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Implementation of a Non-Communicable Disease (NCD) Screening Programme in a Rural African HIV Clinic

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ABSTRACT

Objectives: The objective of this study is to investigate the feasibility and outcomes of an integrated screening programme for risk factors associated with diabetes and hypertension in a busy HIV treatment clinic in rural Swaziland.

Methods: The screening programme identifies patients with risk factors for hypertension and diabetes mellitus (DM). Patients with one or more risk factor also had their blood glucose (BG) tested (random or fasting). High readings for BP or BG were referred for follow-up diagnostic tests at their local community health facility.

Results: Four hundred (6.9%) of 5,821 patients screened positive for at least one risk factor, of which most common was high body mass index (BMI) (5.5%), followed by high BP (3.2%), and relative with diabetes (0.7%). Three point six percent of patients with a risk factor had high BG, and a further 10% had a reading indicative of pre-diabetes. There were problems with patient's attendance and information flow to/from the community facilities. Only 3.7% of patients with high BP, and 23% of patients with high BG, were known to have had full follow-up diagnostic tests. Only one patient was confirmed to have DM, and six patients were confirmed to be hypertensive.

Conclusions: This programme suggests it is feasible to integrate non-communicable diseases (NCD) screening programmes in low-resource sub-Saharan African HIV treatment services. However the known yield was low, and there were challenges to ensure follow-up diagnosis in the health centres. There is a need to do the confirmatory second test prior to a referral to community facilities for follow-up care. The screening of HIV clinic patients in this population may not be cost-effective, and a higher priority may be the general/outpatient population.

KEY WORDS: HIV; Diabetes; Hypertension; Non-communicable disease (NCD); Screening; Africa.

ABBREVIATIONS: DM: Diabetes Mellitus; BMI: Body Mass Index; BG: Blood Glucose; NCD: Non-communicable Diseases.

Background

Non-communicable diseases (NCD) account for more than 60% of global deaths, 80% of which occur in low and middle income countries.[1] It is projected that by 2030 NCD will account for more than 50% of the mortality in low income countries, surpassing communicable diseases.[1] The emergence of non-communicable diseases in low income countries is partially the result of improved outcomes from high burden communicable diseases, such as HIV.[2,3] Large injections of international funding, and improvements in the diagnosis and management of HIV, and other high burden diseases is resulting in much longer life expectancy for those affected.[4] However, as people are now living longer, they are also going on to develop NCD co-morbidities,[5] which

is resulting in a double burden of disease for developing countries.[6,7]

The evidence base shows that HIV treatment is associated with the development of diabetes, hypertension, and metabolic syndrome, normally related to type and length of treatment.[8-19] In the case of diabetes, this may be associated with the development of metabolic syndrome, which in turn is associated with poorer glucose control.[20,21] There is some evidence that the HIV virus itself is associated with lower prevalence rates for diabetes and hypertension.[10,11,15,22] Similarly, treatment naïve HIV+ patients may actually have a lower prevalence of hypertension.[10,11,15]

International aid programmes are becoming more successful at reaching HIV+ patients in low resource settings with effective treatment,[23] which will extend their life, and also lead to a large proportion of some populations on life-long HIV treatment. The increase in life expectancy, and the interaction between HIV treatment and the development of diabetes and hypertension, will contribute to projected large increases in NCD in the coming years.[3]

Donor funded health system development programmes have tended to focus on vertical programmes,[24] dealing with the more prevalent or highest incidence infectious diseases; principally HIV, malaria, and TB. However, there is a growing emphasis on integrated care, which recognizes that patients with HIV are also at a higher risk of being affected by NCD.[25,26] One of the key strategies to avoid the impact of NCD is investment in the technology, processes, and structures to be able to effectively identify, diagnose, and treat people at the earliest possible stage. There is currently poor investment for this in sub-Saharan African countries.[27-30] Cost-effective methods need to be tested and learned from to push this agenda forward, integrating NCD screening, diagnosis, and treatment into the pre-existing vertical structures, where appropriate. Our study is an early attempt to share learning regarding this.

