

The quality of care of diabetic patients in rural Malawi:

A case of Mangochi district

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Abstract

Background

Diabetes mellitus is a global public health problem. In Malawi, the prevalence of diabetes is 5.6% but the quality of care has not been well studied.

Objective

The aim of this study was to assess the quality of care offered to diabetic patients in Mangochi district.

Methods

This was a cross sectional descriptive study. Quantitative data were collected using a questionnaire from a sample of 75 diabetic patients (children and adults) who attended the Diabetes Clinic at Mangochi District Hospital between 20012 and 2013. Qualitative data were also collected using semi-structured interviews with eight Key Informants from among the District Health Management Team. Frequencies and cross-tabulation were obtained from the quantitative data. Patients' master cards were checked to validate results. Clinical knowledge about diabetes, care practices and resources were the themes analysed from the qualitative data.

Results

Among the 75 participants interviewed, 46 were females and 29 males. The overall mean age was 48.3 years (45.6 for females and 53.3 for males). More than half of patients had little or no information about diabetes (40.0 % (n=30) and 22.7 (n=17) respectively. The majority of patients were taking their medicines regularly 98.7% (n=74). Only 17.3% (n=13) reported having their feet inspected regularly. Fifty-six percent of patients were satisfied about services provision. Some nurses and clinicians were trained on diabetes care but most of them left. Guidelines on diabetes management were not accessible. There were shortages in medicines (e.g. soluble insulin) and reagents. Information Education and Communication messages were offered through discussions, experiences sharing and posters.

Conclusion

Quality of diabetes care provided to diabetic patients attended to Mangochi hospital was sub-optimal due to lack of knowledge among patients and clinicians and resources. More efforts are needed towards retention of trained staff, provision of pharmaceutical and laboratory resources and health education.

Introduction

Diabetes mellitus is a chronic disease which occurs when the pancreas produces insufficient insulin, or when the body cannot effectively use the available insulin. This leads to an increased concentration of blood glucose (hyperglycaemia).¹

Globally, about 285 million people live with diabetes and this population is estimated to reach 436 million by 2030.² Chronic non-communicable diseases (CNCDs), including diabetes, cause 60% of all deaths worldwide.³ Nearly 80% of CNCD deaths (29 million) occur in low- and middle-income countries. Diabetes alone is estimated to have caused about 4.6 million deaths in 2011 among the 20-to-79-year age group, which is about 8.2% of deaths due to all causes in this age group worldwide.³ Sub-Saharan Africa carries over 60% of the global burden of diseases but spends less than 1% of the world's total health expenditure.⁴

The prevalence of diabetes in Malawi is 5.6% among adults aged between 25 and 64 years.⁵ The risk factors for diabetes include: sedentary lifestyle and the aging population.⁶ Another important factor contributing to the prevalence of diabetes in Malawi is the relationship with HIV and AIDS, which has been implicated to increase the risk of diabetes.⁷

Quality in diabetes care can be defined within the framework attached to the health services broadly. Harteloh defined quality as "an optimal balance between possibilities realised and a framework of norms and values."⁸ A similar definition of quality in relation to health care is "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."⁹

The International Diabetes Federation (IDF) has developed guidelines for the management of type 2 Diabetes in Sub-Saharan Africa. These guidelines are in three categories: (1) recommended, (2) limited and (3) comprehensive care. In most of Malawi's settings, the limited care is perhaps the most relevant category, and for this reason we concentrated on reflecting how to deliver limited care to diabetic patients.

- CD 1: Offer annual surveillance, agree care plans, deliver protocol-driven care, and ensure that each person with diabetes is recorded on a local list of people with diabetes, as for recommended care.
- CDL2: Organise care around the person with diabetes.
- CDL3: Use an appropriately trained health-care professional to deliver diabetes care.¹⁰

Currently, the Malawian government, through the Ministry of Health (MoH), is developing a CNCD strategy; selected CNCDs, including diabetes, have been incorporated in the Essential Health Package (EHP) and the National Health Research agenda.¹¹ We are not aware of the quality of health services currently provided to diabetic patients at the public rural hospitals in Malawi.

