

Breaking Barriers to Diabetes Management in Rural Communities: Student Nurses Make a Difference Using Point-of-Care Testing

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Abstract— Just as in many parts of the world, rural communities in Cameroon are experiencing a disturbing increase in the prevalence of diabetes. Inadequate or lack of trained personnel, lack of equipment and knowledge deficit about diabetes are among the many factors hindering implementation of control measures. To address this problem, a 14 hour curriculum on the use of point-of-care testing and diabetes management was designed and taught to 14 enrolled nursing students. During their subsequent 12 weeks placement in two rural communities, the students with the involvement of the health center nurses screened for and managed diabetics and high risk cases. A total of 334 clients were screened; overall diabetes prevalence was 4.89%; 11.31% were at high risk; and 35.78% were at risk. The progress reports of the diabetic and high risk clients who were followed-up revealed significant improvements in their health. The health centre nurses gained knowledge and skills in the course of working with the students while the students among many other benefits, improved their leadership skills and accountability awareness. Challenges such as lack of cooperation from lab technicians were overcome.

Keywords- diabetes management, community, rural, point-of-care testing, nurses, student nurses, Cameroon.

I. INTRODUCTION (HEADING 1)

In the past century diabetes was regarded as a rare condition in Africa. Over the past decades however, Africa has been experiencing an increase in the prevalence of this disease [1][2]. A number of factors have been attributed to this trend including; population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity [3]. Most especially, the disease is gaining grounds due to the adoption of western life style [4][2][5]. Current data on diabetes in Cameroon indicates that the disease is on the rise. An international report found that from 1980 to 2008 Cameroonian women have seen a shocking 60+% increase in the prevalence of diabetes, while the men have seen a modest 15 – 30% increase[6]. A 2012 statistics by the International Diabetes Federation placed Cameroon diabetes prevalence at 6.15%[12].

This increasing diabetes prevalence in Cameroon is reported to be higher in urban areas compared to rural areas. For example, Mbanya *et al.*, 1999,[7]reported 2.0% in urban cities versus 0.8% in rural areas. This difference has been attributed

to lifestyle factors associated with the higher socio-economic status of those living in urban areas. However, recent clinical observations indicate that the prevalence of diabetes is on the increase even in the rural sectors in Cameroon. In 2010 for example, Napoli and his colleagues [9]observed an unexpectedly high rate of obesity and dysglycemia among villagers in Cameroon. The figure below summarizes the trends in rural/urban diabetes in Cameroon from 1994 to 2003[8].

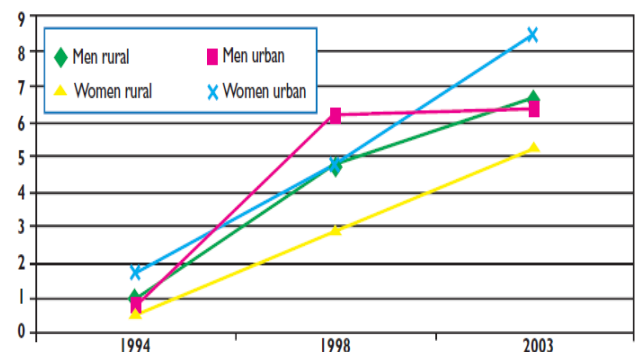


Figure 1: Trends in the prevalence of diabetes in Cameroon from 1994-2003
Source: (Njamnshi *et al.*, 2006)

The most convincing explanation to these rural trends could be the rapidly urbanizing rural areas and the adoption of western life style.

With the increasing trends of diabetes in Cameroon, the ministry of public health has placed diabetes into the national healthcare plan. However, this plan is only executed in urban areas having specialized diabetes centers, with little or no attention to rural areas. The challenges of diabetes care in rural communities include but not limited to:

- Inadequate or lack of trained personnel
- Inadequate or lack of equipment
- knowledge deficit about diabetes
- Higher illiteracy rate
- Financial constraints and
- Limited access to specialized diabetes care units which are located mostly in urban areas

Cameroon's population is evenly distributed between the urban and rural areas. Hence, urgent measures are needed to address this problem in rural Cameroon. As stated by Knapp, *et al* 1999 in Gossechalk, 2010[10], using existing resources in different ways, rather than restructuring the rural health care system, may be the most effective means to provide better health services to rural diabetes. Over the past few decades a number of models/strategies have emerged as candidates for improving diabetes management in rural areas including telemedicine programs, web-based efforts, telephone help lines, and support delivered via community health workers [11]. These methods all have their advantages and disadvantages. However, diabetes education, screening, prevention, or Treatment seem to be a strong components that should be included in successful management programs [11].