This study describes the development and outcomes of a screening programme for diabetes, hypertension and cardiovascular risk in a rural hospital HIV unit in Swaziland. The challenge is to implement a practical screening protocol that is affordable and can deal with the heavy patient flows of a busy HIV unit. The aim of the study is to investigate the feasibility and outcomes of an integrated screening programme for risk factors associated with diabetes and hypertension in a busy HIV clinic in rural Swaziland with limited additional resources.

METHODOLOGY

Study Design and Setting

This study was carried out in the Lubombo region of Swaziland, in Southern Africa. Swaziland has a population of 1.1 million people, and has the highest estimated prevalence of HIV infection in the world.[31]

The study took place in a busy hospital-based HIV treatment clinic in a rural province. The clinic has nearly 6,000 registered patients, who are seen in the clinic at least once every three months. This programme aimed to screen all patients during the three month period for risk factors associated with diabetes and hypertension. The challenge for the programme was to screen the clinic population with limited extra resource, and without substantially disrupting patient clinic flows.

Primary care services are delivered to this rural population through a network of government delivered health centres, which provide a basic package of health services. Health centres are staffed by nurses and healthcare assistants. Follow-up diagnostics were referred to the patient's local health centre for completion.

In this study, high BP was defined as BP≥140/90 mmHg (systolic or diastolic). High BG was defined as either: random blood glucose (RBG) (have eaten within 8 hours before test) ≥11 mmol/L or fasting blood glucose (FBG) (have not eaten for eight hours before the test) ≥7 mmol/L, tested using portable blood glucose monitors.

There were two stages to the screening process, described below.

Stage 1: All patients attending the HIV treatment clinic have measurements taken by a nurse or healthcare assistant for:

- BP (using an automated BP machine);
- Weight and height, to calculate body mass index (BMI);
- Questioned whether they have a first degree relative who is diabetic.

A positive screen was defined as any one of the following:

- BP ≥140/90 mmHg (systolic or diastolic);
- BMI ≥25 kg/m²;
- Have a first degree relative who is diabetic.

Stage 2: Patients who were positive went on to stage 2 screening and had the following additional information recorded:

- Manual check of BP (to confirm automated reading); and
- BG check (random or fasting) using a glucometer.

Patients fulfilling the following criteria were judged to have screened positive for diabetes mellitus and/or hypertension, and were sent for repeat testing at their health centre facility to confirm diagnosis:

- RBG ≥11 mmol/L or FBG ≥7 mmol/L;
- Manual BP ≥40/90 mmHg (systolic and/or diastolic).

Health centres were asked to take one further BG read-

ing, preferably during the same week. If this test was RBG ≥11 mmol/L or FBG ≥7 mmol/L, the patient was confirmed as diabetic. Hypertension was confirmed in patients with two further BP readings, preferably during the same week. If the patient had two consecutive BP readings ≥140/90 mmHg (systolic or diastolic) they were confirmed as hypertensive. Patients with positive diagnostics should be referred back to the hospital-based HIV treatment clinic for management and follow-up.

Study Population

All HIV positive patients attending the Good Shepherd Hospital Antiretroviral Clinic who were 16 years or older, and did not have a previous diagnosis of diabetes or hypertension, during the period December 2014 to end of February 2015 were included in the study. All patients were asked to verbally consent to screening.

Data Collection

Data was collected for all patients who had a risk factor at stage one of the screening process. A standardised data collection tool was used, which captured patient data on: unique patient identifier; date of birth; gender; weight; height; body mass index; BP; and BG reading (specified as random or fasting). The data collection tool also captured information on risk factors: BMI≥25; family member with diabetes; an BP≥140/90. Additionally, the form captured results from follow-up diagnostic tests carried out in health centres.

Patients who screened positive for high BG and/or high BP at the 2nd stage of screening had a standardised referral proforma completed in the hospital-based HIV treatment clinic. This form captured data on follow-up tests performed at health centres.

