–100)	91.4 (89.9–92.8)	31.4
Smoking cessation advice (smokers only)	54.1 (46.0–62.1)	40.0 (31.2–48.8)	11.9 (5.6–18.2)	61.5 (53.6–69.3)	56.3 (47.7–64.8)	43.8 (35.8–51.9)	31.1 (19.5–42.8)	55.4 (46.5–64.2)	46.6 (43.4–49.7)	49.6

BP, blood pressure. *Difference between proportions for highest and lowest scoring countries.

Reproduced from GUIDANCE Study, Diabetes Care,2013 (57).

Even though 53.6% of these persons achieved an HbA1c < 7%, only 6.5% met all three targets for blood pressure, LDL cholesterol and HbA1c (57), see Table 6 below.

Table 6. Percentage meeting intermediate outcome measures

Outcome measure	Target	Percentage (95% confidence limits) meeting target									Variation (%)*
		Belgium	France	Germany	Ireland	Italy	The Netherlands	Sweden	United Kingdom	Total sample	
HbA_{1c} (%)	<7% (53 mmol/mol)	59.7 (56.7–62.8)	65.3 (62.4–68.2)	48.6 (45.4–51.9)	53.4 (50.2–56.7)	35.7 (32.7–38.7)	70.5 (67.7–73.3)	56.5 (52.3–60.6)	39.1 (36.1–42.1)	53.6 (52.5–54.8)	34.8
BMI (not overweight)	<25 kg/m^2	17.7 (14.7–20.7)	14.2 (11.8–16.6)	10.5 (8.3–12.8)	12.0 (9.4–14.6)	20.4 (17.8–23.1)	15.1 (12.8–17.4)	18.4 (14.7–22.0)	10.5 (8.6–12.5)	14.7 (13.8–15.6)	9.9
Waist circumference, men	<94 cm	17.1 (12.3–21.9)	17.0 (12.4–21.6)	6.6 (2.2–10.9)	19.0 (8.9–29.1)	19.0 (13.9–24.0)	15.3 (10.5–20.2)	11.8 (7.5–16.2)	16.2 (7.4–24.9)	15.4 (13.5–17.3)	12.4
Waist circumference, women	<80 cm	4.1 (1.3–7.0)	4.3 (1.2–7.5)	4.8 (1.3–8.2)	4.3 (0.0–10.0)	6.2 (2.9–9.5)	4.6 (1.5–7.7)	5.3 (1.5–9.1)	8.5 (0.5–16.5)	5.0 (3.8–6.3)	4.4
Systolic BP	<130 mmHg	29.3 (26.5–32.1)	26.3 (23.7–29.0)	19.0 (16.5–21.5)	32.9 (29.8–36.0)	31.8 (28.9–34.7)	27.8 (25.1–30.6)	35.3 (31.3–39.3)	32.5 (29.7–35.4)	29.0 (28.0–30.0)	16.3
Diastolic BP	<80 mmHg	36.5 (33.5–39.4)	38.8 (35.8–41.7)	22.4 (19.7–25.0)	57.3 (54.0–60.5)	42.1 (39.0–45.2)	49.2 (46.1–52.2)	53.7 (49.6–57.9)	59.2 (56.2–62.2)	44.3 (43.2–45.5)	36.8
BP (combined)	<130/80 mmHg	17.6 (15.3–20.0	14.9 (12.7–17.1)	7.4 (5.7–9.1)	24.9 (22.1–27.8)	20.8 (18.2–23.3)	20.3 (17.9–22.8)	27.1 (23.3–30.8)	25.0 (22.3–27.7)	19.3 (18.4–20.2)	19.7
Total cholesterol	<4 mmol/L	23.1 (20.5–25.7)	25.7 (23.0–28.5)	11.7 (9.5–13.9)	52.6 (49.3–55.9)	19.7 (17.2–22.2)	34.5 (31.6–37.4)	22.8 (19.1–26.5)	45.5 (42.3–48.6)	30.0 (28.9–31.1)	40.9
HDL, men	>1 mmol/L (>40 mg/dL)	76.2 (72.5–79.9)	74.2 (70.6–77.9)	67.0 (61.5–72.5)	56.4 (52.0–60.7)	73.7 (72.0–79.4)	62.2 (58.2–66.2)	66.8 (60.5–73.1)	50.1 (45.6–54.6)	66.2 (64.7–67.8)	26.1
HDL, women	>1.3 mmol/L (>50 mg/dL)	59.8 (55.5–64.1)	53.8 (48.8–58.7)	56.5 (50.8–62.1)	37.0 (31.8–42.1)	58.1 (53.3–62.8)	49.4 (44.8–54.1)	48.0 (40.1–56.0)	33.8 (28.5–39.0)	50.5 (48.7–52.3)	26.0
LDL	<2.6 mmol/L (<100 mg/dL)	49.7 (46.6–52.8)	52.4 (49.2–55.6)	30.7 (27.1–34.3)	76.9 (74.0–79.8)	40.4 (36.8–43.9)	58.9 (55.8–62.0)	47.3 (42.0–52.5)	74.5 (71.4–77.6)	55.0 (53.8–56.3)	46.2
Fasting triglycerides	<1.7 mmol/L	60.8 (57.8–63.9)	64.4 (61.4–67.5)	43.2 (39.5–46.8)	60.0 (56.6–63.4)	67.2 (64.2–70.2)	63.3 (60.3–66.3)	61.9 (57.2–66.6)	52.1 (48.8–55.3)	59.5 (58.3–60.7)	24.0

BP, blood pressure. *Difference between proportions for highest and lowest scoring countries.

Reproduced from GUIDANCE Study, Diabetes Care,2013 (57).

GUIDANCE showed that shorter diabetes duration, lower BMI, presence of macrovascular conditions, and statin use were associated with an increased likelihood of achieving all 3 targets. The GUIDANCE study is recent and considered both POC and IOC in assessing the quality of DM care in Europe but is limited by the varied structural differences of the healthcare systems of each country. It is likely to have overestimated the achievement of metrics as non-attendants were not included in the sample.

2.4.3 National Diabetes Audit(NDA)

The National Diabetes Audit of the NHS seems to be the most comprehensive and largest audit of diabetes care worldwide involving primary care and some specialist services across England and Wales (39). The audit is done annually and involves both type 1 and type 2 diabetes, with national and practice-based reports which facilitate quality improvement projects in diabetes care. Though the participation by practices and case mix vary year on year, it still provides satisfactory data for comparisons and measurement of the quality of diabetes care delivered across the UK. The first audit of the NDA was published in 2005 for the 2003/04 audit period. The following were the key findings (95):

i. Almost a quarter of people with diabetes were not registered at GP practices.
ii. There was a wide variation in care and complications documented across England.
iii. Less than 10% of all persons with diabetes received all nine processes of care over the year.
iv. Processes like blood pressure, HbA1c, cholesterol and creatinine were documented in about 75% of patients while eye examination, foot examination and urine albumin screening were documented in less than 50% of patients.

Over the years the data collection, interpretations and audits have improved significantly and show results for type 1 and type 2 diabetes mellitus separately.

The most recent report indicates that between 2015 and 2020, all the individual processes of care were achieved in more than 80% of patients consistently apart from urine albumin screening which was about 65%, see Figure 6 below.

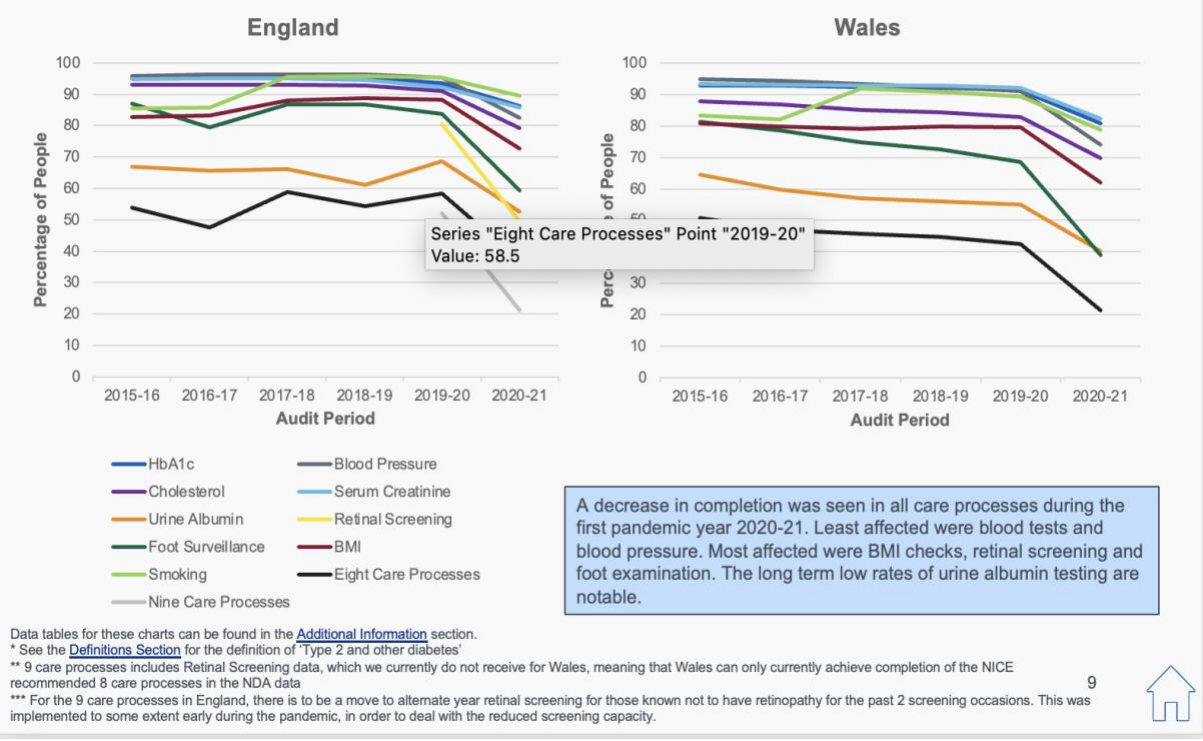


Figure 6. Percentage of people with type 2 and other diabetes* receiving NICE recommended care processes**,*** by audit year and country 2015-16 to 2020-21(15) Reproduced from National Diabetes Audit 2020-21 Full Report (15).

Achievements of these parameters dropped significantly in the 2020/21 audit, likely due to COVID-19 and its impact on primary care. Only about 35% of PLWD in the UK achieved all the three IOC (as shown in Figure 7) and about 45% achieved all nine processes of care even though most of the individual parameters were significantly higher than 70%, as shown in Figure 6 above.

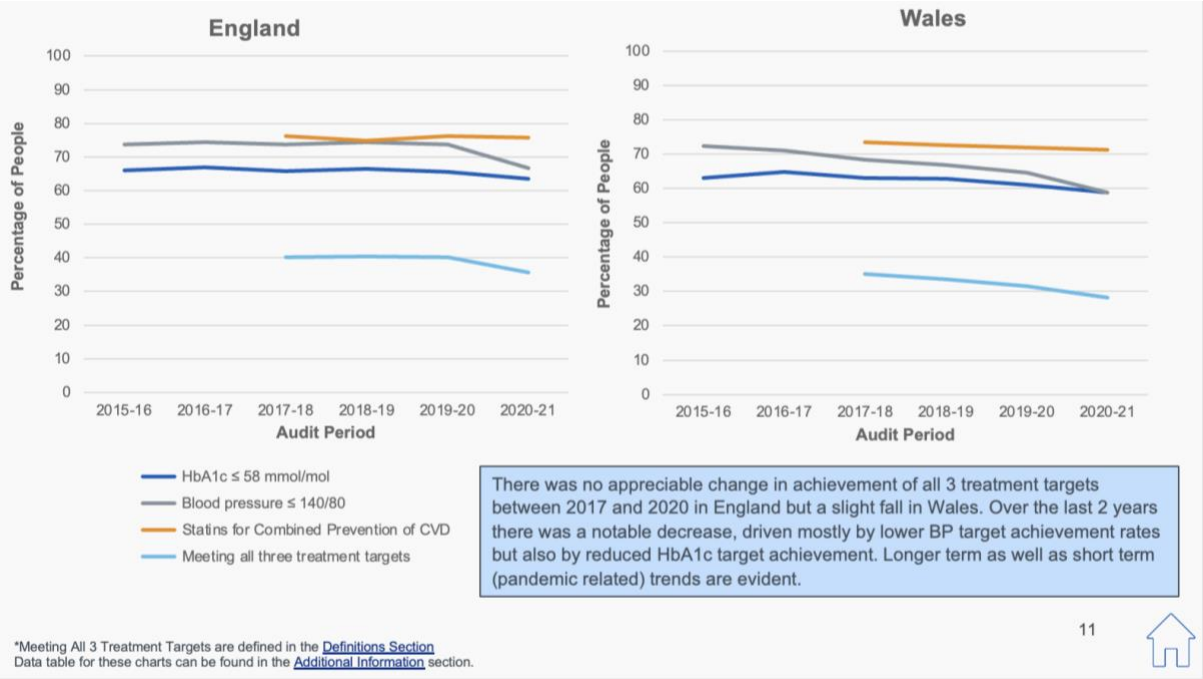


Figure 7. Percentage of people with type 2 and other diabetes* achieving their treatment targets by audit year and country, 2015-16 to 2019-20
Reproduced from National Diabetes Audit 2020-21 Full Report (15).

It is quite notable that even though blood pressure, HbA1c and lipid testing(POC) have consistently been above 90%, the targets for these measures(IOC) are achieved in about 70% of PLWD. The data collected is strongly connected to the fee-for-service payment scheme in the UK, which may impact the results and thus may not be comparable to other settings where such a system is not in place. It is important to note that the funding of the NHS is very different from what pertains in many developing countries and may contribute to the quality of diabetes care in the UK.

2.4.4 USA -Quality of Care of the Initial Patient Cohort of the Diabetes Collaborative Registry

The Diabetes Collaborative Registry(DCR) is a large database of >500,000 people living with diabetes in the USA receiving care across outpatient primary and specialty care continuum (16). This study used these seven carefully selected quality metrics – HbA1c checked in the past year and documented to be $\leq$ 9%, annual eye and foot exams, annual nephropathy screening, tobacco use and cessation intervention, blood pressure control and use of ACEi/ARB with coronary artery disease. Notably absent is a quality measure for achieving LDL targets or use of statins. For all patients and across all sites, blood pressure control and tobacco screening were achieved in >80% whiles foot exam was done only in 14.8% of the eligible population as shown in Table 7 below.

Table 7. Achievement of Quality Metrics

Quality Metric	Eligible for Metric*	Met Metric
Glycemic control†	428 804 out of 569 626 (75.3%)	139 423 out of 428 804 (32.2%)
Blood pressure control	426 879 out of 528 519 (80.8%)	349 391 out of 426 879 (81.8%)
ACE-I out of ARB with coronary artery disease	198 892 out of 535 861 (37.1%)	133 743 out of 198 892 (67.2%)
Nephropathy screening	439 546 out of 574 941 (76.5%)	289 679 out of 439 546 (65.9%)
Diabetes mellitus eye exam	439 571 out of 574 972 (76.5%)	215 004 out of 439 571 (48.9%)
Diabetes mellitus foot exam	573 670 out of 574 972 (99.8%)	84 698 out of 573 670 (14.8%)
Tobacco screening and cessation counseling‡	563 452 out of 564 677 (99.8%)	486 167 out of 563 452 (86.3%)

Reproduced from Diabetes Collaborative Registry, Journal of American Heart Association 2017 (16).

The table below shows the medians for achieving the various quality metrics across primary care, endocrinology and cardiology practices. Endocrinology performed significantly better in glycaemic control and foot exams whiles cardiology achieved better blood pressure control, ACEi/ARB usage and nephropathy screening. Annual eye screening and foot exam were poorly done across all the specialties.

Table 8. Achievement of Quality Metrics Across Specialties

	Cardiology (n=93)*	Endocrinology (n=20)*		Primary Care (n=146)*		*P* Value for Specialty in Model
Quality Metric	Median† (IQR)	Median† (IQR)	Rate Ratio‡ (95% CI)	Median† (IQR)	Rate Ratio‡ (95% CI)	
Glycemic control	9.5% (2.3–30.7)	53.1% (18.9–68.2)	3.77 (2.04–6.96)	27.5% (7.2–54.9)	2.18 (1.43–3.31)	<0.001
Blood pressure control	87.3% (77.1–90.9)	76.9% (59.0–82.2)	0.84 (0.73–0.95)	76.9% (64.6–83.8)	0.90 (0.85–0.95)	<0.001
ACE-I/ARB with CAD	66.6% (58.9–74.6)	59.0% (45.7–64.7)	0.79 (0.64–0.98)	58.1% (47.7–68.2)	0.86 (0.80–0.93)	<0.001
Nephropathy screening	68.3% (59.0–74.4)	57.1% (51.5–65.6)	0.85 (0.79–0.92)	58.4% (50.1–64.3)	0.80 (0.76–0.85)	<0.001
Diabetes mellitus eye exam	1.6% (0.0–57.3)	6.1% (0.0–80.1)	0.95 (0.15–6.07)	0.0% (0.0–83.2)	0.84 (0.32–2.19)	0.935
Diabetes mellitus foot exam	0.0% (0.0–0.9)	13.5% (0.0–50.3)	9.32 (1.75–49.50)	0.0% (0.0–12.6)	3.97 (1.74–9.05)	0.001
Tobacco screening and cessation counseling	87.6% (79.3–93.5)	86.3% (82.8–90.9)	1.02 (0.96–1.08)	85.4% (76.9–93.3)	0.93 (0.88–1.00)	0.073

Reproduced from Diabetes Collaborative Registry, Journal of American Heart Association 2017 (16).

The DCR had over 50% of patients from primary care, indicating that efforts at improving diabetes care at that level will provide the best outcomes for the majority of PLWD.