For optimal care of diabetic patients and early detection of complications in Malawi, the Ministry of Health have set surveillance measures to monitor progress and check for the development of complications. These measures are: health education, foot care and screening for signs of neuropathy and peripheral vascular disease, and screening for visual impairment.¹²

In Malawi there has been limited research in non-communicable diseases (NCDs) in general and diabetes in particular. However, the available data on diabetes care in an urban health facility concluded that the quality of care of diabetic patients was poor in many aspects such as use of treatment protocols, availability of medications and early detection of complications.¹³

The purpose of this study was to assess the quality of care offered to diabetic patients in Mangochi District, Malawi with focus on the availability and capacity of health personnel, the availability of the medicines and other materials, and the knowledge about diabetes among patients (participants).

Methods

This was a cross-sectional descriptive study using a

combination of qualitative and quantitative methods. The study was conducted at the Mangochi District Hospital. The estimated 2012 population for the district was 909,236. The study involved eight key informants from the district health office (the district health officer (DHO), district nursing officer (DNO), district medical officer (DMO), the health management information system (HMIS) officer, the in-charges of pharmacy and laboratory, and two ward nurses). Diabetic patients attending the hospital were also recruited for the study. Of the 104 patients in the diabetes register of the hospital, we selected a sample of 75 participants. The 75-participant sample was reached using consecutive sampling. The inclusion criteria were diabetic patients who were registered in Mangochi Hospital's diabetes register and came to the hospital for care and consented to participate. The exclusion criterion was those not consenting; however no one refused to participate. Data collection was conducted from 4th December 2012 to 5th February 2013.

Qualitative data were collected from key informants guided by a pre-set interview guide. An audio recorder was used to capture all words said. Questionnaires were used to collect quantitative data from patients on knowledge about diabetes, patient satisfaction, and care practices among the diabetic patients. Quantitative data were entered into a database (Microsoft access) and analysed using STATA 11. Descriptive statistics (mean, standard deviation and frequencies) were calculated.

The qualitative data were analyzed manually by applying thematic content analysis (TCA). The main themes were knowledge, resources, setup and organization, and service delivery. Challenges and suggestions for improvement of the services were extracted.

Guidelines on diabetes care, set by the Ministry of Health, were referred to for comparing some indicators.

Results

Socio-demographic characteristics of study participants

A total of 75 diabetic patients were included in the study. Female participants represented 65.3% (n=46) while males represented 35% (n=29) of the study participants. Sixty percent (n=45) knew they have been diabetics for more than three years, 21.3% (n=16) between one and two years, and 18.7% (n=14) for less than a year.

The mean age was 48.3 years (SD= 14.95), and range 12-78 years. There were two children among the participants, both were girls aged 12. The majority of the participants (72%, n=54) had either no formal education or primary education as highest level of education, whilst, 21.3% (n=16) and 6.7% (n=5) had secondary education or a higher level of education, respectively.

Provision of Care and Surveillance

Mangochi District has an established diabetic clinic every Tuesday morning at the outpatients department (OPD) with the following features:

Structure

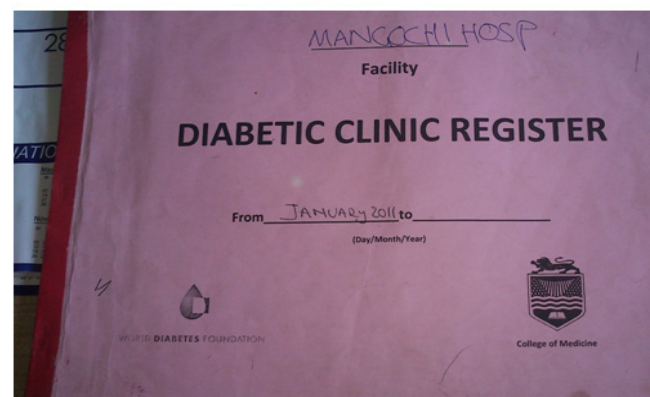
The diabetes clinic was run by a nurse and a clinician at the time of our study. The nurse's role was to attend to patients as they come for routine follow-ups and refilling of drugs.