To address the problem of rural diabetes management in Cameroon, we conducted a pilot study that employed students nurses trained to use point-of-care testing devices to screen and manage diabetics in two rural communities.

II. OBJECTIVES

The general objective of this study was to design and implement a pilot model for diabetes care in the Munyenge and Mbonge rural communities of the South West Region of Cameroon.

The specific objectives were:

- To design and validate the content of a 14hr course on diabetes management using point of care testing.
- To educate 14 enrolled nursing students on diabetes screening and management using point-of-care testing.
- To use student nurses during their placement at the Munyenge and Mbonge areas to play a key role in engaging health center nurses and community workers in a diabetes awareness, screening and control program.

Goal: The overarching goal of this study was to create a successful model for diabetes management in rural communities which could be adopted by the Government and implemented in other regions of the country.

III. METHODOLOGY

A. Study area

The Study was conducted in the Mbonge and Munyenge rural communities. These two communities located in the South West Region of Cameroon depict the typical rapidly emerging rural communities in Cameroon.

B. Study design

The study employed both quantitative and qualitative measures. It was prospective, involving a descriptive approach as the study progressed.

C. Study Participants

The study was composed of final-year (second year) enrolled nursing students, nurses working at the health centers, community workers and participants who presented for screening. Only participants meeting the screening **eligibility criteria** (i.e. males and females above thirty (30) years of age) were involved in the study.

D. Sample size:

The study included the following category of participants 14 final-year enrolled nursing students (7 in each study site) who volunteered and successfully went through the training programme; two nurses at each study site; four community workers (two from each study site); and all eligible participants who presented up for the screening

E. Project Participants

Selection of study participants:

Students: The project was introduced to all the second year enrolled nursing student who were later asked to voluntarily sign up.

Nurses at the health center: the project was introduced to the health nurses at the health centers and community workers who were later asked to voluntarily sign up.

Followed-up clients: the followed-up clients were gotten through screening campaigns.

F. Model of the project

The study was conducted in three phases: designing and validation of the curriculum; education of students and orientation of health center nurses and community leaders; and screening and management of diabetes in the communities.

Phase one: Designing and validation of the curriculum

The project team designed a 14hrs curriculum which was subjected to validation by diabetes experts, curriculum design experts and laboratory specialists. The diabetes experts were to focus their review on the diabetes management aspect of the curriculum, the curriculum designers on the curriculum aspect and the laboratory specialist on the point of care and diagnosis aspect. Each of these parties reviewed the proposed curriculum and made suggestions for amendments. After addressing the comments from all, the corrected documents were later harmonized to one working tool.

Phase two: Education and orientation to the project: An

orientation exercise was organized at the project sites involving the nurses, Laboratory technicians and community workers. Prior to the orientation exercise, the project guide had been issued to the participants to give them time to review it. During the orientation session, doubts were clarified and suggestion on how the screening and management should be approached were reviewed and adopted. This got the participants committed to the project as they felt their contributions were important.

In school, the students went through the curriculum with interactive theory and practice sessions. Topics were

facilitated according to specialties of facilitators. Sessions were organized on Saturdays to avoid interrupting student's normal course periods. Role play was used in most cases where students acted like clients in different capacities (e.g. client on screening, high risk client on control, diabetic on control). Continuous assessment was done with an overall final assessment for selection.

Phase three: Screening and management: During their subsequent 12 week community placement in the two rural communities, the students, with the involvement of the health center nurses, and community workers organized screening campaigns for diabetes. Campaigns were organized during market days when most of the community members were around. Prior to the screening day, announcements were made in churches, local meeting groups, with a general announcement made in the evening by the "town crier".