2.4.5 Malaysia - An Internal Audit of Diabetes Care for Type 2 Diabetic Patients in a Public Hospital Diabetes Clinic in Malaysia

An internal audit of diabetes care in a public hospital published in 2016 showed satisfactory performance of processes of care (96). This audit covered the diabetes clinic of a district hospital run by one general physician and 4 medical officers(and other supporting staff) once weekly. Data from 233 people living with T2DM were included in the statistical analysis out of 275 screened with the eligibility criteria. Even though many similar processes of care were used, the frequency of monitoring certain indicators was higher than once a year used in other audits e.g., FBS, BP, and BMI as seen in Table 9. However, smoking history and cessation counselling were not audited as a process of care but the audit included baseline ECG, the prescription rate for antiplatelet, statins and ACEi/ARB as indicators.

Table 9. Process of care measures for an internal diabetes audit in Malaysia.

Indicators	Frequency (%)
Fasting blood sugar recorded at every visit	231/233 (99.1)
Blood pressure recorded at every visit	230/231 (99.6)
Body mass index recorded at every visit	213/230 (92.6)
HbA1c recorded at least once over last 6 months	185/232 (79.7)
Fasting lipid profile recorded at least once over last 12 months	232/233 (99.6)
Annual complication screening	
Eye	166/233 (71.2)
Foot	60/233 (25.8)
Albuminuria	218/233 (93.6)
Urine Microalbumin done if no overt proteinuria	29/145 (20.0)
Prescription rate	
Antiplatelet	131/233 (56.2)
Statin	206/233 (88.4)
ACE-I/ARB	177/233 (76.0)
Baseline ECG documentation	136/233 (58.4)

Reproduced from Yung CH, Malaysia Journal Medical Science, 2017(96).

The process of care measures were satisfactorily achieved for many(>70%), as shown in Table 9 above, except for annual foot surveillance and urine microalbumin screening for patients with no overt proteinuria that was less than 30%.

Table 10 below shows the achievement of intermediate outcomes of care and the means for the population including FBS and BMI which are not reported in other audits.

Table 10. Intermediate outcomes of care measures for an internal diabetes audit in Malaysia.

Variables	Frequency (%)	Mean (SD)
HbA1c (N = 195)		
Mean SD,%		9.2 (1.91)
< 6.5%	13 (6.7)	
6.6%–7%	9 (4.6)	
7.1%–8%	37 (19.0)	
8.1%–9%	41 (21.0)	
> 9%	95 (48.7)	
Fasting Blood Sugar (N = 232)		
Median ± IQR, mmol/L		9.4 (4.07)
≤ 6.1 mmol/L	54 (23.3)	
> 6.1 mmol/L	178 (76.7)	
Blood Pressure (N = 231)		
Systolic BP Mean ± SD, mmHg		137 (21.0)
Diastolic BP Mean ± SD, mmHg		71 (12.4)
≤ 130/80 mmHg	84 (36.4)	
131–140/81–90 mmHg	40 (17.3)	
141–160/91–100 mmHg	77 (33.3)	
> 160/100 mmHg	30 (13.0)	
Low -density lipoprotein cholesterol (N = 219)		
Mean ± SD, mmol/L		2.4 (0.93)
≤ 2.6 mmol/L	152 (69.4)	
> 2.6 mmol/L	67 (30.6)	
Body mass index (N = 222)		
Mean ± SD, kg/m²		28.5 (4.63)
18.5–22.99 kg/m²	19 (8.6)	
23–27.49 kg/m²	87 (39.2)	
> 27.5kg/m²	116 (52.2)	

Reproduced from Yung CH, Malaysia Journal Medical Science, 2017 (96).

For HbA1c ≤ 7%, BP ≤ 130/80 and LDL ≤2.6mmol/l, only 11.3%, 36.4% and 69% of patients respectively met the criteria. This suggests a disconnect between the processes of care and intermediate outcomes of care. Even though more than 80% of these patients were on insulin therapy +/- oral therapy, the mean HbA1c and FBS were above 9 (9.2%, and 9.4mmol/L) suggesting poor glycaemic control. The mean BP of 137/71mmHg and LDL of 2.4 were satisfactory. There was however no measure to indicate the percentage of patients who achieved all three main IOCs. It is likely that having an organized diabetes clinic with stable staff contributed to the results achieved in this audit.

2.4.6 South Africa – comparison between public and private sector facilities in Johannesburg

This was a retrospective study done in South Africa to compare the quality of diabetes care in 2 specialized settings – a private vs public facility in 2016. With a total of 290 patients, this study suggested that rates of micro- and macrovascular complications were similar between the two sites (97).
It is noteworthy that the public facility was a level 3 academic hospital and the private facility was set up by endocrinologists, both within 5km of each other in Johannesburg. As expected, the PLWD visiting the public hospital were more disadvantaged and had more barriers to accessing care. Both centres offered multidisciplinary care, but nurses played a greater role in patient care in the public facility compared to the private facility. HbA1c was tested more frequently in the public facility whiles renal function testing was higher in the private facility during the past 12 months. Only 27.3% of PLWD achieved an HbA1c target of <7% compared to 45.5% at the private facility. The rates of complications (cardiovascular disease, stroke, nephropathy) were similar, but retinopathy and neuropathy were higher in the private facility although none was statistically significant. A major limitation of this study is the incomplete assessments of the processes of care and intermediate outcomes of care. Less than 50% of patients in each facility achieved glycaemic control, this correlates with the poor control in developing countries in spite of the high calibre of the two facilities and the expertise of their practitioners.

2.4.7 Retrospective assessment of the quality of diabetes care in a rural diabetes clinic in Western Kenya

This retrospective study used a comprehensive assessment(outcomes, processes and structure metrics) to evaluate the quality of diabetes care in a rural outpatient clinic in Kenya, Sub-Saharan Africa (98). The main outcomes of interest were the change in HbA1c from baseline to 18 months, and loss-to-follow-up. The clinic was run by family medicine consultants and residents and physician assistants. Data was collected from 524 people living with type 1 or 2 diabetes mellitus for care received within an 18-month period. There was a statistically significant reduction in mean HBA1c of 1.8% over the 18-month period. There were no significant changes in the blood pressure(systolic and diastolic) and body mass index over the period. More than 80% had blood pressure and HbA1c documented whiles less than 5% had lipids, creatinine and microalbumin test done over the period. This study did not consider POC like annual foot surveillance, retinal screening, lipids and tobacco screening and cessation counselling. Even though the reduction in HbA1c is indicative of good quality diabetes care, not assessing the percentage of patients receiving all processes of care or achieving targets of intermediate outcomes is a significant limitation of this study. Only 7.3 of the total population studied were lost to follow-up during the period, which is significantly low and may be explained by the clinic structure and actions and also the rural setting of the population.

2.5 Improvement in the quality of diabetes care

Assessing the quality of diabetes care has led to several quality improvement projects. The following have been associated with some improvement in the quality of diabetes care;

1. Use of checklists and reminders by physicians during visits (99).

2. Use of nurses as part of multidisciplinary care to focus on persons who are not achieving goals through follow-up calls and group education (100).
3. Use of registries (101–103).
4. Use of multi-strategic models or interventions (104–106).
5. Use of audit and feedback (105).
6. Use of benchmarking (107).
7. Pay for service (45,46,108,109).

Even though these actions have led to improvements in various settings, the evidence is still inconclusive as there is no large-scale RCT or meta-analysis on the effects of other actions apart from audit and feedback (110).
However, in a recent systematic review and meta-analysis, the quality of diabetes care was not associated with physician sex, experience and type of practice with the quality of diabetes care (111).

2.6 Summary of findings from the literature.

1. The quality of diabetes care has been assessed for several years in different healthcare settings.
2. Process of care and intermediate outcomes of care are the commonest measures used for assessing the quality and has been used in various means and combinations.
3. Globally, the achievements of all three intermediate outcomes are suboptimal and raise concerns about the quality of diabetes care.
4. There are significant variations in achieving these measures across primary care and primary care vs other specialty care.
5. Achievement of processes of care may not directly be linked to the achievement of intermediate outcomes of care.
6. Primary care is the best place to improve diabetes care for better long-term outcomes for the many persons living with diabetes.
7. Even though the quality of diabetes care has been well-researched in many parts of the world, very little is known about it in sub-Saharan Africa.
8. In terms of outcomes of diabetes care, the public and private sectors may be comparable.
9. Annual foot exams, retinal and microalbumin screening are the least completed processes of care across many settings and countries.
10. Some interventions have been linked to improvement in the quality of diabetes care and can be implemented in other settings.

In sub-Saharan Africa, there is a paucity of data on the quality of diabetes care and its connection with clinical outcomes in persons with Type 2 diabetes mellitus in sub-Saharan Africa. Additionally, there is a dearth of evidence on quality improvement activities and their effects on the quality of diabetes care. There were no peer-reviewed articles on the assessment of the quality of diabetes care identified in the Ghanaian healthcare setting. Therefore, this clinical audit provides a baseline assessment of the quality of diabetes care in a premiere facility in Ghana and contribute to the literature on this topic.

Chapter 3: Methods

A clinical audit is one of the basic tools used to assess the state of healthcare delivery and support quality improvements to the benefit of patients. Several developments over the years have led to the establishment of multidisciplinary clinical audits as a key part of healthcare in developed countries (112).

3.1 Methodology

Clinical Audit – "A quality improvement process that seeks to improve patient care and outcomes through a systematic review of care against explicit criteria, followed by the implementation of change" (113). A clinical audit involves a cycle of baseline data collection, implementation of change ideas, re-auditing/ monitoring and feedback which usually continues until best practices are embedded for improved patient outcomes.

This audit used a quantitative approach to assess the quality of diabetes care in Nyaho Healthcare Limited. Quality of diabetes care has been topical in the NHL due to the trends of morbidity and mortality and the audit sought to use objective criteria to provide information on the topic. Due to the limited time available, qualitative research was avoided even though that could have provided more robust answers to questions. This audit was therefore not looking for the right thing to be done for quality diabetes care but rather ensuring that diabetes care at NHL meets the international standards (114).

Audit and feedback can be used to improve the management of chronic diseases (110). Evidence suggests that audit and feedback are more effective if the source is a colleague or supervisor, given repeatedly in varied formats(written and verbal) with set targets and an action plan, and the baseline performance is low(110). Consistently it has been shown that audit and feedback are significantly effective when there is poor compliance with recommended practice at baseline (115). Considering the time available, the setting and the availability of electronic medical records, a clinical audit was chosen to best answer the question of whether the quality of diabetes care at the NHL meets international standards or not.

This audit is incomplete as the implementation and re-audit cannot be completed within the time period, however, the plan for completing it will be described in this dissertation.

3.2 Ethical consideration

The ethical principles of beneficence, non-maleficence, autonomy and justice must be upheld in all scientific works dealing with any aspect of patient care. It is recommended that a good risk-benefit balance is achieved and maintained throughout the conduct of a quality improvement project to deliver benefits to the patients and healthcare as a whole (116). Throughout the journey of this audit, ethical principles were always upheld and the author guaranteed ethical oversight.
The proposal for this clinical audit was shared with the University of Leicester (Diabetes Distance Learning team) and subsequently defended. Feedback received was used to

finalize the proposal. The final proposal for the audit was then shared with the Division Lead for Public Health in NHL for review and approval. After reviewing and answering a few questions, the author was cleared to conduct the audit(Appendix 3). The IT Director of the NHL was also contacted concerning access and use of patient data from the hospital's electronic medical records and approval was given with the direction to maintain utmost patient confidentiality(Appendix 4). As this project is a clinical audit evidenced by the UK Research and Innovation Medical Research Council online questionnaire(Appendix 4), there was no need for formal approval from an institutional review board.
Individual patient consent was not sought as this data was collected as part of routine clinical care and thus satisfied the principle of autonomy. The overriding ethical concern of patient confidentiality was handled by only collecting the minimum necessary information and anonymizing the patient information collected prior to data analysis. The audit will contribute to efforts in improving the quality of diabetes care which gives benefits to the patient population in line with the beneficence principle. This audit had a minimal risk as there was no direct patient involvement and patient anonymity was assured, thus having a favourable benefit-risk balance. Only necessary (adequate) data were collected by doctors who already had access to patient records at Nyaho Healthcare Limited. The data collected was saved in a cloud folder(on the NHL OneDrive) with access granted to only verified team members and will be kept for a maximum of five years. This complied with Data Protection Act, 2012 (117) and Caldicott principles (118).
This clinical audit benchmarked against IDF and WHO guidance, which are scientifically valid.

3.3 Design of the clinical audit

This clinical audit was guided by principles recommended by the University Hospitals Bristol NHS Foundation Trust (119,120). This clinical audit was designed as retrospective using data available on the hospitals' EMR over a 15-month period. The 2020-21 National Diabetes Audit report was very helpful in the conduct of this audit by serving as a recent comparable work (15).

3.3.1 Stages of the audit cycle

The stages of this clinical audit were based on Best Practice in Clinical Audit, published by the Healthcare Quality Improvement Partnership in 2020 (121).
The audit cycle is a major change to clinical audit which has improved its impact on health outcomes. It promotes actions beyond just baseline measurement against standards, to implementation of change and re-auditing.

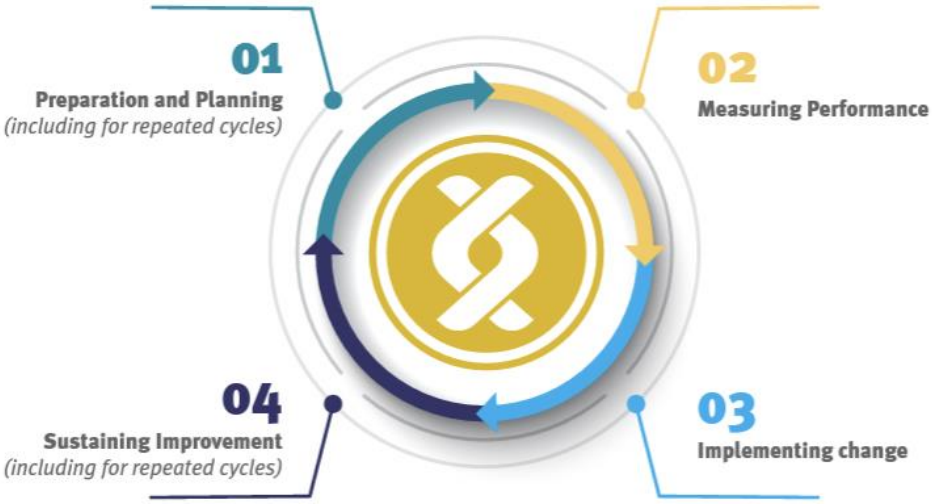


Figure 8. HQIP Clinical Audit Cycle
Reproduced from Best Practice in Clinical Audit, HQIP, 2020(121)

The cycle implies an ongoing process from preparation and planning to measuring performance, implementing change and sustaining the improvement or learning from it to plan the next cycle(Figure 8). This cycle even though similar to the one published by the University Hospitals Bristol NHS Foundation Trust (120), varies marginally(Figure 9).

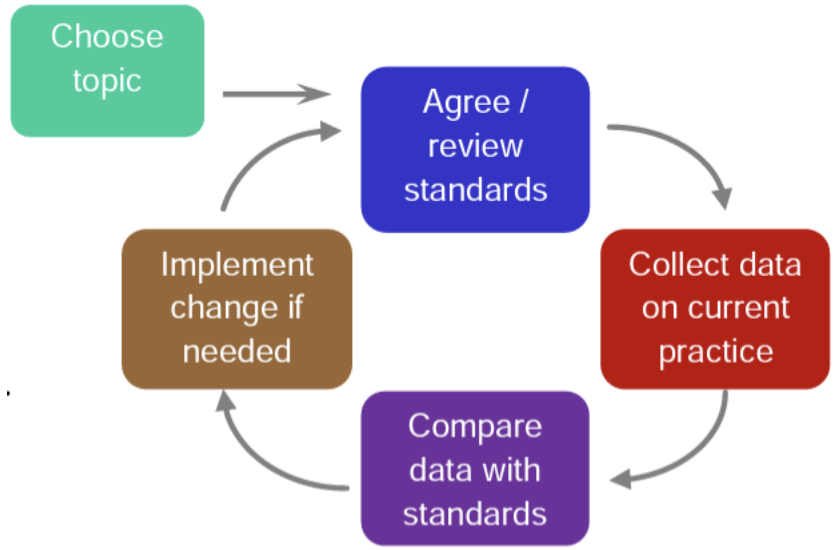


Figure 9. Audit cycle
Reproduced from University Hospitals Bristol NHS Foundation Trust, 2017 (120).

The major difference is the absence of sustaining improvement stage in the cycle from the University Hospitals Bristol guide.

3.4 Preparation and planning

The author drafted the proposal with feedback from the supervisor and presented it orally to the University of Leicester for assessment. Feedback from the assessment was used to complete the final proposal of the audit. A core team was formed with the author(diabetologist in training and family physician) and three other medical officers involved in patient care at the NHL. The final proposal was shared with the core team, and subsequently, training was conducted on the audit and data collection via MS Teams. A buy-in from the facility had been secured as the proposal was shared with key stakeholders of care at the NHL. The audit targeted all people with Type 2 diabetes receiving care who were eligible.

3.5 Eligibility Criteria

A total enumeration sampling method was used. NHL electronic medical records were searched for people with T2DM diagnoses who presented to the clinic within 3 months (1st August – 31st October 2022). The three-month window allowed for a large sample as many patients are given review dates of up to 3 months. These selected records were then reviewed for documented diabetes care over the 15-month period (1st August 2021 – 31st October 2022).

Records from people above 18 years with T2DM who have received care from NHL for at least 12 months were included in the study. Eligible patients had at least 2 visits to the NHL over the period. Records of pregnant and people with other types of diabetes or terminal illness (end-stage renal disease, cancer, cirrhosis) were excluded. These eligibility criteria were chosen because they were easily applicable, identified appropriate patients who benefit from the POC and IOC and limited patient factors in achieving these measures. A Microsoft Form data collection sheet was used to collect data on participants' demographics, process and intermediate outcome measures of quality diabetes care (Appendix 5).