Data was collated into an excel spreadsheet. Where information was missing from the data collection tool, the patient's case notes were consulted.

Data Analysis

Data was analysed using Microsoft Excel™. Descriptive statistics were calculated for all patients who screened positive for at least one risk factor at the first screening stage: mean age; mean weight; mean height; proportion of patients with risk factors (BMI≥25; family member with diabetes; BP≥140/90; Symptoms of diabetes; symptoms of hypertension; high BG); proportion of patients with follow-up diagnosis tests; and proportion of patients with diagnosis of hypertension or diabetes.

Ethics

This study was approved under a larger study for NCD decentralisation of care, by the Swaziland Ethics Committee, and also by University of Leeds Ethics Committee.

RESULTS

First Stage of Screening

From 1st December 2014 to 28th February 2015, 5,821 patients attended the hospital-based HIV treatment clinic. All patients had first stage screening, of which 400 (6.9%) screened positive at stage one, and had at least one risk factor (BP ≥140/90 mmHg (systolic and/or diastolic), BMI ≥25 kg/m², or a first degree relative who is diabetic).

Table 1: Summary Data from First and Second Stage of Screening.

Mean age (years)		44.9
Weight (Kg)		80.3
Height (cm)		162
Body mass index	Mean	30.3
	Median	30
	IQR	27-33
1st BP test	BP<140/90	51% (205)
	BP≥140/90	47% (189)
	Not recorded	2% (6)
Family member with DM		41 (10.25%)
1st BG Result	Negative	78% (312)
	Pre-DM	10% (41)
	Positive	3% (13)
	Not recorded	9% (34)

IQR: interquartile range; BP: Blood Pressure; DM: Diabetes Mellitus.

Table 1 describes the outcomes for participants who screened positive for a risk factor at first stage of screening. BMI was the most common risk factor identified; 5.5% of those who were screened had a BMI indicative of being overweight or obese (BMI≥25 kg/m²), which is substantially lower than the estimated prevalence of 19.7% for the national population.[32] The second most common risk factor was high BP; 3.2% of the total screened had a high BP reading (systolic or diastolic ≥140/90 mmHg). This is substantially lower than estimated prevalence of 33.2% for the national population.[32]

Only 1.2% of patients from the total patient population had a known first degree relative with diabetes.

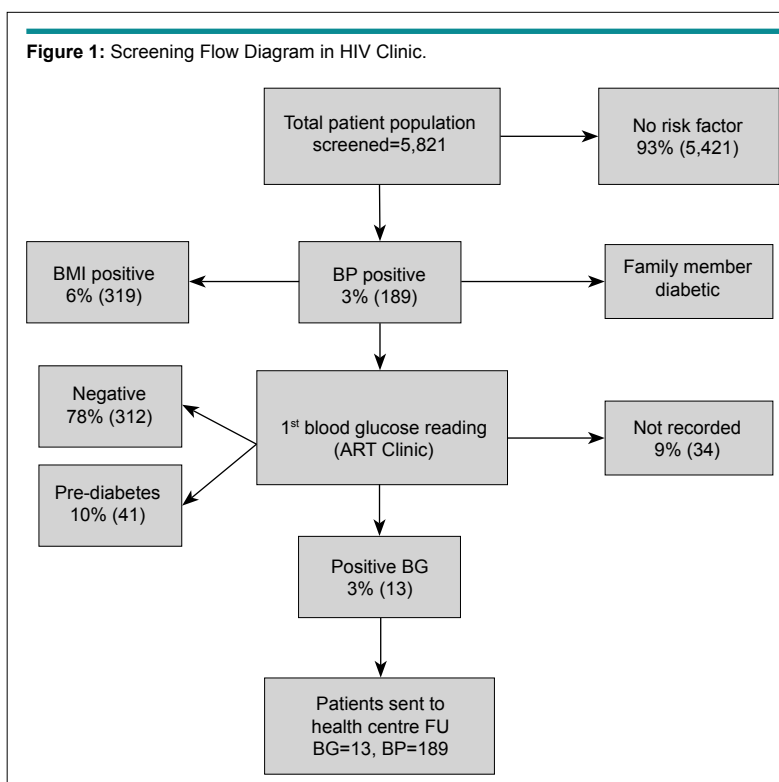## Second Stage of Screening and Diagnosis