At the end of the screening the following category of clients immersed

- Those at risk
- Those at high risk
- Newly diagnosed diabetics

NB: known/existing diabetic cases also showed up on the screening day.

All participants had their results recorded in their hospital books. Those at risk were grouped together and given general advice on how to prevent diabetes. Those at high risk and diabetic (newly diagnosed and existing) were enrolled into a control programme. The programme was held at the health centers every four weeks and involved: history taking; physical examination; glucose monitoring; education on disease, life style modification and use of POCT for self-monitoring; and nursing care of diabetes related conditions (e.g. wounds and sores). A general assessment was done at each visit to keep track of progress while each client had few minutes of personal evaluation to bring out personal difficulties (individualized care).

NB: Cases requiring specialist attention were referred to the specialized diabetic centers in the main cities.

The students spent a total of 12 weeks in the community with three visits organized. After the students left, the nurses at the health centers who were involved in the project continued with the control programme with continuous inputs from the project team.

G. Ethical considerations

The project proposal was scrutinized by experts and the St Francis institutional review board and found to be ethically sound. It was then submitted to the Regional Delegation of the Ministry of Public Health for further ethical review and approval. Additionally, clearance was obtained from the traditional chiefs of the communities and head of the health centres used for this study.

All participants of the study were provided with detailed information about the study and had time to ask questions and to clear their doubts. Informed consent forms were then presented to the volunteer participants who gave their consent with the knowledge that they could withdraw participation any time they felt so.

Full orientation and adequate explanation was given to clients regarding each procedure to be conducted so as to eliminate any social or psychological stress. The students and nurses were trained and given proper orientation to maintain good nurse-client interactions and to uphold the ethical principles of research. In order to maintain confidentiality, codes were used and client information was not disclosed to a second party without prior consent. All services rendered to the clients were free of charge.

H. Project Monitoring, Evaluation and data analysis

The project was monitored by the head of the health center (chief of post). The project team was in constant communication with the chief of post to address any problems. Evaluation was done by the project team after each phase of the project.

For **phase one**, after the curriculum was developed, it was handed to curriculum experts, laboratory scientists/technologists and diabetic experts for review and validation.

For **phase two** (Education and orientation to the project), nurse, community workers and laboratory personnel were given a feedback form after the orientation session. The feedback form requested the participants to rate their knowledge and understanding of the whole project. For students, assessment tasks involving knowledge, skills, and attitudes were conducted. To assess knowledge, multiple choice questions were used; for skills assessment, practical exercises were conducted; and behavior was assessed by observation of client-nurse encounters (students played the role of clients/patients). The students' scores from the selection test formed the bases for inclusion into or exclusion from the project.

For **phase three** (screening and management), interviews were conducted and questionnaires administered to all who participated in the study including the clients, students, nurses, and community workers. Data collected during screening and control (i.e. progress report forms for each client) was also evaluated. Interviews were transcribed word verbatim, coded and themes produced. Demographics and other quantitative variables were analyzed using Microsoft excel.

IV. RESULTS & DISCUSSION

The general characteristics of the participants are shown in table 1.

Results are discussed according to the phases in which the project was conducted. Facilitating factors, challenges encountered and sustainability measures are equally discussed.

A. Phase one: Designing and validation of the curriculum

A 14-hours curriculum was successfully developed and validated.

B. Phase two: Education and orientation to the project

The orientation process of the participants at the project sites went on smoothly with great contributions. A total of 16 students volunteered to participate in the training program with 14 successfully going through the final selection test.

C. Phase three: Screening and management of diabetes in the communities

Results in this phase are presented in two parts: results of the screening exercise and impact of the project on followed-up clients, nurses and students.