3.6 Criteria and standard

The established processes and intermediate outcomes of care measures were reviewed in the context of the IDF clinical practice recommendations for managing Type 2 Diabetes Mellitus in primary care settings in 2017 (53) and other African guidelines, to establish criteria and treatment targets for this audit.

3.6.1 Processes of care

The criteria were identified after a careful review of the guidelines and literature(see Chapter 2) and considered the availability of data on the topic at the NHL. As documented in Table 2, the criteria for the audit were modified to fit the set below in Table 11. The criteria included at least documentation/evidence of Blood pressure, BMI, Tobacco history, HbA1c,

Lipids, UACR, Serum creatinine +/- eGFR, foot exams and ophthalmology consult/retinal screening in each patient's EMR at least once within the period under review.

The standard for many of the processes of care was set at 90% for the population because in the setting it was achievable and many guidelines recommended 100% i.e., all patients should have these POC at least once a year (Table 11). The literature review above consistently showed that at least for some POC, 80% or more of patients completing these were achievable. Therefore 90% was chosen as an ambitious yet potentially achievable target.

The complete set of criteria and standards for the process of care are shown in Table 11 below.

Table 11. Audit criteria and standard for process of care measures.

Audit Criteria	Standard	Exceptions	Source of evidence
Blood Pressure(BP) The record shows at least one blood pressure documented over the period.	90%	Virtual consult	IDF, Kenya, SA
Body Mass Index(BMI) The record shows at least one body mass index documented over the period.	90%	-	IDF, Kenya, SA
HbA1c The record shows at least one HbA1c documented over the period.	90%	-	IDF, Kenya, SA
Lipids The record shows at least one lipid test documented over the period.	90%	-	IDF, Kenya, SA
Tobacco screening and cessation The record shows smoking history documented at least once over the period.	90%	-	IDF, SA
Foot risk surveillance. The record shows at least one foot exam documented over the period.	90%	Lower extremity amputations - bilateral	IDF, Kenya, SA
Urine albumin creatine ratio. The record shows at least one UACR documented over the period.	90%	-	IDF, SA, Kenya
Serum Creatinine +/- eGFR The record shows at least one renal function test documented over the period.	90%	-	IDF, Kenya, SA

Retinal screening. The record shows documented fundoscopy or ophthalmology consult over the period.	90%	Persons with T2DM who are blind.	IDF, Kenya, SA

Kenya - National Clinical Guidelines for Management of Diabetes Mellitus(Kenya, 2010) (63)
SA - Management of Type 2 Diabetes in Adults at Primary Care Level(South Africa,2014) (64).
IDF - Clinical practice recommendations for managing Type 2 Diabetes Mellitus in primary care settings in 2017 (20).

3.6.2 Intermediate outcomes of care

Based on the literature review above, three targets were identified as criteria for the intermediate outcomes of care(Table 3 above). These three included controls of glycaemia, blood pressure and lipids – the most strongly linked to cardiovascular morbidity and mortality.

The targets for the IOC were selected from the IDF guidelines (53) which were quite similar to other guidelines reviewed (54,55). The standard of 80% achievement for the individual IOC measures was based on the WHO targets for 2030 (23) and 50% for all three IOC measures selected as a realistic target. Even though many guidelines advocate for individualized targets, on a population or practice-level assessment, some general targets are more useful.

The most recent(last 3 months) documentation of blood pressure, HbA1c, and last prescription in each patient's electronic medical record were used for the IOC measures shown in Table 2 below.
The complete set of standards for the intermediate outcomes of care is shown in Table 12 below.

It was anticipated that these targets even though realistic, were not likely to be achieved in the baseline audit but would guide subsequent quality improvement actions and ultimately accrue better outcomes.

Table 12. Audit criteria and standard for intermediate outcomes

Audit Criteria	**Standard**	**Exceptions**	**Source of evidence.**
The intermediate outcome measures that correlate with strong cardiovascular risk reduction and should be met are 1. A. Most recent HbA1c	80%	Other types of Diabetes Terminal illness (ESRD, cancers) Pregnancy Persons under 18 years	IDF Clinical Practice Recommendations for managing T2DM in Primary Care – 2017

B. Glycaemic control target : HbA1c should be ≤ 7%; or ≤ 8% in those with short life expectancy(≥ 80years) dementia, CKD 4 and 5.			
2. A. Most recent blood pressure B. Blood pressure target: Target of ≤ 140/80, except in persons > 80 years	80%		
3. A. Most recent lipid test or prescription B. Statin prescription for all ≥ 40 years with T2DM, established CVD or CKD.	80%		
4. All three parameters met in those who had checks done.	50%		

3.7 Measuring Performance

Data collection and validation

The author and three other medical officers, all working with the NHL collected the data. The author and two of the three medical officers are involved in the routine data collection for the clinical effectiveness of the hospital. The team of doctors were trained on the use of the data collection form to ensure uniformity and adherence to the proposal, via MS Teams. A data collection pilot was conducted to verify ease of use and appropriate data collection. The author, with the help of the IT manager, identified all patients with diagnoses of type 2 diabetes mellitus who were seen across the NHL from 1st August 2022 to 31st October 2022. Due to the start date of the Tema and Takoradi satellites and the eligibility criteria of the audit, PLWDs seen there were also excluded. PLWD who had been seen more than once during the 3-month window period were counted once. The remaining list of patients together with other relevant materials for the audit were uploaded onto OneDrive(NHL official). Having reviewed the eligibility criteria and the data collection sheet, and completed training, each team member was granted access to the files via email. The list was shared into 4 parts and each person was assigned a set to review and collect the required data. Each doctor subsequently reviewed the electronic medical records of patients assigned to them to complete the data collection form, which automatically populated an MS excel sheet. Each patient record was reviewed from 1st August 2021 to 31st October 2022. The data collected on the excel sheet was later verified for accuracy by randomly reviewing selected patients against their EMR over the period. The medical record number was the

only patient identifier collected and was subsequently deleted before sharing the final dataset with the statistician for data analysis.

Continuous values were expressed as mean values with standard deviation (SD) and/or medians with their interquartile ranges (IQR). Categorical variables were presented as frequencies with their percentages. The process of care and intermediate outcome measures were presented in proportions and percentages that achieve individual measures and some combined measures. The analysis was stratified according to the site of care (Airport main vs Satellites) and care provider (Family physicians/Medical officers vs. Physician specialists). All analyses were performed using Microsoft Excel.

Where audit findings differed from the target, reasons for these were explored through a root cause analysis. Based on the findings some best practice recommendations were proposed for possible implementation.

3.8 Implementation of change ideas

After the baseline data collection and analysis, the results were shared with the team. A root cause analysis was done by the team(3 doctors and author), 1 nurse, 1 quality officer and the chronic care educator on 2nd February 2023, all were staff of NHL and work in different facilities of NHL. The root cause analysis was done via MS Teams at an agreed time (80 minutes blocked time) using a fishbone diagram (122) after a presentation of the audit and the data collected. The fishbone diagram used can be seen in Figure 10 below.

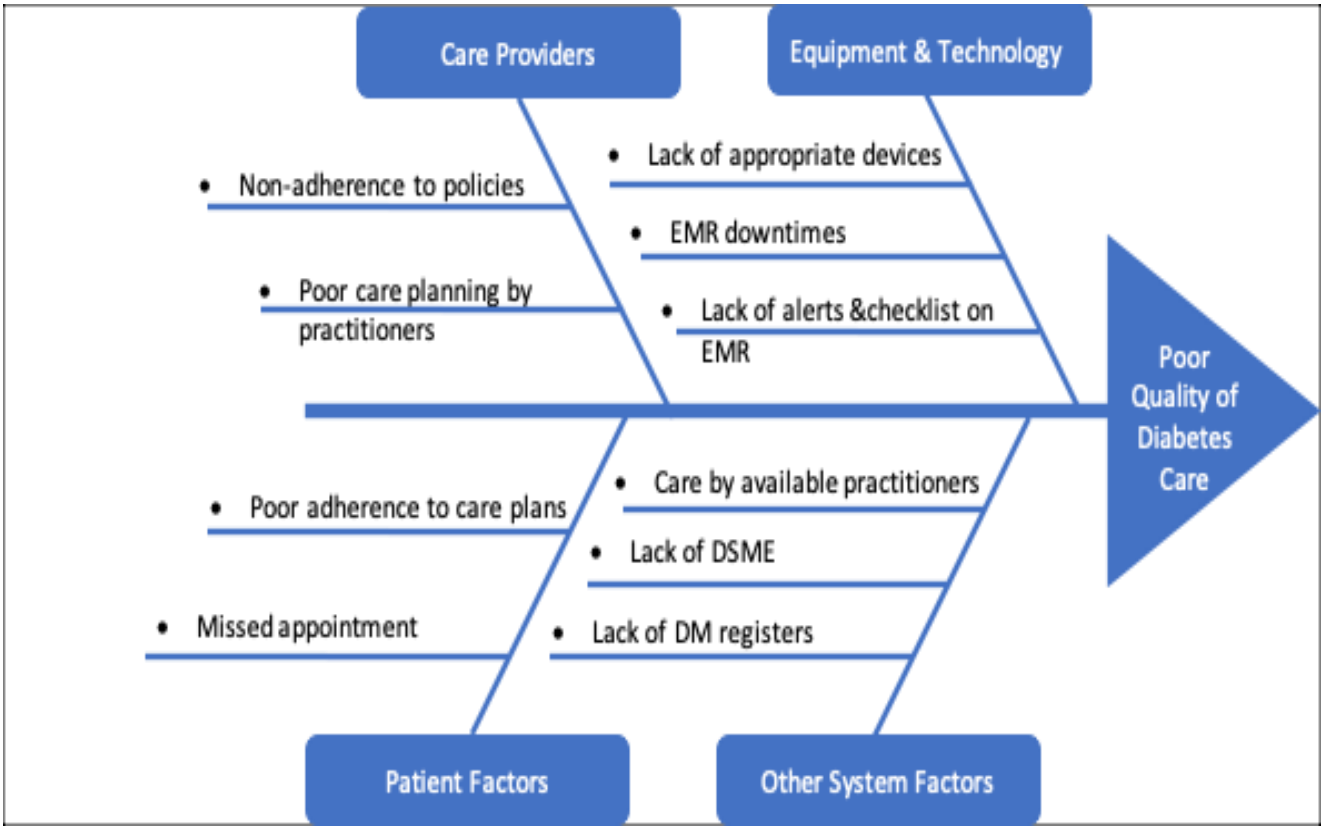


Figure 10. Fishbone diagram for root cause analysis of quality of diabetes care

The root cause analysis helped to identify possible reasons contributing to the quality of diabetes care across the NHL. The different perspectives of the stakeholders were helpful in understanding possible barriers and identifying key change ideas that could be tested to improve the quality of diabetes care across the NHL. The themes that emerged from the root cause analysis are summarized in Table 13 below.

Table 13. Themes and key issues from root cause analysis

Themes	Key issues
Patient factors	1.**Poor adherence to care plans** – Patients alter their medication taking behaviours and choose to conduct or not conduct investigation, fill prescriptions or follow through with referrals. 2.**Missed appointment** – Patients missing appointments affects the continuity of care and missed opportunities for needed changes in management
Care providers	1. **Non-adherence to policies** – Some practitioners do not comply with laid down hospital policies, especially with HbA1c testing and referrals. 2. **Poor care planning by practitioners** – Even though there are multiple specialties available across NHL practitioners do not seem to utilize it fully especially dietetics and ophthalmology services as shown by the data
Equipment and technology	1. **Lack of appropriate devices** - There was a concern about the lack of or difficulty getting XL blood pressure cuffs, 10g monofilament, tuning fork and stadiometers. 2. **EMR downtimes** – This leads to manual processes in care provision and usually not all is transferred back onto the EMR when the system was restored 3. **Lack of alerts and checklists on EMR –** The absence of these lead to possible forgetfulness on the part of practitioners especially when workloads are heavy.
Other system factors	1. **Care by available practitioners** – Patients routinely complain about being seen by different FP/MO when they come for their visits and this probably affects their continuity of care. 2. **Lack of DSME** – This leads to poor patient knowledge and self-care behaviours, ultimately compromising the quality of care as an activated and well-informed patient leads to better outcomes. 3. **Lack of DM registers** – This leads to many patients being lost to follow-ups and not being called in when appointments or checks are missed. 4. **Lack of regular training** – Many practitioners are not current in their knowledge of diabetes management and the lack of regular updates does not help.

Following the root cause analysis, some change ideas were identified and discussed. These change ideas were converted to specific action plans that can be implemented within the year before the re-audit. As audit and feedback are usually effective when baseline

performance is low, and feedback is given consistently and by a colleague(110), feedback will be used in the NHL to improve the quality of diabetes care.
The findings of the study will be presented to the whole organization at a staff durbar to get all stakeholders aligned on their roles.
The nursing team, being a key part of patient care across the NHL, will also be trained on their contribution to quality diabetes care, and this will be done twice yearly. A key focus will be on measuring BP, BMI and supporting PLWD with investigations and referrals.
Training for all doctors on quality diabetes care will be done quarterly at the general medical meetings across all sites via MS Teams. This training plan was drawn with the training coordinator and sessions will focus on key measures that were poorly achieved. A diabetes register will be created from the list of people with diabetes seen across the NHL in 2022 and shared with the chronic care clinic. The chronic care clinic will be encouraged to consistently review the list and coordinate the care of PLWD, especially those not at targets and/or missing appointments. The chronic care educator can arrange for diabetes education for these PLWD especially. This action plan is summarized in Table 14 below.

Table 14. Action plan for change ideas

Actions	**Timeline**
1. Present finding to the whole organization	End of 1st quarter, 2023
2. Training for nurses	Half yearly (twice in 2023)
3. Training for doctors	1st quarter,2023 – quality of care(QoC) , change ideas and use of resources at NHL. 2nd quarter,2023 – QoC, UACR and DM Nephropathy 3rd quarter,2023 – QoC, Foot exam and DM Neuropathy 4th quarter,2023 – QoC, Fundoscopy and DM eye disease.
4. Creating a diabetes register	End of 1st quarter, 2023
5. Active role of chronic care clinic	Year-round , with quarterly reviews
6. Re-audit	October, 2023

3.9 Sustaining Improvement

Expected change

As knowledge of the problem, why and what can be done are powerful steps towards behaviour change, emphasizing these is expected to improve the quality of diabetes care across NHL. The client service will appreciate their roles and consistently book patients for follow-up visits to reduce the loss to follow-up. Patients that are booked for clinic appointments are called 24 hours prior to confirm or reschedule which will be helpful. Sessions with nurses will show the highly achieved BP metric but poorly achieved BMI metric and help them appreciate their contribution to quality diabetes care across NHL. This will motivate the team to accurately measure and document appropriate vitals to improve the achievement of these POC.

Doctors are expected to consistently examine certain key areas, do appropriate investigations and refer appropriately to other members of the multidisciplinary team. The diagnostic team will understand the context of UACR and BUE+Cr, and strive to deliver these results in a timely fashion. The chronic care clinic will use the register to identify appropriate patients for care coordination. The sessions with the chronic care educator are expected to empower the PLWD to positively contribute to their care.
The re-audit is expected to confirm the maintenance of highly achieved measures and improvements in the poorly achieved measures by at least 10%. The findings of the re-audit will provide evidence to confirm whether the change ideas implemented were effective or not and guide subsequent cycles of this audit. This new learning will be reshared across the organization and, if appropriate, with other primary care facilities in Ghana to improve the quality of diabetes care for the majority of PLWD.

Chapter 4 Results

The data collected was the first comprehensive audit of the NHL and showed that different metrics were achieved at varied levels.

4.1 Audit population

The audit population selection process is summarized in Figure 10, below. The total number of OPD consultations across the NHL was 25,003 from 1st August 2022 to 31st October 2022. As expected, the Nyaho Medical Centre (Airport Main) had 16,677 consultations, Airport Primary care – 3,214, Accra Central satellite - 3,043, Tema Primary care - 1,392 and Takoradi Primary care - 677 consultations during the same period. These numbers were relatively stable across other quarters of 2022 with the exception of the Tema and Takoradi satellites which have been increasing quarterly.

The total list of consultation records was filtered for persons with a diagnosis of Diabetes or Type 2 diabetes and 498 consultations were identified. This list was subsequently filtered by location (to include Airport Main, Airport Primary Care and Accra Central Satellite) which yielded 364 consultations. Duplicate records(PLWD who were seen more than once between 1st August 2022 to 31st October 2022) were counted once and a total of 149 consultations were reviewed individually for data collection using the eligibility criteria. Subsequently, 1 patient was excluded for being less than 18 years, 5 excluded for having a terminal illness or pregnancy, 10 for inappropriate diagnosis (likely type 1 or not diabetic at all), 6 for less than 12 months of care, and 17 for less than 2 visits within the period.
In all complete data were collected for 111 PLWD who were eligible for the audit.