The second stage of screening captured further information regarding a patient's BG (random or fasting), and manually confirmed blood pressure readings. Screening and diagnosis outcomes are summarised in Figures 1 and 2 of those patients screening positive for a risk factor in the first stage of screening, 92% had BG measured using a glucometer. Eight five percent of those who were tested had a negative result. Eleven point two percent of those tested had BG levels which were suggestive of being pre-diabetic. Three point six percent of those tested had a BG level considered high. As a proportion of the total patient population (5,821), only 0.22% were identified as having a high BG level (RBG≥11 mmol/L or FBG≥7 mmol/L), and 0.7% had a reading indicative of pre-diabetic RBG ≥7.8 mmol/L).
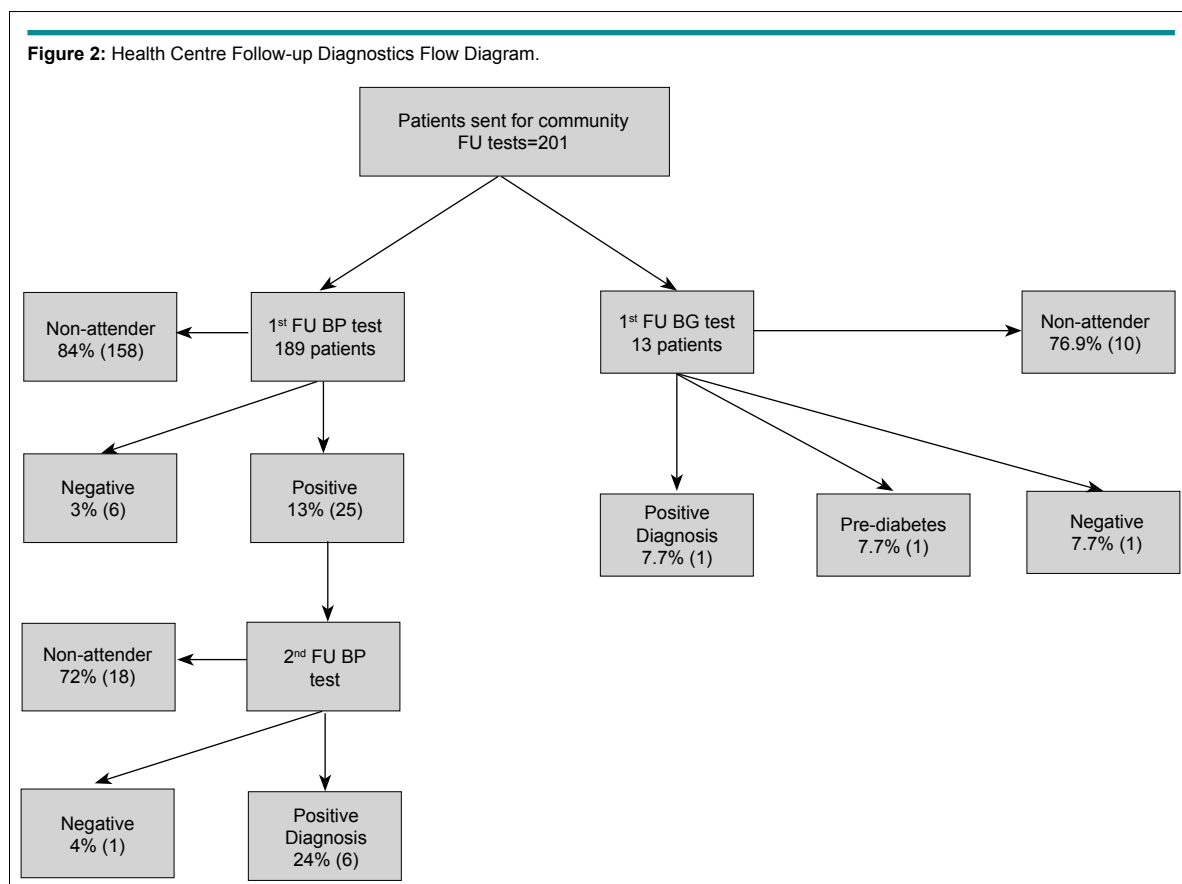
All patients who were identified as having a high BP or BG reading were referred to their local health centre for follow-up diagnostic tests (one further BG and/or two further BP readings). Thirteen patients with a measure for high BG levels were referred to their local health centre for a follow-up diagnostic test (one further BG measurement). Only three of the 13 patients referred for a further diagnostic test at their clinic returned a result. Of the three patients, one patient was confirmed as diabetic, another patient returned a result indicative of pre-diabetes, and the remaining patient had a negative result.