Table 1: Characteristics of participants

Category	Characteristics
Student nurses	<ul style="list-style-type: none"> Number - 14 Level - Final year of their two-year course went through diabetes management training programme successfully Age range 18 – 40.
Nurses	<ul style="list-style-type: none"> Two Nursing assistants (had one year of training) Two enrolled nurses (had two years of training) Two state registered nurses (had three years of training). Range of years of experience - 2-18 Age range - 25 – 51
Community workers	<ul style="list-style-type: none"> Had basic primary education Could read and write Age range - 45 – 57
Clients screened	<ul style="list-style-type: none"> Number - 334 Permanent residents Age range 30-81

1) Results of the screening exercise

As shown in Table 2, only 157 (48.01%) of the 334 participants screened were free from diabetes; the rest were either at risk (35.78%), at high risk (11.31%) or diabetic (4.89%). The prevalence data reported here corroborate with the study of Nicola et al., (2010), who found an unexpected high increase of diabetes in rural north of Cameroon. However, the results vary markedly from that of Mbanya *et al.*, 1999,[7], who reported a 0.8% rural diabetes prevalence. This difference could be explained by the time difference (12years) between the two studies, and indicates a rapidly rising prevalence of diabetes in rural Cameroon. The high

prevalence of risk (35.78%) and high risk (11.31%) cases equally suggest a further exacerbated diabetes situation in future if urgent preventive measures are not put in place.

Out of the 5 existing diabetic cases, none were under any kind of follow-up programme. A few had registered on a diabetes control program in urban cities but defaulted due to accessibility and financial problems. Three out of the five had glucometers sent to them by relatives but never knew how to use them. Some of them take medications when ever their relatives in cities decide to send to them. There was clearly a great need for a control programme to be set up in these communities.

Table 2: Results of the Diabetes screening exercise

Status	Frequency	Percentage
At risk for diabetes	117	35.78
At high risk for diabetes	37	11.31
Diabetics diagnosed	New cases	11
	Existing cases	5
Number not at risk/diabetic	157	48.01
Total	334	100

2) Impact of the project on followed-up clients, nurses and students

a) Impact on client's health

Within the limitation of time, the control programme had considerable impact on the health of the clients. The interview reports (table 3) for the clients, nurses and student nurses all indicated a palpable improvement in most of the client's condition as confirmed by the individual control progress reports of the clients.

Table 3: followed-up clients opinion on care received

Question	Response	Frequency (%)
Has your health improved in the course of this program?	Yes, slightly	38(71.69)
	Yes, greatly	13 (24.53)
	No	11 (20.75)

Table 4: Nurses' opinion on outcome of care students provided to clients.

Question	Response	Frequency (%)
How would you rate the success of the care students provided to the diabetic clients?	Poor	0 (0.00)
	Satisfactory	0 (0.00)
	Successful	2 (33.33)
	Very successful	3 (50.00)
	Excellent	1(16.67)

Table 5: Student nurses' opinion on outcome of care they provided to clients.

Question	Response	Frequency (%)
How would you rate the success of the care you provided to the diabetic clients?	Poor	0(0.00)
	Satisfactory	0(0.00)
	Successful	3 (21.43)
	Very successful	8 (57.14)
	Excellent	3 (21.43)

measurement		(18.7)	(24.53)	(54.77)
Urinalysis	4 (7.55)	5 (9.43)	6(11.32)	38 (71.69)
BP measurement	0 (00)	0 (00)	10 (18.7)	43 (81.13)

Fig. 2 shows an example of a 55 year old known diabetic male who had a difficult diabetic wound. In his words the patient complained when he was first met:

“This wound has been troubling me for over 8 months today. I initially went to a diabetic center in town where I was given some medication and asked to be visiting the health centers for dressing. But my condition has been moving from bad to worse every day. I have been referred to a diabetic center in town by people in the health center, but I can't go because I do not have somewhere to stay, besides it is raining season and the roads are too bad. A relative told me if they amputate the leg I will be fine, but I do not want my leg to be amputated”.

The patient's wound was managed by the students with great success.



Figure 2: Patient with Diabetic wound managed by student nurses

A good number of clients made confessions about considerable improvements in their health why showering the students with blessings and gifts on their departure day. A good number of the clients equally gained knowledge and skills on nature of the disease and self care management strategies; and use of POCT for monitoring (Table 6).

Table 6: Knowledge gained by followed-up clients in self-monitoring using POCT

POCT procedure	Unable to perform test and/or interpret result	Unable to perform test but can interpret result	Able to perform test with assistance and interpret result	Able to perform test and interpret result
Glucose	1 (1.89)	10	13	29

b) Impact of project on the nurses:

The nurses acknowledged acquiring skills from the process as shown in table 7. They confessed the programme had improved patient flow to the health center and created a lot of awareness about the disease.