Organization

The clinic ran on Tuesday mornings in the OPD.

There was a register provided by the World Diabetes Foundation (WDF) (see figure 1).

Figure 1: The diabetes register at Mangochi District Hospital



There was also a master card for every patient for follow-up information and documentation of complications and medications. Our study found that master cards were often not completely filled and that the majority were not updated. The master cards were accompanied by some job aids on how to use and fill in the cards. There were also guidelines on management with some details and these guidelines were kept in a folder.

Access to diabetes services

A total of 76% (n=57) of the study participants lived within a radius of ten kilometres of the hospital and the remainder lived at a distance more than ten kilometres from the hospital. Out of the ten Traditional Authority Areas (TAAs) served by the hospital (and represented by the participants), the two closest TAAs had 58 patients and the remaining 17 patients were distributed among the other eight TAAs.

Knowledge about diabetes

Knowledge was assessed subjectively by asking direct questions about different aspects of diabetes and care. On the type of diabetes, only 22.7% (n=17) knew the type of diabetes they had. When asked to estimate the knowledge they have about the disease in general, 13.3% (n=10) reported their knowledge to be good, 24.0% (n=18) thought it was fair, 40.0% (n=30) had little and 22.7% (n=17) had no information about diabetes. The main source of information was the hospital (82.7%) through discussions, posters and experience sharing. The second most common source of information was the radio and television with 8.0%; third was information provided by a friend (6.67%), while there was perceived little influence from fellow patients and "other" sources. Only one participant mentioned that he gets his information from the Diabetes Association of Malawi (DAM). Seventy (93.3%) of the respondents claimed to have knowledge about the recommended diabetes diet.

Knowledge about the symptoms and signs of hypo- and hyperglycaemia was probed and results are summarized in the Table 1 below.

Table 1: Reported knowledge on hypo- and hyperglycaemia among study participants in the study of quality of diabetes care in Mangochi, Malawi

Knowledge parameter	Yes	No
Symptoms and signs of hypoglycaemia	40 (53.3%)	35 (46.7%)
Symptoms and signs of hyperglycaemia	55 (73.3%)	20 (26.7%)

About two thirds of the participants (68.0%) knew that when they develop symptoms of hypoglycaemia they should take some sugar or sweets, and 18.7% said they should take a meal. The remaining 13.3% said they would either take medicine or consult a clinician.

Care practices among patients

We questioned the participants on some basic care practices that contribute to improving the quality of care and the desired outcomes. Sixty-nine (92.0%) patients had started treatment with medicines at the time of diagnosis, and only six (8.0%) had started later. Reasons behind delaying drug treatment were lack of services near their residence, and one reported that treatment was delayed because of pregnancy. On clinical reviews schedule, 43 patients (57.3%) reported to be on monthly reviews, 11 (14.7%) two-monthly, two (2.7%) every three months, and 19 (25.3%) irregularly.

On the type of anti-diabetic medicine, there were 61 patients (81.3%) on oral hypoglycaemic agents (mainly glibenclamide and/or metformin), while 14 patients (18.7%) were on injectable insulin. Out of those 14 participants, 13 reported they have been self-injecting and only one reported to be injected by a guardian. The majority reported to be taking their medicines regularly 98.7% (n=74).

Only 17.3% (n=13) of participants reported that they inspected their feet regularly, 45.3% (n=34) inspected sometimes, and 37.3% (n=28) did not inspect their feet at all. In relation to foot care, participants were asked whether they wore shoes. We found that 66.7% (n=50) wore shoes most of the time, while 14.7% (n=11) did not and 18.7% (N=14) did occasionally.