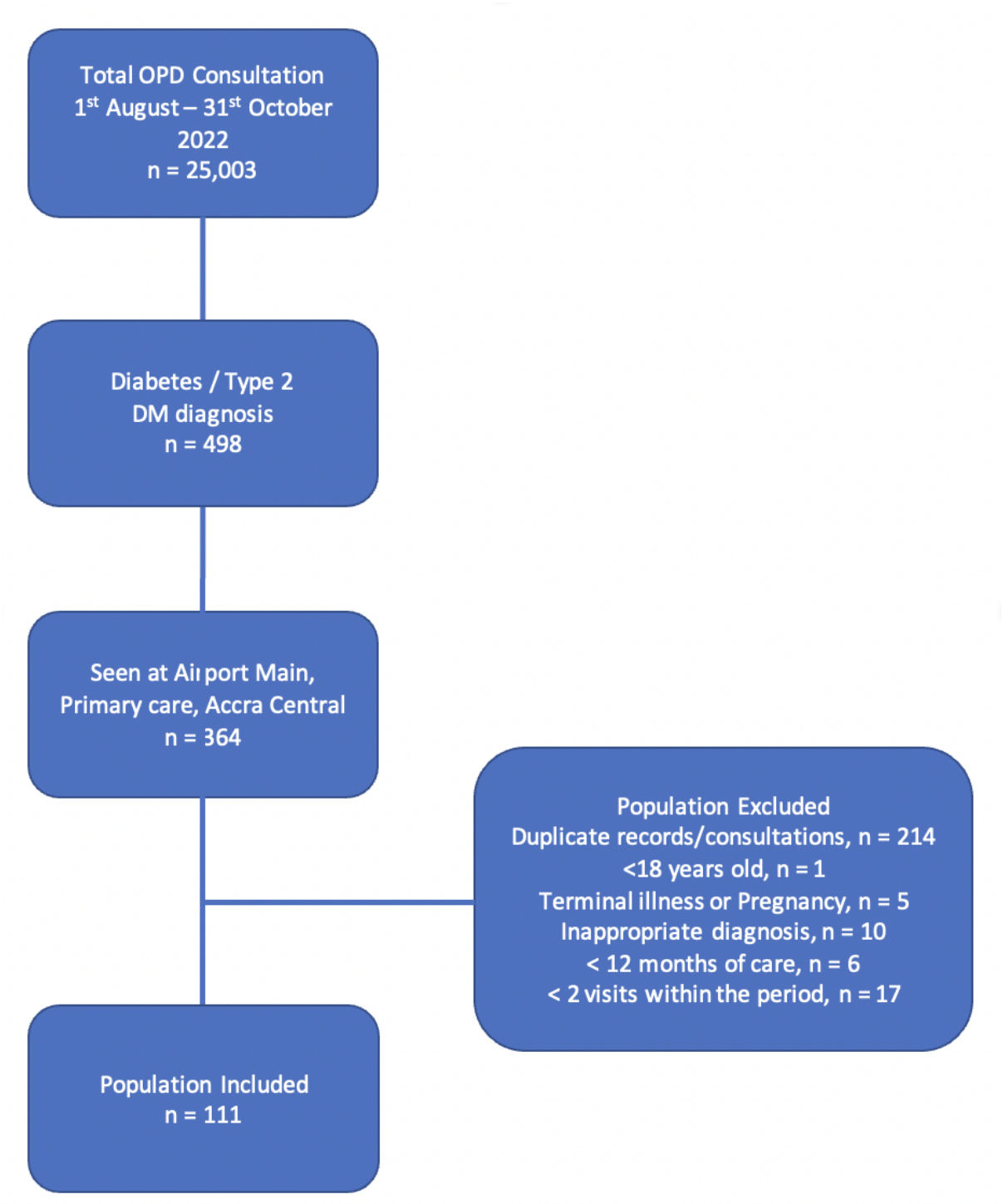


Figure 10. Flow chart showing the audit population

4.1.1 Characteristics of audit population

Table 15 below demonstrates the characteristics of the population included in the audit over the period as collected.

Table 15. Descriptive characteristics of audit population

Parameter	Unit	Value
Age (years)	Mean(SD)	56.7(14.1)
Gender	Male, n(%) Female, n(%)	57(51.4) 54(48.6)
Weight (kg)	Mean(SD)	86.8(20.8)
Mode of payment	Cash, n(%) Corporate Account, n(%) Insurance, n(%)	37(33.3) 20(18.0) 54(48.6)
Site of care	Airport Main, n(%) Satellites, n(%)	85(76.6) 26 (23.4)
Care provider	Family Physician/Medical Officer, n(%) Physician Specialist, n(%)	54(48.6) 57(51.8)
Dietitian consult	Yes, n(%) No, n(%)	20(18.0) 91(82.0)
Insulin use	Yes, n(%) No, n(%)	19(17.1) 92(82.9)
ACEi/ARB use	Yes, n(%) No, n(%)	59(53.2) 52(46.8)
Statin use	Yes, n(%) No, n(%)	58(52.3) 53(47.7)
Frequency of visits, n(%)	2 3 4 5 6 7 or more	21(18.9) 17(15.3) 25(22.5) 16(14.4) 14(12.6) 18(16.2)
eGFR (ml/min/1.73m2)	Mean(SD)	80.4(26.8)

The age of the population ranged from 28 years to 94 years with a mean age of 56.7 (+/- 14.1) years. About 60.4% of the audit population was below 60 years. Figure 11 below shows the age distribution of the audit population.

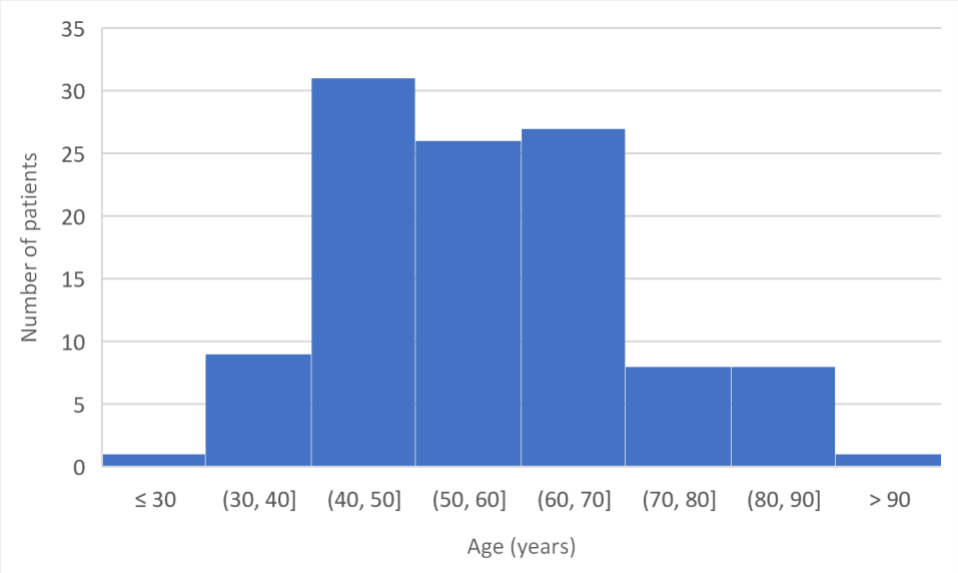


Figure 11. Age distribution of audit population

There were 54 females, representing 48.6% of the audit population. The mean weight for the audit population was 86.8kg with a standard deviation of 20.8kg. Figure 12 below shows the weight distribution of the population.

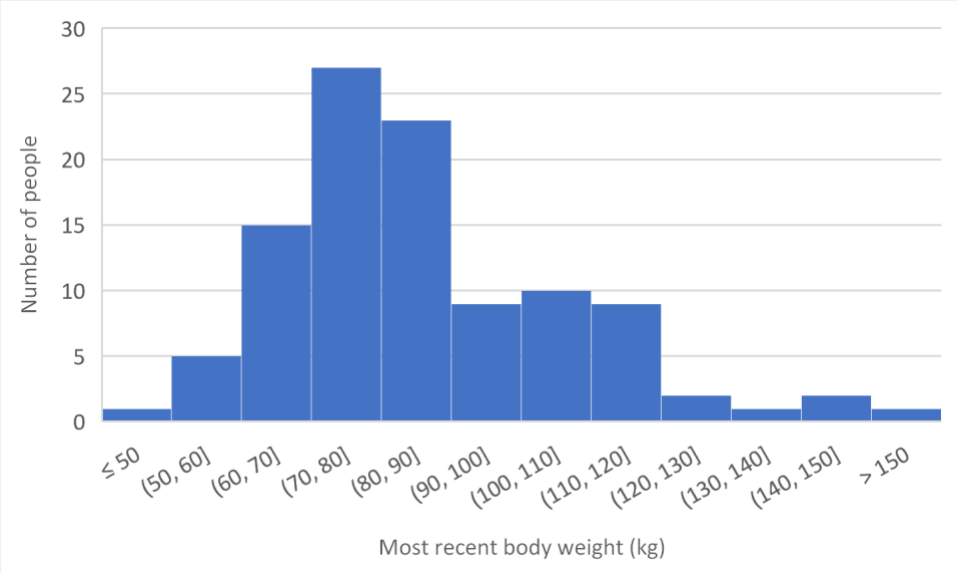


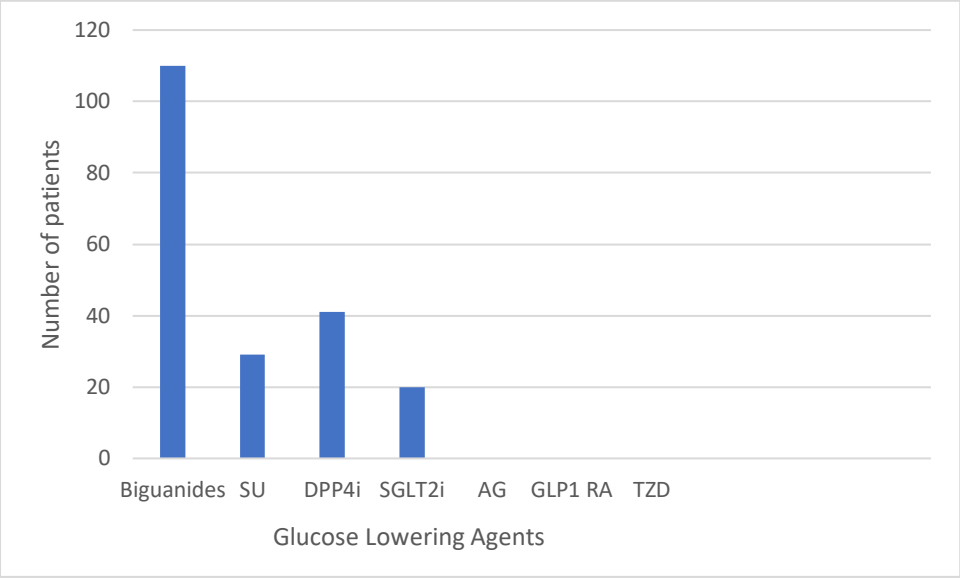
Figure 12. Distribution of weight of the audit population.

Only 37(33.3%) paid cash for their diabetes care across the NHL with the remaining 66.7% being covered by commercial insurance (48.6%) and corporate account (18.0%) with NHL. Out of the 111 people, 85(76.6%) were seen at Airport Main and 26(23.4%) at the Satellite clinics.

A slightly lower population of 54(48.6%) were seen by family physicians and medical officers(FP/MO) across all sites compared to 57(51.3%) seen by physician specialists(P/S).

Even though there is a dietitian clinic across all sites, only 20 (18.0%) patients saw the dietitian within the 15-month period.

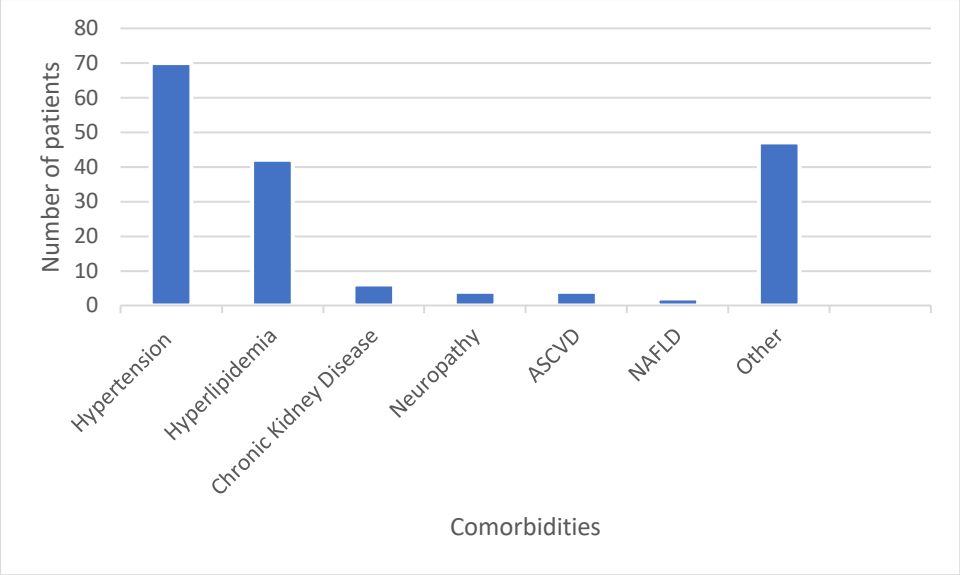
According to the last prescription, 59 out of 111(53.2%) received an ACEi/ARB and 58 out of 111(52.3%) received statins. Only 19 out of 111(17.1%) were on Insulin alone or in combination with other glucose-lowering agents(GLA) during the period. Figure 13 below shows the number of people with type 2 DM who received other GLA agents apart from Insulin.



SU – Sulphonylureas, DPP4i – Dipeptidyl peptidase 4 inhibitors, AG – Alpha-glucosidase inhibitors, GLP-1 RA – Glucagon-like protein 1 receptor agonists, TZD - Thiazolidinediones
Figure 13. Use of other GLA apart from Insulin.

All 111 patients received glucose-lowering agents in addition to lifestyle changes as shown in Figure 13 above. The majority of 110(99.1%) were prescribed Metformin alone or in combination with other GLA. The use of Sulphonylureas, DPP4i or SGLT2i was 26.1% 36.9%, and 18.0% in different combinations respectively

Comorbidities were documented for about 82(73.9%) of the audit population with Hypertension being the commonest comorbidity(70 out of 111). Only 17 out of the 111 had 3 or more documented comorbidities documented. Figure 14 shows the distribution of other documented comorbidities



ASCVD- Atherosclerotic Cardiovascular Disease, NAFLD – Non Alcoholic Fatty Liver Disease
Figure 14. Documented comorbidities

During the period of the audit, 43.2% of people in the audit population had 5 or more visits for diabetes care (i.e., approximately 1 visit every 3 months or less) and 18.9% had only 2 visits (Table 15).

Glycated Haemoglobin was measured 4 or more times (i.e., approximately every 3 months) for 23.4% and only once for 37.8% of the population during the 15-month period (1st August 2021 to 31st October 2022) of the audit as shown in Figure 15 below. 14 out of the 111(12.6%) did not have any HbA1c done during the audit period.

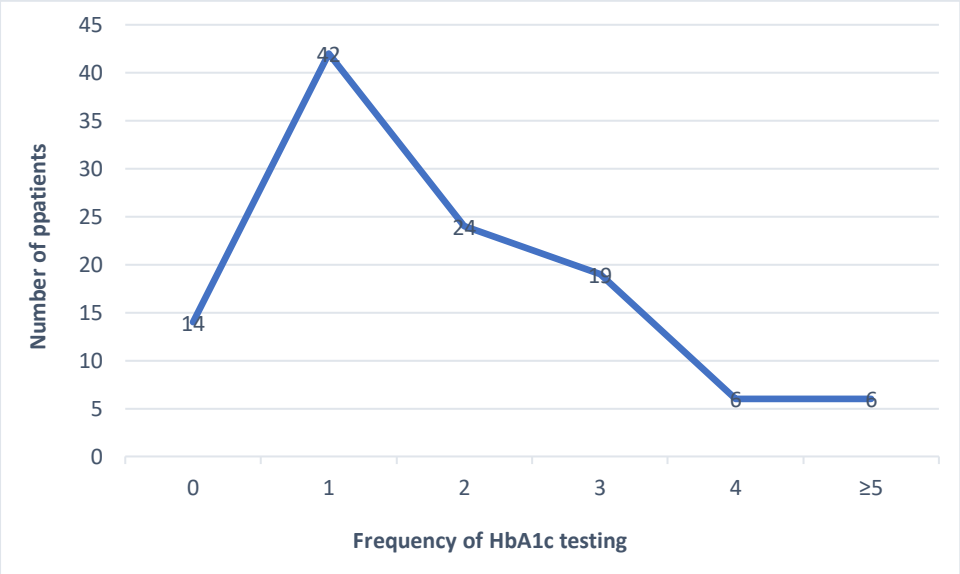


Figure 15. Frequency of HbA1c testing

4.2 Achievement of processes of care

The achievement of these POC across NHL during the audit period is shown in Table 16, below and this is stratified by site of care and care provider.

Table 16. Achievement of processes of care by site of care and care provider

Audit Criteria	Standard	Entire NHL Proportions and Percentages	Site of care: Proportions and Percentages		Care provider: Proportions and Percentages	
			Airport Main	Satellites	FP/MO	P/S
Blood Pressure (BP) Records show at least one blood pressure documented over the period.	**90%**	111/111 **100**%	85/85 **100%**	26/26 **100%**	54/54 **100%**	57/57 **100%**
Body Mass Index (BMI) Records show at least one body mass index documented over the period.	**90%**	11/111 **9.9%**	6/85 **7.1%**	5/26 **19.2%**	9/54 **16.7%**	2/57 **3.5%**
Foot risk surveillance. Records show at least one-foot exam documented over the period.	**90%**	8/111 **7.2%**	6/85 **7.1%**	2/26 **7.7%**	4/54 **7.4%**	4/57 **7.0%**
Tobacco screening and cessation Records show smoking history documented at least once over the period.	**90%**	101/111 **91.0%**	79/85 **92.9%**	22/26 **84.6%**	50/54 **92.6%**	51/57 **89.5%**
Serum Creatinine +/- eGFR Records show at least one renal function test documented over the period.	**90%**	82/111 **73.9%**	61/85 **71.8%**	21/26 **80.8%**	43/54 **79.6%**	39/57 **68.4%**
Urine albumin creatine ratio(UACR). Records show at least one UACR documented over the period.	**90%**	11/111 **9.9%**	1/85 vs **1.1%**	10/26 **38.4%**	10/54 **18.5%**	1/57 **1.8%**
Lipids		79/111	60/86	19/26	44/54	35/57

Records show at least one lipid test documented over the period.	**90%**	**71.1%**	**69.8%**	**73.1%**	**81.5**	**61.4**
HbA1c Records show at least one HbA1c documented over the period.	**90%**	97/111 **87.4%**	74/86 **86.0%**	23/26 **88.5%**	49/54 **90.7%**	48/57 **84.2%**
Retinal screening. Records show documented fundoscopy or ophthalmology consult over the period.	**90%**	18/111 **16.2%**	12/85 **14.1%**	6/26 **23.1%**	11/54 **20.4%**	7/57 **12.3%**

The table above clearly shows the high achievement of blood pressure, smoking history and HbA1c documentation at 100%, 91.0% and 87.3% respectively across the NHL. Foot surveillance, BMI, and UACR were the least achieved POC across the NHL recording 7.2%, 9.9% and 9.9% respectively. The table demonstrates that at least 5 out of the 9 POC were achieved in over 70% of the audit population over the period.