One hundred eighty-nine patients had a high BP reading recorded and were sent for follow-up diagnosis testing at their local health centre. Only 31 patients (16.4%) returned at least one follow-up BP test result. The first follow-up BP test was positive for 25 of the patients who attended for a follow-up test (80.6%). However, only seven patients in total had two follow-up BP tests, which represents 3.7% of those with a high BP reading at screening. Of the seven patients who had both follow-ups, six were diagnosed with high BP.

DISCUSSION

This study shows that it is feasible, with a relatively small investment, to screen a large population of patients attending a HIV clinic in a resource-constrained part of rural sub-Saharan Africa. By developing a two stage screening process, which identified the patients at highest risk of hypertension or diabetes, a large number of patients could be reviewed at relatively little cost.

Figure 1: Screening Flow Diagram in HIV Clinic.

Figure 2: Health Centre Follow-up Diagnostics Flow Diagram.

This process enabled the patient clinic flows to remain largely unaffected and ensured that time and cost resources related to the administration of glucometer tests were minimised.

However, the study found relatively few people with high BG and high BP in comparison to the estimated prevalence for the country.[32] Prevalence data for Swaziland predicts high BP prevalence rates for adults as 33.2%, compared to our study rate of 3.2% (patients with at least one high BP reading). Similarly estimated prevalence of DM in Swaziland is 3.6%,[33] whereas our study identified less than 1% of the study population with high BG levels. In the case of high BG this could be a reflection of the poor sensitivity of our first stage of screening criteria; as only those with at least one risk factor went on to have a measurement taken for BG levels. It may also be a reflection of the rural location of the study population; with rural populations often experiencing substantially lower prevalence of DM than their urban counterparts.[29] However, our study suggests that prevalence estimates for high BP in Swaziland may not provide an accurate picture of this subset of the population who are receiving HIV treatment in a rural area of the country. The low rates of high BP and BG recorded could also be a reflection of the demographics of our study population, who had mean average age of less than 45-years-old. We already know that there are substantial variations in prevalence of high BP and BG within and between populations,[29,34,35] so it is reasonable to assume that there will be substantial variation across the population from which our sample is drawn.

There are also issues with the sensitivity of BG monitoring to predict diabetes,[36] although it is a cost-effective method, and appropriate for use in resource constrained environment with high patient volumes. BMI was chosen as a risk factor to predict poorer cardiovascular outcomes; however, evidence suggests that waist circumference is a stronger predictor of high blood glucose and high blood pressure.[37] In our study BMI was chosen as a pragmatic measure as clinic staff felt more confident measuring and interpreting this rather than waist circumference.

While our screening protocol was able to identify key non-communicable disease risk factors in a time and cost effective manner, it appeared to be very ineffective in delivering timely follow-up diagnostic tests. The low numbers are likely to be due to a number of factors: poor communication between health centre and hospital; poor travel infrastructure to health centres; cost of using public transport (where available) to reach health centres; and poor awareness of the potential seriousness of diabetes and hypertension as health issues.