Care measures offered by the care provider

Health care workers are expected to offer some basic examination and check-up in order to assess the general status of their patients. Study participants were asked whether their care providers offered them routine check-ups during the reviews. These measures were: general examination and blood pressure measuring, testing for blood sugar, testing for urine, and feet examination. Thirty-six (48.0%) respondents mentioned that they were offered general examination and blood pressure measurement every visit, 12.0% (n=9) sometimes and 40.0% (n=30) never. On blood sugar testing, the majority declared to be tested every visit 84.0% (n=63), 4 participants (5.3%) sometimes, and 8 (10.7%) never been tested. In contrast to blood sugar testing, few patients reported to be offered a urine test every visit 18.7% (n=14). Those who had urine testing at occasions represented 30.7% (n=23) and those who reported never to have been tested were 50.7% (n=38). About two thirds of the study participants did not have their feet checked (69.3%,

n=52), 16.7% (n=12) were examined occasionally and only 14.67% (n=11) reported being offered feet examination every visit.

Patient satisfaction

More than half of the participants 56.0% (n=42) were fully satisfied with the service that was provided to them, 30.7% (n=23) were satisfied to some extent, and 13.3% (n=10) were not satisfied.

Prevalence of complications and general health improvement

We asked direct questions on a number of common diabetic complications, including those concerning vision (as an indication for retinopathy) and whether participants can feel their feet (as an indication for peripheral neuropathy). The results are summarized in the Table 2 below, but it is important to appreciate that these are crude indicators, and may not reflect the true prevalence of these complications:

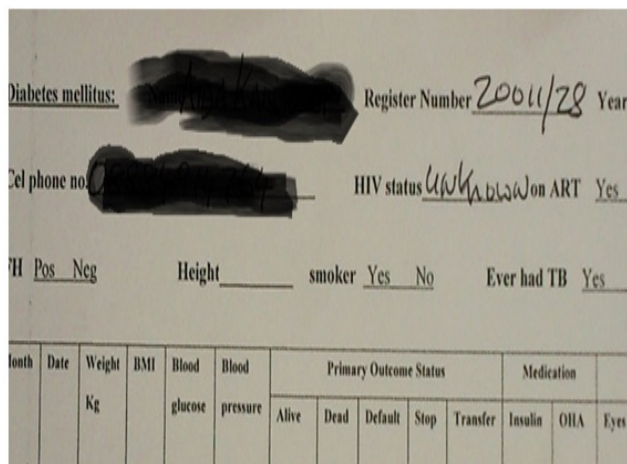
Table 2: Frequency of impaired vision and sensation among study participants in the study of quality of diabetes care in Mangochi, Malawi

Complication	Yes	No
Impaired vision	43 (57.3%)	32 (42.7%)
Impaired sensation	23 (30.7%)	52 (69.3%)

Study participants were also asked if they felt their health is generally better than before they started treatment. About two thirds, 65.3% (n=49) felt their general health has been better than before, 25.3% (n=19) felt slight improvement, while 9.3% (n=7) felt worse than before.

In attempt to validate some results from the quantitative data, we looked at the master cards kept at the diabetes clinic, and we found that most of them were not updated and much of information was missing. See Figure 2 below (name and phone numbers are masked for ethical reasons).

Figure 2 Patients' master card with missing information



Results from Qualitative data

Qualitative data revealed the following results in regard to quality of diabetes care in the district:

Supplies of Medicines, Laboratory equipment and reagents and other resources

Study participants reported that supplies of medicines,

laboratory reagents and equipment were unavailable some of the times. Complaints of shortages were reported in all hospital departments assessed.

Medicines and pharmaceuticals

Some medicines commonly prescribed for treating diabetes and its co-morbidities were available but there were few options to enable treatment decisions tailored to individual patients. For instance, at the time of the interview, there was only Glibenclamide and one type of insulin.