The trend of high achievement of blood pressure, HbA1c and smoking and low achievement of foot surveillance and BMI did not vary by care provider. There was a 10% or more difference in the achievement of BMI, and UACR in favour of the satellite clinics as shown in Figure 16, below.

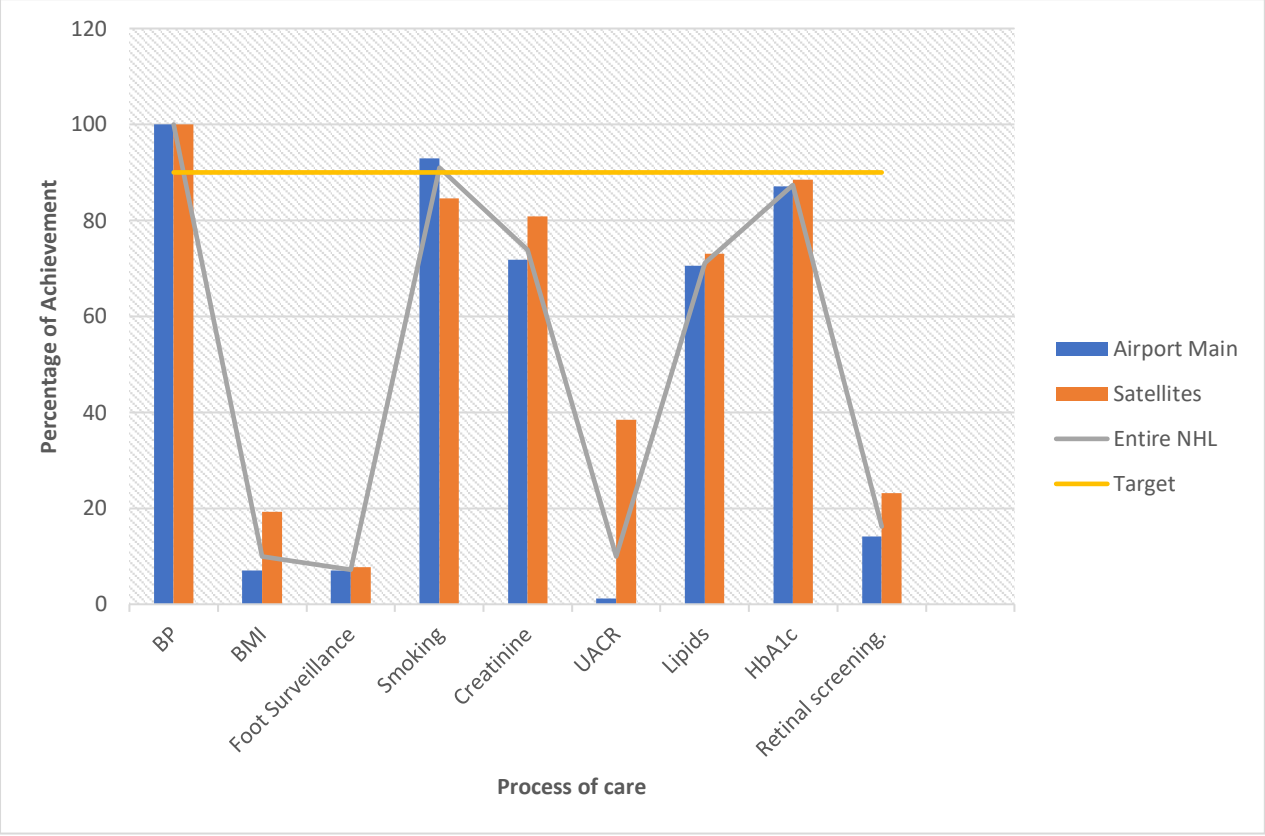


Figure 16. Achievement of POC across the NHL and by site of care.

Figure 16 demonstrates the achievement of 5 POC – blood pressure, smoking, HbA1c, Creatinine and Lipids above 70% in all sites of care.

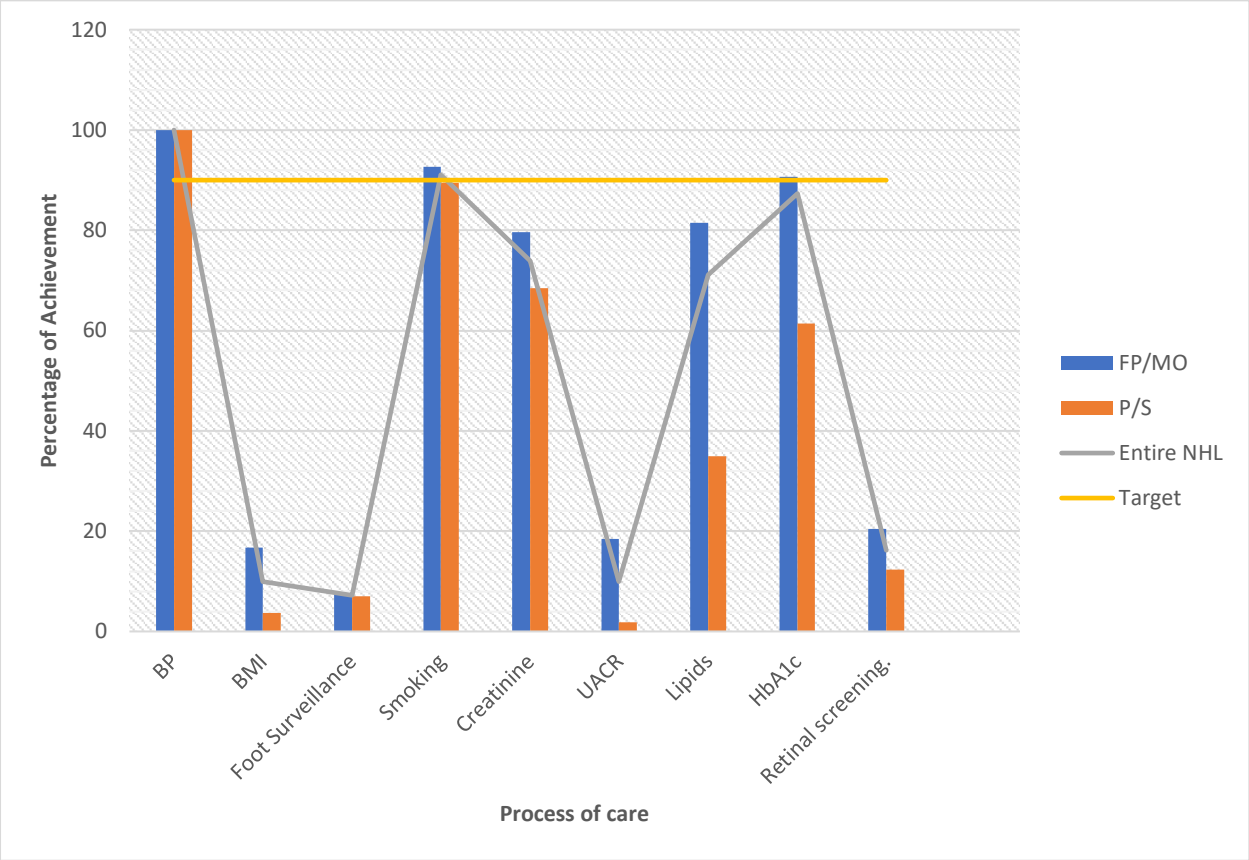


Figure 17. Achievement of POC across NHL and by care provider.

A similar trend of high achievement of BP, smoking, and low achievement of foot surveillance was noted and did not vary by the care provider. Figure 17 above shows that family physicians/medical officers achieved higher (more than 10%) in lipids, HbA1c and BMI than the physician specialists. Even though BMI documentation was significantly low, about 103 representing 92.8% of the audit population had a recent weight documented.

Considering the above, it is evident that family physicians and medical officers met or exceeded the target for 3 POC (vs 2 by physician specialists), and Airport Main met or exceeded the target for 2 POC (vs 1 by Satellites). The entire NHL also met or exceeded targets for only 2 POC in this clinical audit. Achievement of all nine POC was 0% across the NHL and did not change by care provider or site of care.

4.3 Intermediate outcomes of care

Figure 18 below demonstrates the achievement of intermediate outcomes of care across NHL and by the site of care.

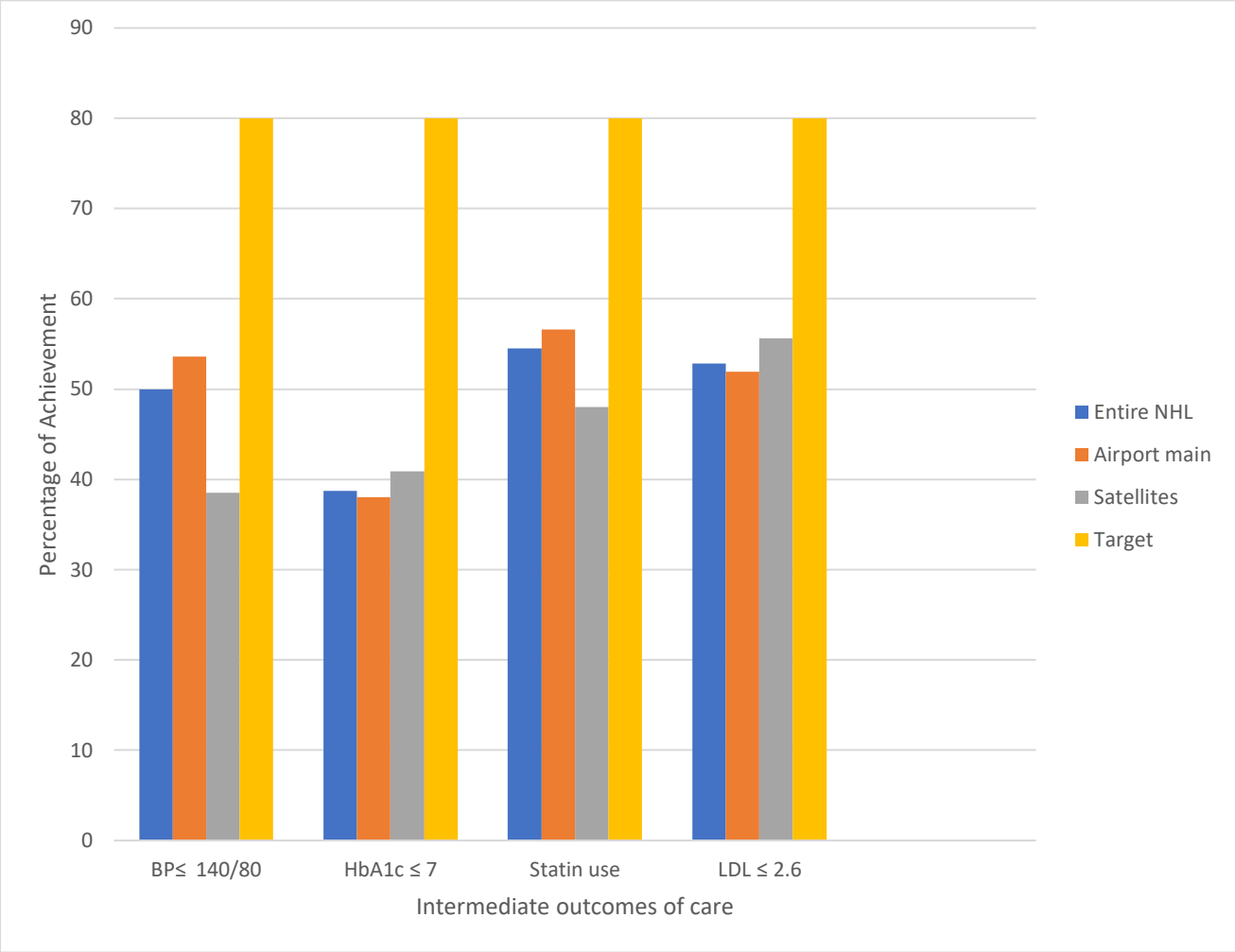


Figure 18. Intermediate outcomes of care across NHL and by site of care

Achievement of intermediate outcomes of care across NHL and by care provider is shown in Figure 19 below

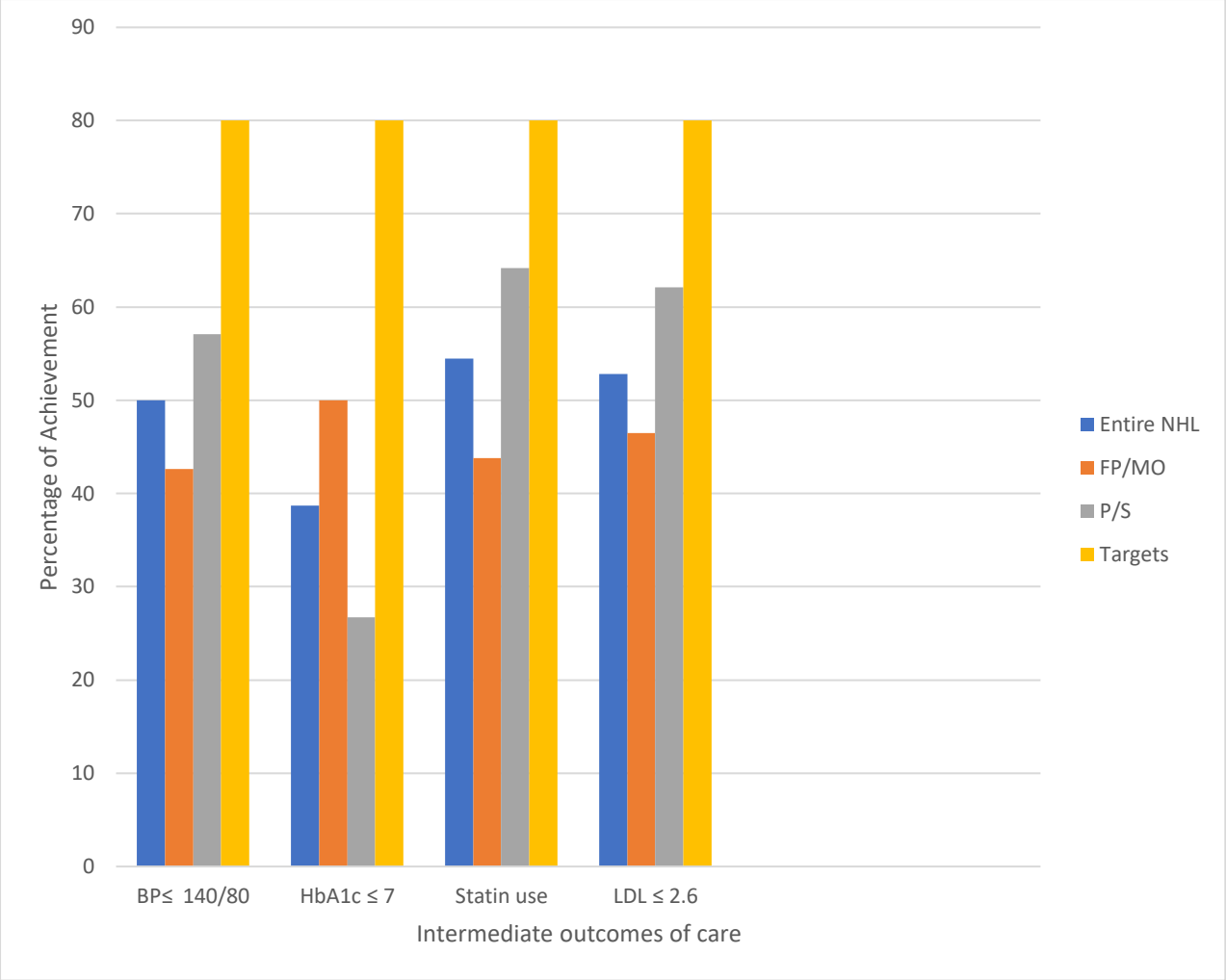


Figure 19. Intermediate outcomes of care across NHL and by care provider.

Figure 18 and 19 clearly shows that targets(achievement in 80% of audit population) for the separate intermediate outcomes of care were not achieved across NHL.

4.3.1 Glycaemia targets.

Figure 15 above shows the frequency of HbA1c testing over the audit period across the entire NHL over the audit period. Even though 97 out of the 111 had at least 1 HbA1c done during the audit period, only 93 had a most recent HbA1c documented. Figure 20 below shows the distribution and the ranges for the most recent HbA1c.