It is possible that poor communication of the results from the health centre to the hospital-based HIV treatment service, and/or low capacity and capability in diabetes and hypertension diagnosis and management at health centres, were key factors in follow-up rates. Recently, implemented training of health centre staff in diabetes and hypertension diagnosis and treatment, increased availability of diabetic and hypertension medication at health centres, and improved support in diabetes

and hypertension diagnosis and management, should improve this situation substantially. As mentioned, HIV unit clients found to have a high BP or glucose were expected to be sent to the community clinic for confirmatory repeat of these tests, and then be sent/come back for further case management. However, distances and travel infrastructure to health centres may still be substantial barriers for patients, who may have low-income and have relatively poor understanding regarding the significance of their risk factors to health outcomes.[38] It should also be noted that the hospital base and health centres are located in a rural region of Swaziland, with limited travel infrastructure. Moreover, the cost of using public transport, where available, can represent a substantial barrier for patients who have limited financial resource to call upon. In retrospect it would have been more effective if follow-up tests had also been performed at the hospital-based HIV treatment service as part of the patient's normal treatment package.

Adherence to HIV treatment in Swaziland is higher than the average for sub-Saharan Africa, with retention at 6 months reaching 92% and 65% at 60 months.[39] Decentralised HIV treatment in health centres has been established for several years in Swaziland. This patient group are used to obtaining regular healthcare input through health centres. In theory, targeting this group, who also have higher risk of developing non-communicable disease, for identification and management of diabetes and hypertension could be a cost-effective development. However, even where risk factors were identified, the health centres and the patients attending were not possibly not sensitised sufficiently as to the health impact of these conditions. Moreover, as discussed, there are also substantial transport and finance barriers to accessing follow-up care.

The published evidence is that there is a link between HIV and the development of non-communicable disease risk factors. This is likely to increase substantially during the coming 20 years. However, prevalence data for diabetes and hypertension is highly variable across sub-Saharan African countries, and also across in-country populations. It is important that population health risk factors are understood before implementation of screening and management services for diabetes and hypertension, as this is a key factor in approach to screening and its likely cost-effectiveness. The prevalence rates of high BG and high BP in our HIV patient population appear to be much lower than estimated prevalence for the national population, which highlights important information gaps required to support screening programme implementation decisions. Our study suggests the feasibility of integration of NCD screening programmes in low-resource sub-Saharan African HIV services. However, there were inappropriate design assumptions made and important challenges to ensure timely follow-up diagnosis.

LIMITATIONS

The use of glucometers to assess risk of poor glucose control has limitations particularly in terms of sensitivity,[36] and has been criticised as a routine screening method.[40] However, this was as-sessed as being the only feasible option for use in a resource constrained service, with high patient numbers, and limited laboratory testing facilities.[41-43] While this study provides valuable insights into the feasibility of the development of a screening protocol in a HIV treatment setting, it cannot tell us how sensitive or specific the screening criteria is, as patients did not undergo comparative gold standard diagnosis. Nevertheless, the risk factors were chosen based on evidence of their strength of association with common NCD. For patients who were identified as having a risk factor, or who were subsequently diagnosed with hypertension or diabetes, this study cannot inform whether these patients had improved outcomes compared to patients who were not identified. It is important that future studies look at this, to assess whether investments result in improved patient outcomes.

CONCLUSION

It is feasible to integrate NCD screening programmes into HIV care, even in this high HIV prevalence low-resource sub-Saharan African setting. However the known yield was low in part due to the expectation to attend for a confirmatory second test at a community facility and then return. The BP and glucose screening of HIV clinic needs to be piloted with the screening and confirmatory test at the HIV unit. Then the cost-effectiveness screening at the HIV unit can be assessed, and in comparison with screening in, for example, the hospital general outpatients department.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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