For insulin we don't experience more stock outs, I think this is our first time in two years period time [pharmacy in-charge representative].

The insulin syringes, cotton and disinfectants were available almost all the time. Some anti-hypertensive drugs were available, such as angiotensin-converting enzyme inhibitors (ACEis) and beta-blockers such as propranolol. Cholesterol lowering drugs (statins) were not available. Of note, statins are generally unavailable throughout the public health system in Malawi.

At the main pharmacy at the district hospital the storage conditions were unfavourable. One of the two air conditioners was not working at the time of the interview, and some medicines were laid on the ground. The fridge was also found to be not working:

Currently I can say our pharmacy storage condition is not OK because the air condition got damaged two weeks ago... So as you can see the temperatures are very high... again fridge is not functioning... drugs... are being kept in the laboratory [pharmacy in-charge representative].

Laboratory equipment and reagents

At the laboratory, some equipment and reagents were available at the time of the interview. Rapid tests for proteinuria, biochemistry (including blood sugar), and reagents used to perform renal function tests were reported to be available:

We have the equipment for biochemistry, which can as well do the glucose discovery... rapid tests, they are available... renal function tests? Yes we have [laboratory in-charge].

There were no lipid profile and glycated haemoglobin tests—an unsurprising finding, given that even central hospitals in Malawi are lacking such capabilities. Some problems were identified:

Supply of reagents is not forthcoming... central medical stores do not always have what we need... we are like restricted and we always have inadequate supplies or supplies not in right quantities, or poor quality of supplies [laboratory in-charge].

The Chairlady of the Mangochi branch of the DAM reported that the testing machine belonged to the Association and that they buy the test strips and the nurse and the clinician only performs the test. They contribute money every month to buy the strips, as the health workers at the hospital had been reporting a lack of strips and reagents. So they had to bring the machine and the strips every week, and at the end of the clinic they take them back and keep these until the following week.

Knowledge about diabetes and staff training

Mangochi District has a project for caring the diabetic patients which was established with support from the World Diabetes Foundation (WDF) in partnership with the University of Malawi's College of Medicine (CoM). This project included other districts in the southern region of Malawi, with the aim

of helping the MoH tackling the disease.

Among clinicians and nurses, it was reported that there was lack of diabetes knowledge:

In general they—clinicians—don't have a good clinical knowledge... [though] a certain group of clinicians... underwent a specific training by a consultant medical specialist [DMO representative].

Six were trained and four were posted away...and I think at the moment we have two remaining in the ambulatory service [DNO].

Usually, our nurses are prepared as general practitioners... diabetic is taken as a component of a general nursing care [DNO].

[Diabetes] was included during the training we had at school, but not on job [maternity in-charge].

Also there is lack of mentorship on diabetes due to staff turnover:

Trained staff... to be mentors to other...but... have been transferred out of the district [DNO].

The laboratory in-charge knowledge about diabetes-related investigations and tests was good except for knowledge regarding glycated haemoglobin.

Care provision

The hospital was reported to have capacity to handle diabetes emergencies:

"Does the hospital have capacity to handle diabetes emergencies?" [interviewer].

"Yes we do" [DHO].

In-wards care

There were no guidelines or structures in place to handle diabetic cases in the wards. At the maternity department there was no awareness of—nor were there resources dedicated to handling—gestational diabetes:

We actually we are not doing any screening, so we might be having them but maybe we miss them (gestational diabetes patients) [maternity in-charge].

Screening for complications

Screening available included: urinalysis, foot examination, and blood pressure measurements, which were performed in less than 50 % of patients overall.

Surveillance

At the district level, there were no active surveillance activities in regard to diabetes since it is not included in the returns of the HMIS:

At our reports, [diabetes] is not included [HMIS in-charge representative].

Even the available data were obtained and kept at the hospital and not at the HMIS office.