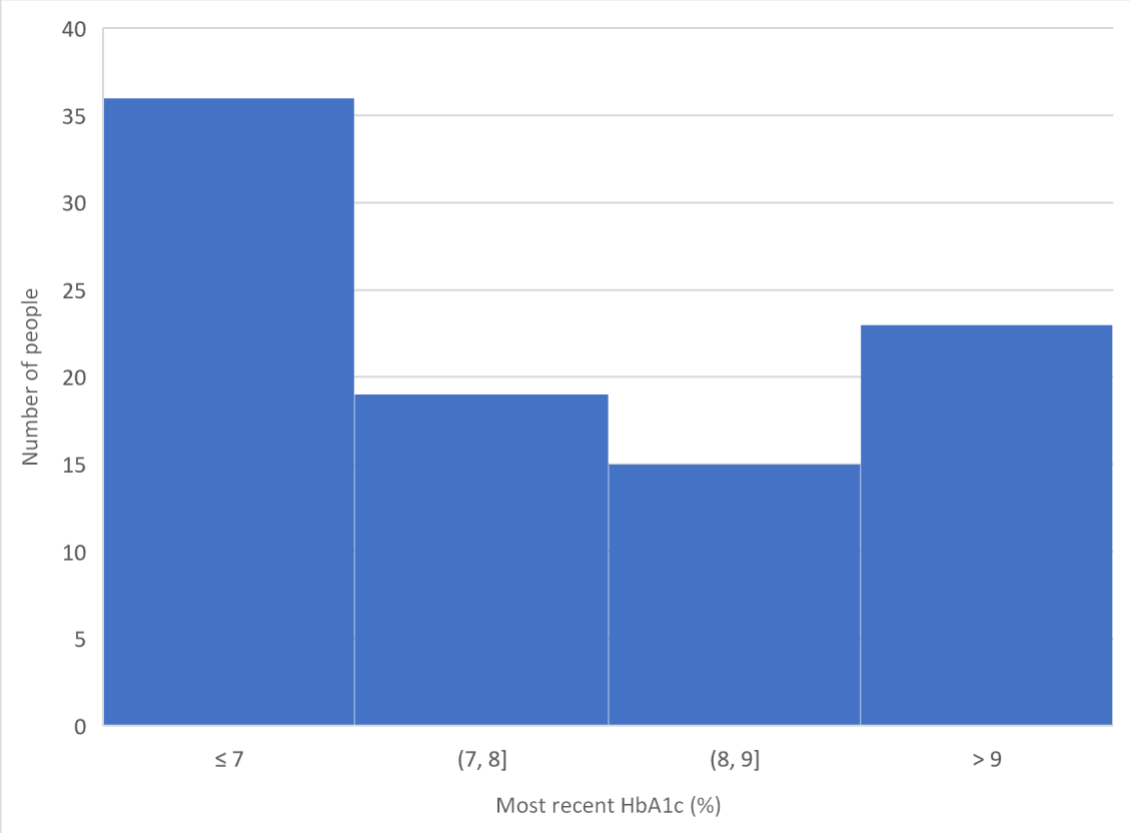


Figure 20. Distribution of most recent HbA1c.

The glycaemic target of HbA1c ≤ 7% was achieved by 38.7% (36 out of 93) across NHL, 38% (27 out of 71) vs 40.9% (9 out of 22) by the site of care (Airport main vs Satellites) and 50% (24 out of 48) vs 26.7% (12 out of 45) by the care provider (FP/MO vs P/S), see Figures 18 & 19 above. The median (most recent) HbA1c was 7.5%(IQR- 2.45) and mean was 8.0%(SD 2.1%)% for the entire NHL. Only 24.7% (23 out of 93) had poor glycaemic control (HbA1c > 9.0%) from the most recent HbA1c.

4.3.2 Blood pressure target

The blood pressure target of ≤140/80mmHg was achieved by 50% (55 out of 110) across NHL, 53.6% (45 out of 84) vs 38.5% (10 out of 26) by site of care (Airport main vs Satellites) and 42.6% (23 out of 54) vs 57.6% (32 out of 56) by care provider (FP/MO vs P/S), see Figures 18 and 19 above. There was only one patient with no BP documented in the most recent visits. Hypertension was documented as a comorbidity in 70 out of the 111 patients (Figure 14). Out of the 70, 55 (78.5%) received an ACEi/ARB in line with the current recommendation as first-line therapy in PLWD.

4.3.3 Lipid management

Across the NHL 54.5% (55 out of 101) of patients 40 years or more had statin therapy according to the most recent prescription and this was 56.6% (43 out of 76) vs 38.5% (12 out of 25) by site of care (Airport main vs Satellites) and 43.8% (21 out of 48) vs 64.2% (34 out of 53) by care provider (FP/MO vs P/S), see Figures 18 & 19 above. The most recent LDL was

≤2.6mmol/L in 52.8% (38 out of 72) across the NHL and 51.9% (28 out of 54) vs 55.6% (10 out of 18) by site of care (Airport main vs Satellites) and 46.5% (20 out of 43) vs 62.1% (18 out of 29) by care provider (FP/MO vs P/S).

4.3.4 All three intermediate outcomes of care

The targets of HbA1c ≤ 7%, BP ≤ 140/80mmHg and statin therapy for all patients >40 years were achieved in 20.4% (13 out of 71) of patients across the NHL. This reduces when LDL ≤2.6mmol/l is used to 18.3% (19 out of 93). Figure 21 below shows that these targets were achieved in 22.9% (10 out of 54) seen at the Airport main and 17.8% (3 out of 17) seen at the satellites. These targets were achieved in 22.9% (7 out of 43) seen by family physicians/medical officers and 17.8% (6 out of 28) seen by physician specialists as shown in Figure 21 below.

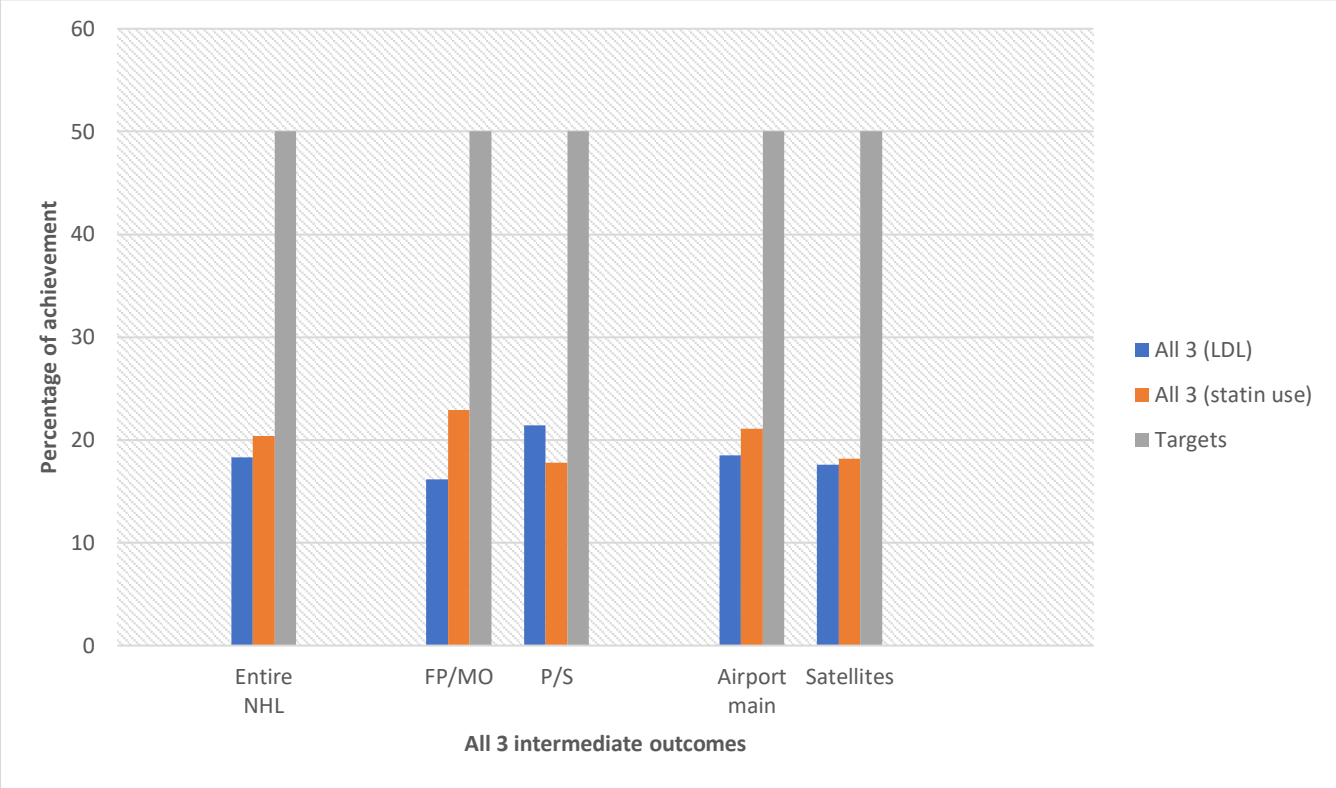


Figure 21. Achievement of all 3 intermediate outcomes of care

Summary

These results were reviewed by a multistakeholder team and a root cause analysis was done to understand the possible causes of the poor quality of diabetes care across NHL, see Chapter 3.8. An action plan was designed from specific change ideas identified(Table 14). The expected changes after the implementation of the action plan are discussed in Chapter 3.9 above.

Chapter 5. Discussion

This audit is the most comprehensive ever done to assess the quality of T2DM care at NHL in its more than 50 years of existence. Furthermore, no similar published work was found for Ghana. The GAIA, which assessed only POC without achievement of intermediate outcomes of care (58) in several countries including Ghana, is the most similar previous work identified. The aim of this clinical audit was to assess the quality of diabetes care for persons with T2DM at Nyaho Healthcare Limited. The standard was set after a review of the literature and considered the WHO targets for 2030 to improve DM care (22,23).

5.1 Key findings

The following are the key findings from the audit

- Across the NHL, the standard was only achieved for 2 out of 9 POC over the period however none was achieved for IOC.
- Not even one person had all nine processes of care documented over the period across NHL whiles about 20% achieved all three intermediate outcomes of care.
- Consistently POCs were better achieved by FP/MO as compared to P/S over the audit period.
- The achievement of intermediate outcomes varied slightly by care providers with P/S achieving better blood pressure control and use of statins than FP/MO.
- The satellites did significantly better in the documentation of UACR, BMI and retinal screening.

5.2 Interpretation of audit findings and context

The mean age of 56 years was similar to the GAIA global audit (58) and other studies in South Africa, Kenya, and Malaysia (96–98), but much higher than Qatar (19) and lower than the DCR Cohort from the USA (16). This also aligns with the findings of a systematic review and meta-analysis that suggested that the risk of diabetes is high with age >40 years in Ghana(27).

It is important to note that since almost 50% of these patients have private health insurance, they are likely to receive care from other facilities within the year which will affect the general outcomes of diabetes care in NHL. It is also possible that some POC like UACR, Lipids and HbA1c were done outside the NHL and results were not documented on the NHL EMR.

The mean weight of 86.8kg with a standard deviation of 20.8kg is similar to that of a South African study (97) but significantly higher than the 59.7(10.4)kg in Vietnam (123). Assuming an average height of the Ghanaian adult to be 164.6cm (124), 57 out of 111 (51.4%) can be classified as obese(BMI ≥ 30kg/m2). This may also be explained by the socioeconomic status and urban population of patients seen across the NHL. Evidence suggests that the

prevalence of obesity and T2DM is rising in Africa, and there is a positive correlation between body mass index and diabetes (1,4). Weight loss has therefore become a central theme in diabetes management and the use of insulin, sulfonylureas, not using GLP-1 RA and other patient factors may be limiting this.

The physician specialists delivered care to almost 52% of the PLWD in this audit. This proportion varies significantly from findings in the wider literature, with several studies suggesting that the majority of PLWD receive care from primary care physicians (17,57). The physician specialist clinics at NHL provide continuity of care with the same doctor whiles other patients usually see any medical officer or family physician who is available on the day of their visit. This may also be due to informed patients choosing to see physician specialists, the referrals of complex cases and recently admitted to the physician specialists.

Considering that the standard of care is to see PLWD at least once every 3 months or more frequently if needed, the lack of follow-up visits is a concern. About 34.2% of the audit population was seen less than 4 times in the audit period(15 months), this is significantly higher than the average of 23% missed appointments in a recent study (125). Missed appointments have been shown to be highest in Africa(43.0%) and lowest in Oceania, our finding of 34.2% correlates with this finding (125). Even though the lack of private insurance is associated with missed appointments (125), this may not be the case at NHL as that population is low.

The pattern of medication prescription (see Figure 13) varies significantly from other real-world studies (126,127), as none from the audit population received a GLP 1RA, TZD, Alpha-glucosidase inhibitors or Meglitinides. The use of SU and SGLT2i at the NHL was similar to findings in the CAPTURE study, in higher-income settings (126). Almost all of the study population received a Biguanide(Metformin) according to the recommendation of many international guidelines (55,128). DPP4i is the 2nd commonest GLA used at NHL probably because of the existence of a combined tablet with Metformin which is stocked at NHL(Vildagliptin/Metformin and Saxagliptin/Metformin). According to the most recent prescription, ACEi/ARB and statins use was about 50% in the audit population.

The GAIA included data from 2 diabetes clinics (secondary/tertiary hospitals) in Ghana (58). Apart from BP, BMI, Smoking and Eye examination which were achieved significantly higher in the best Ghanaian cohort, all other POC were better achieved at the NHL than the 2 Ghanaian cohorts. This is probably due to the availability of laboratory services(24hr at Airport Main) and the low cash-paying population at NHL which facilitates the uptake of investigations i.e., HbA1c, lipids, UACR, and serum creatinine.

Although BMI as a POC was poorly achieved, recent body weight was documented for the majority of the population(92.8%). This implies that documentation of height is a significant limitation as the BMI is calculated automatically by the EMR. It is also possible that height was not been measured to reduce the time spent at triage or doctors are not requesting it.

UACR was better documented in the satellites and by FP/MO, and this may be due to the influence of a particular family physician with an interest in diabetes who practices mainly in the satellite clinics. UACR is available across all sites, inexpensive and covered by insurance

therefore it is only limited by the request of a doctor and the patient completing the request. The low UACR is however consistent with findings from several studies, irrespective of income status (15,57,58,96).

Even though lipid test was requested frequently by family physicians and medical officers, statin use or achievement of target LDL was higher amongst PLWD managed by P/S. This is probably because physician specialists are more focused on the management of patients with complications.

This audit demonstrated that 38.7% of the population achieved an HbA1c ≤7% and this was similar to studies from Vietnam(123) but much higher than Kenya (98), and Malaysia (96). Achievement of the HbA1c target was however lower for PLWD managed by the P/S as their case mix is more diverse and includes many more with poorly controlled DM and comorbid conditions. Variation in the quality of diabetes care has been widely documented in the literature irrespective of the indicators used (15,19,57). Achievement of HbA1c targets in this clinical audit correlates well with the clinical effectiveness data shown in Figures 4 & 5 above. Both suggest that family physicians and medical officers achieve HbA1c targets better than physician specialists.

The Literature review (Chapter 2) shows a wide variation in the quality of diabetes care across the globe. The Global Alphabet Strategy Audit showed that 29 centres out of 45 achieved 0% for all 9 care processes (58). NHL also achieved 0% for the achievement of all 9 POC and this did not vary by care provider or site of care. This was an unexpected finding considering the availability of resources, calibre of facility and commitment to quality healthcare at the NHL. Achievement of all nine processes of care was greatly limited by foot surveillance, BMI, UACR and retinal screening as all other POCs were documented in 70% or more of the audit population. This 0% achievement of all nine POC even though significantly lower than the about 50% achieved in the National Diabetes Audit (15), is a good start and may serve as a springboard for greater achievement. The results achieved in this audit fall within the interquartile ranges of the medians in the Diabetes Collaborative registry for all the seven quality metrics measured (16).

Twenty per cent of the audit population achieving all the targets for intermediate outcomes of care is significantly better than the 6.5% shown in European countries by the GUIDANCE study (57). It is also impressive when compared with the almost 40% achieved in NDA, as this is the first time auditing and NDA uses HbA1c≤ 58mmol/mol (7.5%) and statin use for combined CVD prophylaxis (15).

The satellites did significantly better in the documentation of UACR, BMI and retinal screening. These positives did not translate into the overall achievement of all nine care processes of care and three intermediate outcomes of care. Even though higher patient volumes tend to lower the quality of diabetes care (129), this was not clearly shown in the case of NHL(Airport main vs Satellites).

Family Medicine has been shown to contribute positively to the quality of diabetes care and may explain the slightly better care by FP/MOs across NHL(130,131). Even though physician

knowledge may correlate with the quality of care, the evidence is not so robust (132) and was not clearly evident in this audit(FP/MO vs P/S).

The findings of this clinical audit cannot be generalized as it did not include all patients or randomly selected patients after a calculated sample size. However, due to standard practice, all PLWD are expected to be seen at least once every 3 months. This audit, therefore, used a 3-month window and included all eligible PLWD who were seen within the period and reviewed their medical notes over the period.

5.3 Strengths and Limitations

5.3.1 Strengths

This clinical audit establishes a comprehensive baseline for the quality of diabetes care in the NHL. The audit used international guidelines (15,53–55) and WHO targets (22,23) to define the criteria and standards for processes of care and intermediate outcomes of care. Another strength is the use of a clinical audit methodology and multistakeholder involvement throughout the audit process. It also identifies areas for improvement and recommends actions to be implemented.

5.3.2 Limitations

This audit cycle is not complete until the implementation of recommended changes and a re-audit is conducted to measure improvement and make it sustainable. The lack of a re-audit is a limitation. Duration of diabetes affects diabetes care and achievement of intermediate outcomes significantly and not having that data limits the interpretation of the results. Considering only people with T2DM and not reviewing an adequate(larger) sample affect the generalizability of the results. The accuracy of this audit is also limited by the possibility of poor or incomplete documentation from other technological challenges and patient factors that were not assessed.

5.4 Future research

As there is a huge dearth of studies on the quality of diabetes care in Africa, this is a great place for future research. Understanding the quality of diabetes care in low-resource settings will further guide research into actual contributors to evidenced-based diabetes care and cost-effective means of improving the current state of diabetes care. It will also be important to understand from the patients' perspective what constitutes quality diabetes care and what needs to change. Across the NHL it will be important to assess the quality of diabetes care across a larger sample and other types of diabetes.