Information, Education and Communication

Patients who came for care at the hospital received some information, education and communication (IEC) messages by the focal nurse at the OPD diabetes clinic:

So health education is given to cater the needs of the clients... like more or less like discussions, sharing experiences and mapping out the way forward on how they can manage their conditions [DNO].

There were also posters available:

We do have quite a lot of posters for that [DHO].

Study Limitations

Ideally, it would have been useful to also check for quality of care objectively, e.g., measuring the blood glucose levels, glycated haemoglobin (HbA1c), and actually checking for complications such as retinopathy, macro- and micro vascular changes, peripheral neuropathy, and kidney functions. We attempted to extract some information from the master cards but these were not well updated, with extensive missing data. The study was done in one district and generalizability may not be granted. The sample size (75 participants) of the study is small, which might also affect generalizability. Notably, however, the total number of patients registered at Mangochi District Hospital was only 104 (at the time of the study). The cross-sectional design used in this study could be a limit to explore other aspects of the quality of care.

Discussion

Referring to the minimum guidelines on caring for diabetes patients which were set by the Ministry of Health, we assessed the quality of diabetes care in Mangochi, Malawi. There was sub-optimal care and it was found to be due to disruption of medicinal and laboratory supplies, and a lack of staff that had been trained to deliver diabetes care. The Ministry of Health has indicated that, aside from medicinal prescriptions, there should be screening for neuropathy, nephropathy and visual impairment as well as provision of health education. Some clinicians and nurses were trained but some had left the hospital for different reasons. The knowledge about diabetes and care practices among patients was sub-optimal as well. It has been observed that the percentage of females who come for care is more than that of males. This trend was also shown by Cohen et al,¹³ who found that the female-to-male attendance ratio at the Blantyre, Malawi diabetes clinic was 60.1%: 39.9%. However, results from a nationwide assessment of NCD risk factors revealed no significant differences between men and women in terms of raised fasting blood glucose.⁵ This would suggest that there are barriers that particularly affect men in accessing diabetes care. From our results, there were only two children registered and both came for care regularly. The available literature shows that, in developing countries, the age range most affected by diabetes is 45-64 years.¹⁴ The International Diabetes Federation (IDF) estimated the number of type 1 diabetes patients in Malawi to be 300 in the year 2010.¹⁵ The majority of patients were from the two closest Traditional Authority Areas (TAA Mponda and TAA Chowe) while very few from other TAAs. This might be due to lack of services in the other parts of the district (so that less people are screened/diagnosed) and/or may also relate to difficulties to travel to and from the hospital. Therefore, decentralizing the services at the level of the district to reach other public health facilities, might improve access to and quality of care especially in remote areas. The commonly available hypoglycaemic agent, glibenclamide, was not recommended as first line or drug of choice in Malawi, rather it was recommended to be an adjuvant drug to Metformin.¹⁶ Metformin was recommended as drug of choice in treatment of type 2 diabetes especially in obese patients.¹⁷ As hypertension occurs nearly twice as frequently in diabetic patients as non-diabetic,¹⁸ the availability of anti-hypertensive drugs was therefore reassuring, even if amlodipine—one of the important drugs listed in the Malawi Standard Treatment Guidelines—is not always available. A number of laboratory tests were available at the hospital. However, in most cases, there was no clear protocol on how these were utilised. For

example, although the hospital was routinely measuring fasting blood glucose, patients also frequently (including every clinic visit) had a urine dipstick test. This would be unnecessary for if meant to inform diabetes control (with available blood glucose results). Urine testing (to detect albuminuria) is recommended as a screening tool for diabetic nephropathy, but this would normally be only undertaken once or twice a year. Health education offered to the community in general and to diabetic patients, in particular, improves quality of care in many aspects.^{19,22} In this study, the level of knowledge about diabetes among patients was reported to be low, yet the main source of information was the hospital, which reflected that some efforts have been missed to educate diabetes patients. The shortage of staff, especially clinicians, raises the need to discuss the possibility of adopting so-called “nurse-led” diabetes care. This approach has shown to improve quality of care, especially in rural areas of low income countries.²³⁻²⁵ It seems the level of knowledge and the available resources at the district and at the hospital were not properly used or were not employed effectively. For instance, some laboratory tests were available which could be offered to monitor progress and early detection of complications. Additionally, a number of nurses and clinicians who were trained had been posted to other facilities outside Mangochi District Hospital. In regards to patients, some care practice parameters investigated in the study had excellent to good indices such as frequency of reviews, patient compliance to prescriptions, and insulin storage, while other parameters were poor such as feet inspection and care, and footwear use.