5.5 Implications and Recommendations

This audit clearly demonstrates the need to improve the quality of diabetes care at the NHL, especially in terms of processes and intermediate outcomes of care. The current good practices should be shared and measures put in place to sustain and improve them further.

The following recommendations will likely help as they have been tested in other settings(see Chapter 2.4) and shown some benefits.

1. Regular audits of care and feedback to care providers.
2. Establishment of diabetes registers to facilitate callbacks and appropriate scheduling for consultations and annual assessments.
3. Establish a diabetes self-management education and support program to empower patients to positively contribute to their care.
4. Regular training for care providers to serve as reminders and means of updating knowledge as diabetes care is rapidly evolving.
5. The chronic care clinic should be proactive and actively review the NHL EMR database to reach out to PLWD who have missed their appointments or have poor control.
6. Increase the usage of checklists and flowcharts for diabetes care.

5.6 Challenges anticipated

As change is difficult and many people resist changing the status quo, this is likely to be a challenge. Specific practitioner perspectives and knowledge in diabetes vary and not understanding this fully may hinder actions to improve diabetes care. With a staff strength of over 500 across multiple sites, staff turnover will also hinder improvement in the quality of diabetes care as experienced and more skilled staff may leave the organization.

5.7 Conclusion

The quality of diabetes care for persons living with type 2 diabetes mellitus at Nyaho Healthcare Limited was suboptimal during the audit period.

Documentation of blood pressure, smoking history and HbA1c were the highly achieved POC whiles BMI, UACR and foot surveillance were the least achieved.

Overall, family physicians and medical officers achieved a slightly higher quality of care as evidenced by the achievement of POC.

Outcomes may be influenced by the setting of care (main hospital vs satellite clinics) and/or expertise of the care provider(physician specialist vs medical officer/family physician). Other known contributors to the quality of diabetes care that was not assessed include therapeutic adherence, medication adherence etc.

The findings were much better overall than the 2 cohorts from Ghana that were included in the GAIA audit, probably because NHL is a private facility in Accra with adequate capacity and resources.

Findings from this audit agree with previous findings that the achievement of processes of care or the lack thereof may not directly affect the achievement of all three intermediate outcomes.

This clinical audit contributes strongly to the literature on the quality of diabetes care in a developing country and is very current. Although the comparability of the different settings and expertise may be limited, common eligibility and audit criteria were used.

“If you can’t measure it, you can’t manage it” – Peter Drucker.

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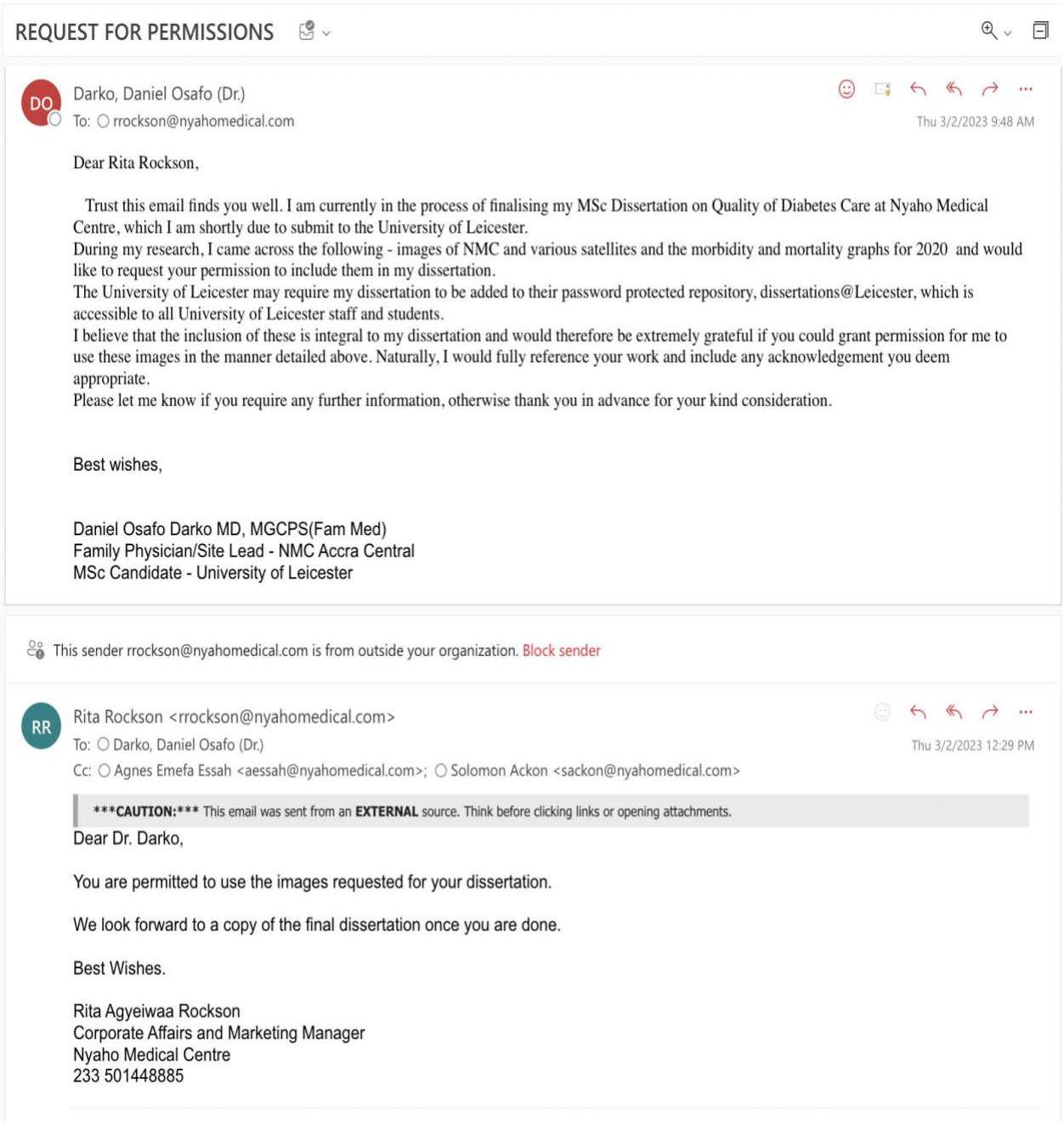
Appendices

Appendix 1 - Copyright permission from NHL



REQUEST FOR PERMISSIONS

Darko, Daniel Osafo (Dr.)
To: rrockson@nyahomedical.com
Thu 3/2/2023 9:48 AM

Dear Rita Rockson,

Trust this email finds you well. I am currently in the process of finalising my MSc Dissertation on Quality of Diabetes Care at Nyaho Medical Centre, which I am shortly due to submit to the University of Leicester.
During my research, I came across the following - images of NMC and various satellites and the morbidity and mortality graphs for 2020 and would like to request your permission to include them in my dissertation.
The University of Leicester may require my dissertation to be added to their password protected repository, dissertations@Leicester, which is accessible to all University of Leicester staff and students.
I believe that the inclusion of these is integral to my dissertation and would therefore be extremely grateful if you could grant permission for me to use these images in the manner detailed above. Naturally, I would fully reference your work and include any acknowledgement you deem appropriate.
Please let me know if you require any further information, otherwise thank you in advance for your kind consideration.

Best wishes,

Daniel Osafo Darko MD, MGCPS(Fam Med)
Family Physician/Site Lead - NMC Accra Central
MSc Candidate - University of Leicester

This sender rrockson@nyahomedical.com is from outside your organization. Block sender

Rita Rockson <rrockson@nyahomedical.com>
To: Darko, Daniel Osafo (Dr.)
Thu 3/2/2023 12:29 PM
Cc: Agnes Emefa Essah <aessah@nyahomedical.com>; Solomon Ackon <sackon@nyahomedical.com>

CAUTION: This email was sent from an **EXTERNAL** source. Think before clicking links or opening attachments.

Dear Dr. Darko,

You are permitted to use the images requested for your dissertation.

We look forward to a copy of the final dissertation once you are done.

Best Wishes.

Rita Agyeiwaa Rockson
Corporate Affairs and Marketing Manager
Nyaho Medical Centre
233 501448885

Appendix 2 – MeSH search strategy

Medline search done on 17th November 2022 - Final

Search terms used:

- Quality of care or “”
- Clinical audit or
- Medical Audit or
- Standard of care or

AND

- Diabet* or
- Diabetes Mellitus or
- Type 2 diabetes

AND

- Primary care or
- General practice*

(("Quality of care" OR "Clinical Audit" OR "Medical Audit" OR "Standard of Care") AND ("Diabet*" OR "Diabetes Mellitus" OR "Type 2 diabet*") AND ("Primary care" OR "General Practice" OR "Family Medicine")

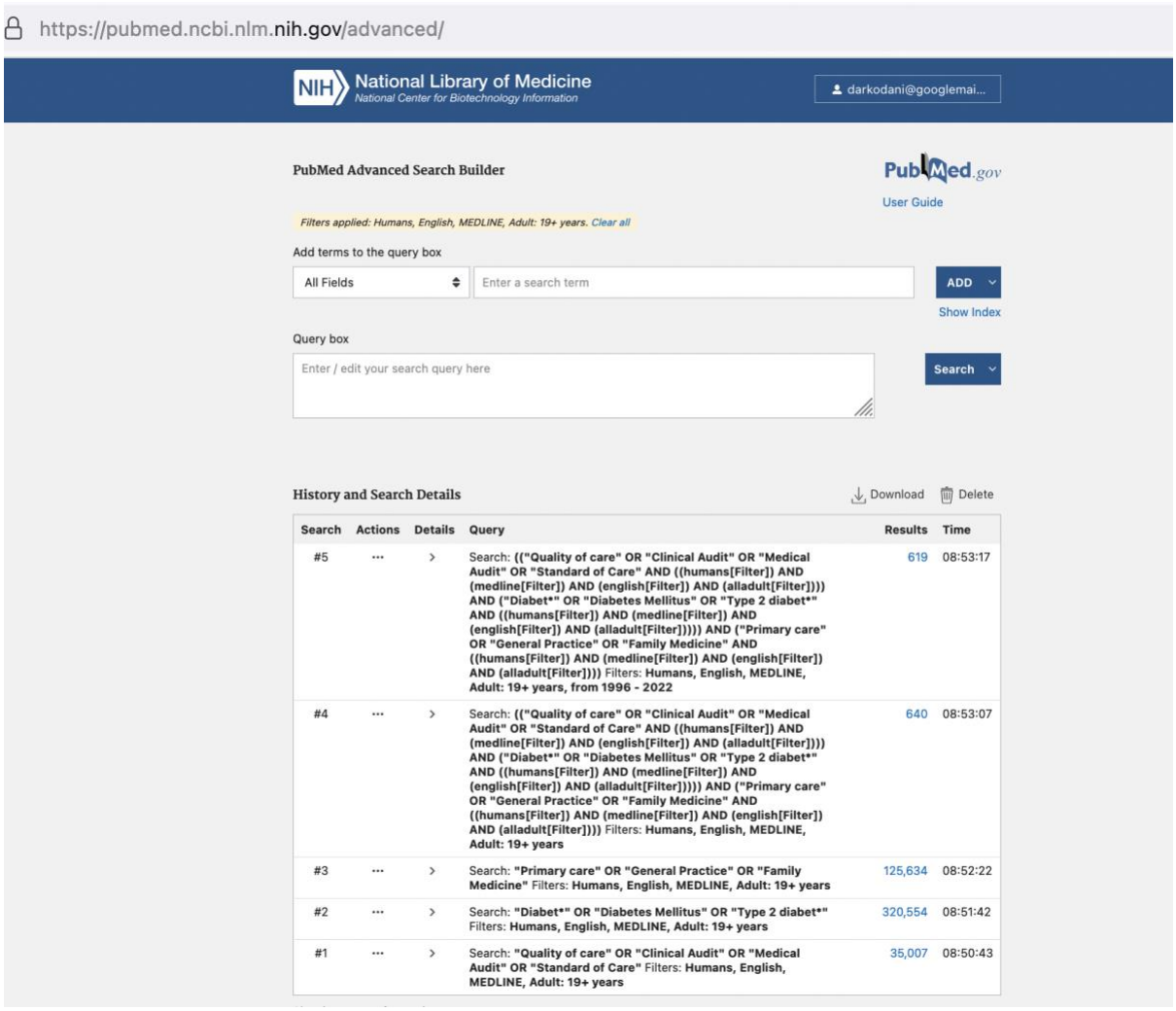
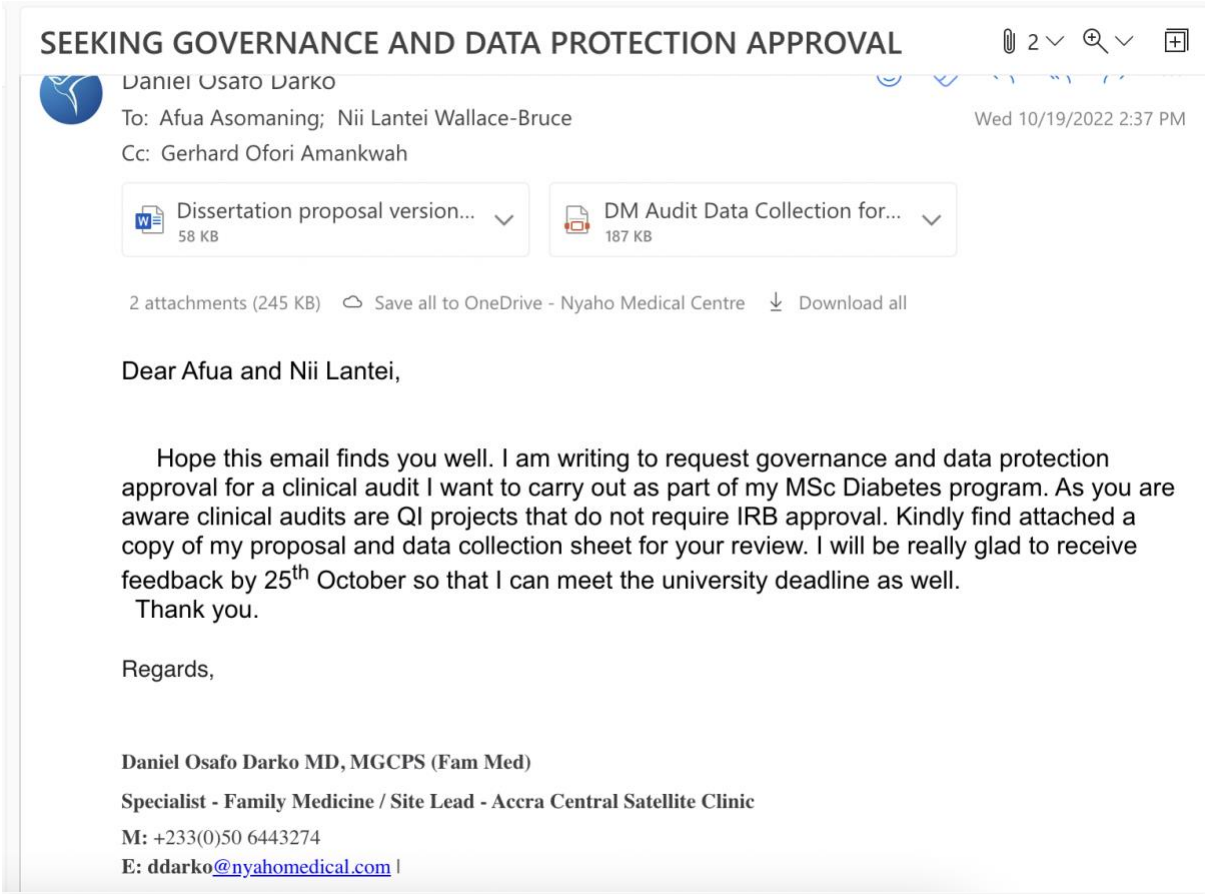


Figure - Image from Pubmed showing the search strategy.

Appendix 3 - NHL Public Health Division Lead Approval



SEEKING GOVERNANCE AND DATA PROTECTION APPROVAL

2

Daniel Osafo Darko

To: Afua Asomaning; Nii Lantei Wallace-Bruce

Wed 10/19/2022 2:37 PM

Cc: Gerhard Ofori Amankwah

Dissertation proposal version...
58 KB

DM Audit Data Collection for...
187 KB

2 attachments (245 KB) Save all to OneDrive - Nyaho Medical Centre Download all

Dear Afua and Nii Lantei,

Hope this email finds you well. I am writing to request governance and data protection approval for a clinical audit I want to carry out as part of my MSc Diabetes program. As you are aware clinical audits are QI projects that do not require IRB approval. Kindly find attached a copy of my proposal and data collection sheet for your review. I will be really glad to receive feedback by 25th October so that I can meet the university deadline as well.
Thank you.