Conclusion

We conclude that the quality of care offered to diabetes patients at Mangochi District Hospital faces many challenges in terms of numbers of well-trained health care personnel in regard to diabetes care, mainly due to staff turnover and transfer-outs. The district also lacks many medical resources including medicines and proper storage conditions, laboratory reagents and tests, and updated and easy-to-reach management protocols. Patients are also under-served, with relatively little attention paid to monitoring and checking for complications, and general health improvement.

Recommendations

There is a need to consider capacity building for diabetes care and retention of trained staff, extending services, and adopting other cost-effective strategies (e.g., nurse-led service delivery) to utilise the available workforce. It is important to improve the supply chain management of pharmaceutical and laboratory supplies. Development of a diabetes management protocol is indispensable if the quality of diabetes care is to be improved.

References

1. WHO. Health topics, diabetes [Internet]; 2012 [cited 2012 May 5]. Available from: http://www.who.int/topics/diabetes_mellitus/en/
2. WHO global report 2005: preventing chronic diseases: a vital investment [Internet]; 2005 [cited 2011 Nov 4]. Available from: http://www.who.int/chp/chronic_disease_report/en/
3. International Diabetes Federation (IDF) diabetes atlas: burden of mortality due to diabetes [Internet]; 2011 [cited 2012 Jul 22]. Available from: <http://www.idf.org/diabetesatlas/5e/mortality/>
4. WHO. What are the socioeconomic impacts of NCDs? Non communicable diseases Fact Sheet, September 2011 [Internet]; 2012 [cited 2011 Nov 10]. Available from: <http://www.who.int/mediacentre/factsheets/fs355/en/index.html>