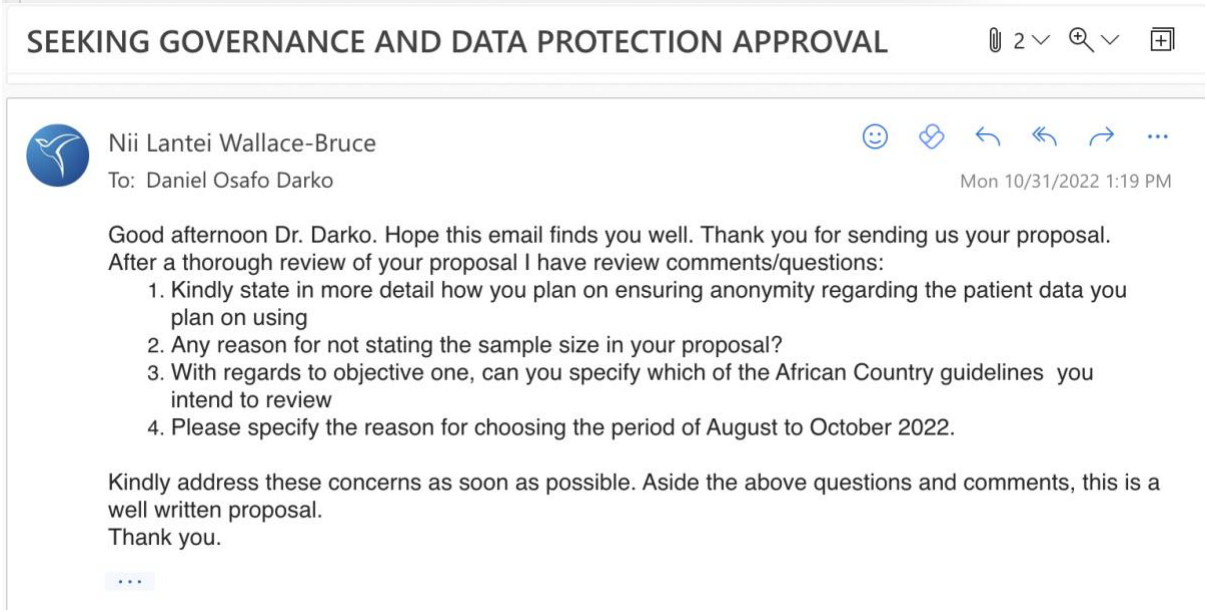
Regards,

Daniel Osafo Darko MD, MGCPS (Fam Med)

Specialist - Family Medicine / Site Lead - Accra Central Satellite Clinic

M: +233(0)50 6443274

E: ddarko@nyahomedical.com |



SEEKING GOVERNANCE AND DATA PROTECTION APPROVAL

2

Nii Lantei Wallace-Bruce

To: Daniel Osafo Darko

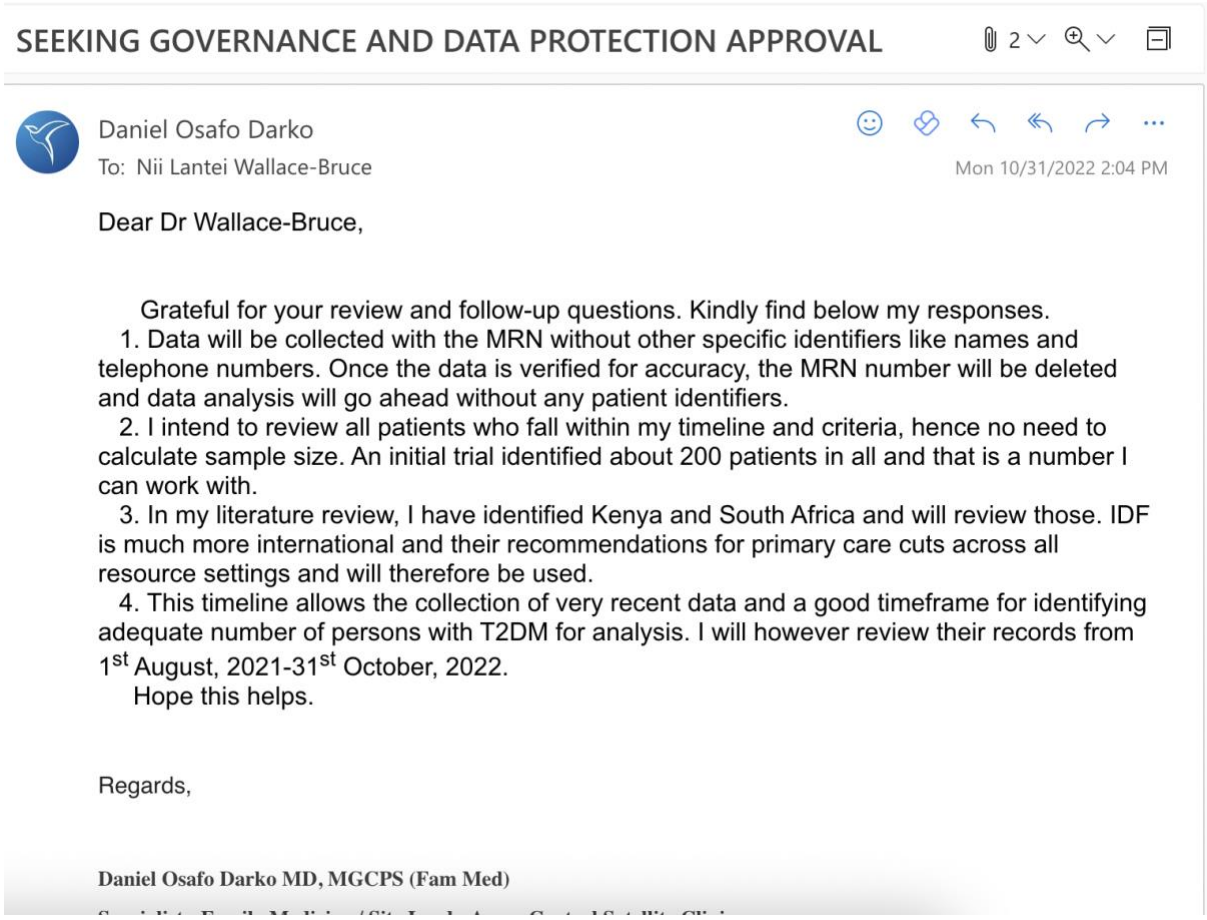
Mon 10/31/2022 1:19 PM

Good afternoon Dr. Darko. Hope this email finds you well. Thank you for sending us your proposal. After a thorough review of your proposal I have review comments/questions:

1. Kindly state in more detail how you plan on ensuring anonymity regarding the patient data you plan on using
2. Any reason for not stating the sample size in your proposal?
3. With regards to objective one, can you specify which of the African Country guidelines you intend to review
4. Please specify the reason for choosing the period of August to October 2022.

Kindly address these concerns as soon as possible. Aside the above questions and comments, this is a well written proposal.
Thank you.

...



SEEKING GOVERNANCE AND DATA PROTECTION APPROVAL

Daniel Osafo Darko
To: Nii Lantei Wallace-Bruce
Mon 10/31/2022 2:04 PM

Dear Dr Wallace-Bruce,

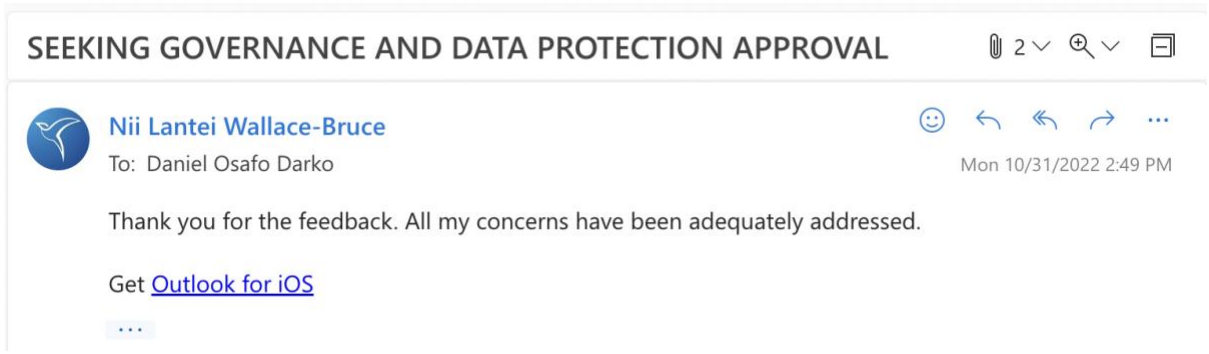
Grateful for your review and follow-up questions. Kindly find below my responses.

1. Data will be collected with the MRN without other specific identifiers like names and telephone numbers. Once the data is verified for accuracy, the MRN number will be deleted and data analysis will go ahead without any patient identifiers.
2. I intend to review all patients who fall within my timeline and criteria, hence no need to calculate sample size. An initial trial identified about 200 patients in all and that is a number I can work with.
3. In my literature review, I have identified Kenya and South Africa and will review those. IDF is much more international and their recommendations for primary care cuts across all resource settings and will therefore be used.
4. This timeline allows the collection of very recent data and a good timeframe for identifying adequate number of persons with T2DM for analysis. I will however review their records from 1st August, 2021-31st October, 2022.

Hope this helps.

Regards,

Daniel Osafo Darko MD, MGCPS (Fam Med)



SEEKING GOVERNANCE AND DATA PROTECTION APPROVAL

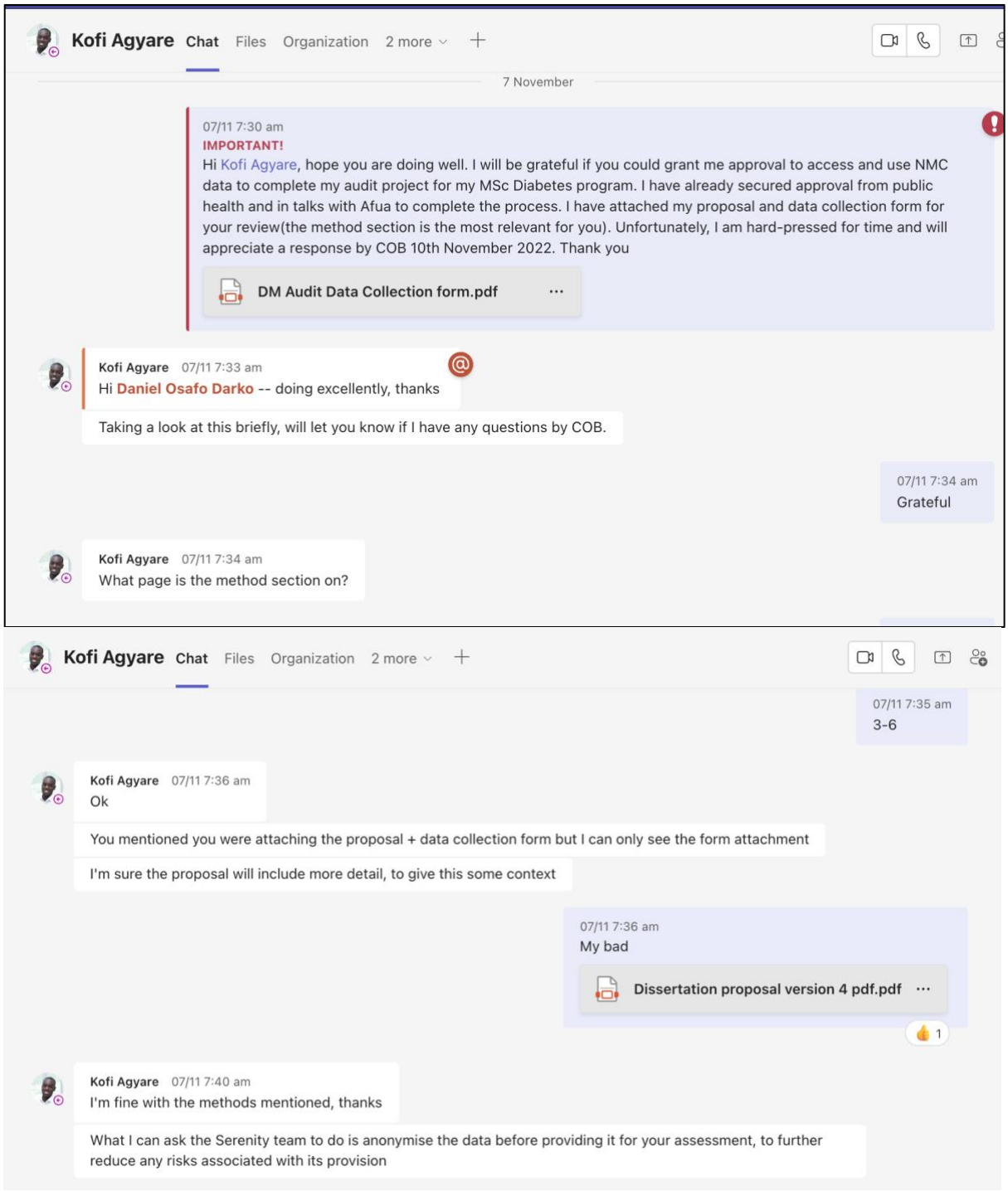
Nii Lantei Wallace-Bruce
To: Daniel Osafo Darko
Mon 10/31/2022 2:49 PM

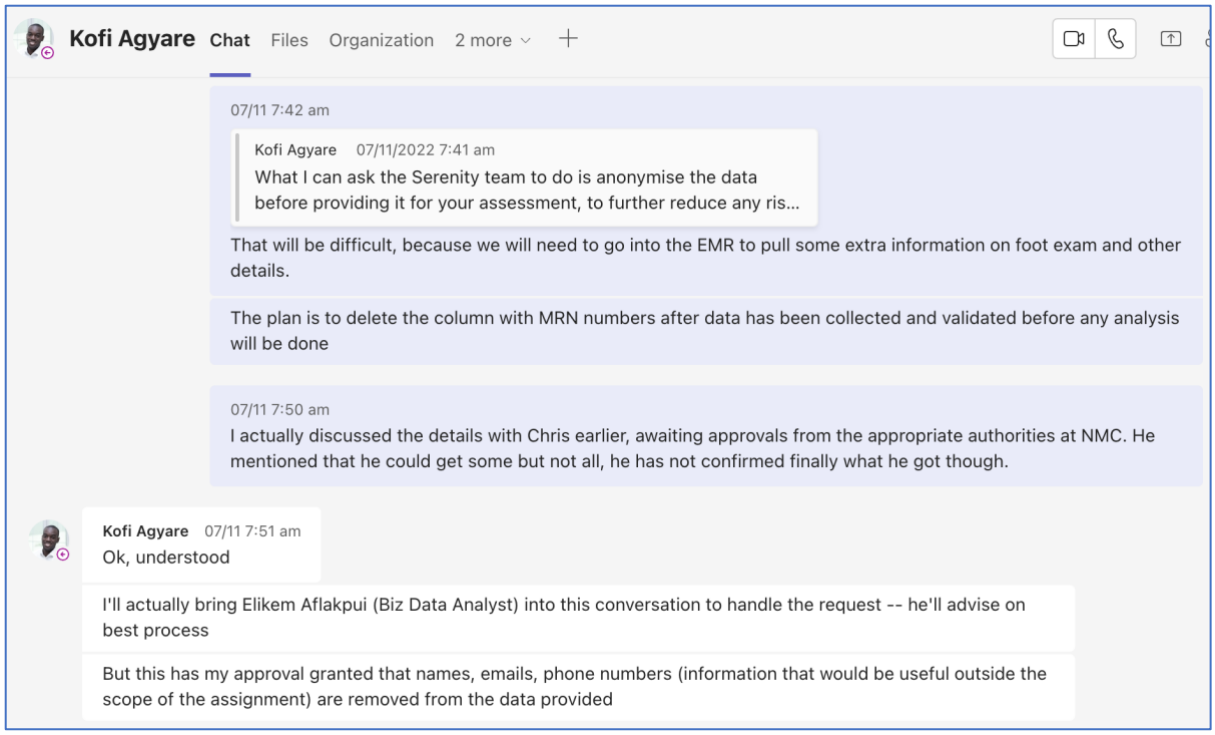
Thank you for the feedback. All my concerns have been adequately addressed.

Get Outlook for iOS

...

Appendix 4 - Nyaho Healthcare Limited IT Director Approval




Kofi Agyare
Chat
Files
Organization
2 more
07/11 7:42 am
Kofi Agyare 07/11/2022 7:41 am
What I can ask the Serenity team to do is anonymise the data before providing it for your assessment, to further reduce any ris...
That will be difficult, because we will need to go into the EMR to pull some extra information on foot exam and other details.
The plan is to delete the column with MRN numbers after data has been collected and validated before any analysis will be done
07/11 7:50 am
I actually discussed the details with Chris earlier, awaiting approvals from the appropriate authorities at NMC. He mentioned that he could get some but not all, he has not confirmed finally what he got though.
Kofi Agyare 07/11 7:51 am
Ok, understood
I'll actually bring Elikem Aflakpui (Biz Data Analyst) into this conversation to handle the request -- he'll advise on best process
But this has my approval granted that names, emails, phone numbers (information that would be useful outside the scope of the assignment) are removed from the data provided

Appendix 5 – Medical Research Council Questionnaire.

Go straight to content.

Medical Research Council

NHS Health Research Authority

Is my study research?

To print your result with title and IRAS Project ID please enter your details below:

Title of your research:

QUALITY OF CARE OF PEOPLE WITH TYPE 2 DIABETES IN A PRIVATE FAMILY MEDICINE TRAINING FACILITY IN ACCRA, GHANA: A CLINICAL AUDIT

IRAS Project ID (if available):

You selected:

- **'No'** - Are the participants in your study randomised to different groups?
- **'No'** - Does your study protocol demand changing treatment/ patient care from accepted standards for any of the patients involved?
- **'No'** - Are your findings going to be generalisable?

Your study would NOT be considered Research by the NHS.

You may still need other approvals.

Researchers requiring further advice (e.g. those not confident with the outcome of this tool) should contact their R&D office or sponsor in the first instance, or the **HRA** to discuss your study. If contacting the HRA for advice, do this by sending an outline of the project (maximum one page), summarising its purpose, methodology, type of participant and planned location as well as a copy of this results page and a summary of the aspects of the decision(s) that you need further advice on to the HRA Queries Line at **Queries@hra.nhs.uk**.

For more information please visit the **Defining Research** table.

Follow this link to start again.

Print This Page

NOTE: If using Internet Explorer please use browser print function.

About this tool **Feedback** **Contact** **Glossary** **Accessibility**

Appendix 6 - [DM Audit Data Capture.url]

DM Audit Data Collection form (Final)

Please review patient EMR Records from both Serenity and HIS and answer the following questions as accurately as possible.

* Required

1. Patient ID/MR No

*

2. Sex *

- ◯ Male
- ◯ Female

3. Mode of payment *

- ◯ Cash
- ◯ Insurance
- ◯ Corporate account
- ◯ Not Available

Appendix 7 – Supplementary data