5. Msyamboza KP, Ngwira B, Dzowela T, Mvula C, Kathyola D, et al. The burden of selected chronic non-communicable diseases and their risk factors in Malawi: nationwide STEPS survey. *PLoS ONE* [serial online]. May 2011 [cited 2012 November 15]; 6(5):e20316. doi: 10.1371/journal.pone.0020316. Available from: <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020316>
6. Allain T and Bothmer E. Tip of the iceberg: comments and interviews [Internet]. November 2011; [cited 2013 March 20]. Available from: <http://www.dandc.eu/en/article/diabetes-spreading-fast-malawi-and-other-developing-countries>
7. Vugt M, Hamers R, Schellekens O, Rinke de Wit T, and Reiss P. Diabetes and HIV/AIDS in sub-Saharan Africa: the need for sustainable healthcare systems [Internet]; 2012 [cited 2011 December 23]. Available from: <http://www.ajol.info/index.php/dmsj/article/viewFile/76278/66739>
8. Harteloh P. The meaning of quality in health care: a conceptual analysis. *Health Care Analysis* [serial online]. 2003 [cited 2012 April 21]; 11(3):259–67. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK2681/>
9. Lohr K. Committee to design a strategy for quality review and assurance. In: Medicare, editor. Medicare: a strategy for quality assurance. Vol. 1. Washington, DC: National Academy Press; 1990.
10. International Diabetes Federation. clinical guidelines task force. Global guideline for type 2 diabetes. 2012. Available from: <http://www.idf.org/global-guideline-type-2-diabetes-2012>
11. Government of Malawi, Ministry of Health. Malawi Health Sector Strategic Plan (HSSP) 2011-2016: moving towards equity and quality [Internet]; 2011 September; p. 28.
12. Ministry of Health. Malawi Standard Treatment Guidelines (MSTG). 4th ed. Lilongwe: Ministry of Health ; 2009; p. 36.
13. Cohen DB, Allain TJ, Glover S, Chimbayo D, Dzamalala H, Hoffland HW, et al. A survey of the management, control, and complications of diabetes mellitus in patients attending a diabetes clinic in Blantyre, Malawi, an area of high HIV prevalence. *Am J Trop Med Hyg.* [serial online]. September 2010 [cited 2012 November 08]; 83(3):575–581. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2929054/>
14. Holt T, Kumar S. ABC of diabetes. 6th ed. Chichester, West Sussex: Wiley-Blackwell; 2010; p. 47.
15. Soltész G, Patterson C, Dahlquist G. Diabetes in the young: a global perspective. International Diabetes Federation (IFD). *IDF Diabetes Atlas*. 4th ed. [Internet], [n.d.] [cited 2013 March 20]: 11. Available from: http://www.idf.org/sites/default/files/Diabetes_in_the_Young.pdf
16. Ministry of Health. Malawi Standard Treatment Guidelines (MSTG). 4th ed. Lilongwe: Ministry of Health; 2009; p. 38.
17. Holt T, Kumar S. ABC of diabetes. 6th ed. Chichester, West Sussex: Wiley-Blackwell; 2010; p. 25.
18. Bild D and Teutsch S M. The control of hypertension in persons with diabetes: a public health approach. *Public Health Report*. 1987 Sep-Oct;102(5):522.–529.
19. Beran D. Implementing national diabetes programmes in sub-Saharan Africa. London: International Insulin Foundation; 2006.
20. Gagliardino JJ, Aschner P, Baik SH, Chan J, Chantelot JM, Ilkova H, et al. Patients' education, and its impact on care outcomes, resource consumption and working conditions: data from the International Diabetes Management Practices Study (IDMPS). *Diabetes and Metabolism*. 2012 Apr;38(2):128-34. Epub 2011 Oct 22. <http://www.ncbi.nlm.nih.gov/pubmed/22019715>
21. Vallis T, Higgins-Bowser I, Edward L, Murray A and Scott L. The role of diabetes education in maintaining lifestyle changes. *Canadian Journal of Diabetes* [serial online]. 2005 [cited 2013 March 12]; 29(3):193-202. Available from: http://www.diabetes.ca/files/Vallis-Role_of_Lifestyle_pages193-202.pdf
22. Chuang LM, Lin BJ, Wu TJ, Chen YH, Tai TY. The effect of health education for diabetics in the community. *Journal of the Formosan Medical Association*. 1989 Nov-Dec;88(11-12):1143-6.
23. Strine TW, Okoro CA, Chapman DP, Beckles GL, Balluz L, Mokdad AH. The impact of formal diabetes education on the preventive health practices and behaviors of persons with type 2 diabetes. *Preventive Medicine* [serial online]. 2005 Jul [cited 2013 March 13]; 41(1):79-84. Epub 2004 Nov 19. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/15916996>
24. Labhardt ND, Balo JR, Ndam M, Manga E, Stoll B. Improved retention rates with low-cost interventions in hypertension and diabetes management in a rural African environment of nurse-led care: a cluster-randomised trial. *Tropical Medicine and International Health* [serial online]. 2011 Oct [cited 2013 March 13]; 16(10):1276-84. doi: 10.1111/j.1365-3156.2011.02827.x. Epub 2011 Jul 6. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21733046>
25. Kengne AP, Fezeu L, Sobngwi E, Awah PK, Aspray TJ, Unwin NC, et al. Type 2 diabetes management in nurse-led primary healthcare settings in urban and rural Cameroon. *Primary Care Diabetes* [serial online] 2009 Aug [cited 2013 March 13]; 3(3):181-8. Epub 2009 Sep 11. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/19748331>