Table 7: Knowledge gained by Nurses in using POCT

POCT procedure	No knowledge gained on how to perform test and/or interpret results	Gained knowledge on how to perform test but not on interpretation of results	Gained knowledge on how to perform test and how to interpret result	Already knew how to perform test and interpret results
Glucose measurement	0 (0.0)	1 (16.7)	4 (66.7)	1(16.7)
Urinalysis	0 (0.0)	0 (0.0)	6 (100)	0 (0.0)
BP measurement	0 (0.0)	0 (0.0)	3 (50)	5(83.3)

c) Impact of project on the student nurses:

Amongst the many ways students reported the project impacted them, development of leadership skills (ability to speak in public, teaching, problem solving, negotiation, collaboration, team work), increase in social accountability awareness, and self-actualization were most prominent (Table 8). Ultimately, all the students felt confident they could function as a diabetic educator and could coordinate a diabetes management programme with limited support.

D. Facilitating factors for the screening and control programme

1) Role of Known cases

The momentum for a control program was facilitated by the known diabetic cases who spoke highly of the imitative and encouraged the new cases to cooperate with the nurses. The current state of health of some known cases and confession of defaulters inspired many (especially the newly diagnosed) to adhere to the control programme. Trembling, a 40 year –old

newly diagnosed saw a known case with an amputated leg and screamed:

“So I could get my leg amputated if I do not adhere to treatment? Please doctor I will do anything to make sure I do not get my leg amputated

Table 8: Students’ views on the impact of the project on them

Interview Question	Theme	Grounding (%)	Example
In what ways has participation in this project impacted you?	Improvement of leadership skills	14 (100)	<i>“My greatest fear at the beginning of the project was how to teach nurses who already had lots of experience, but as time went on I learnt to fit myself in and collaborate with them. For example just calling them ‘sister’ or ‘auntie’ created a good atmosphere for collaboration.”</i>
	Increase in social accountability awareness	12 (85.7)	<i>“I came to realize that we were not only here to conducting a study but it was important that we provide quality care to these people who have supported and given us the opportunity to acquire knowledge.”</i>
	Self-actualization	12 (85.7)	<i>“I feel very proud of myself that even as a student, I was able to provide specialized care to patients and even teach other nurses”</i>
	Confidence to function as diabetic educator	14 (100)	<i>“the most important thing is that I have learnt a lot in the course of this project and can work in any diabetic unit without any fears”</i>

2) Use of patient centered and individualized care approach

The patient centered and individualized care approach utilized encouraged commitment to and success of the programme. Most of the clients confessed that requesting the opinion and participation of their care givers/close relatives facilitated implementation of management strategies and adherence to treatment. One care giver reported to the nursing students with great relief

“Thank you very much my sister, my mother had always insisted I reduce her salt intake due to her condition but I always rebuked her saying she was just overreacting. But now I have understood a lot of things and will make sure all the advice is implemented and that she does not miss a rendezvous”.

Appreciating individualized care, one known and previous defaulter case said:

“To tell you the truth my daughter, what is encouraging me more in this your treatment programme is that, unlike in diabetic centers in town where they only give us general group advice, you people take time to look at our individual difficulties”.

3) Use of POCT

All of the students and nurses reported the point-of-care testing devices played a key and major role in the success of the screening and control programme. Not only did the devices help in diagnosing and monitoring cases, they had a major psychological impact in the clients who often would not believe they are been treated unless they take a test. In some cases during the screening procedure, some candidates who

were not eligible for screening (ended at the prescreening stage) insisted they must have their glucose test done for them to be satisfied they were actually not sick.

4) Student commitment and community oriented approach

The commitment of the students and community oriented approach to management equally played a great role in the success of the project. The students did not only wait for the patients to show up at the health centers for the control, they from time to time visited the clients at their homes. In many cases, some clients never showed up for the control programme but when the students later on visited them in their homes, they realized they were sick and they had to do their own control at their home. The home visits equally gave the students an opportunity to appreciate their client’s problems and to better plan their care. The clients on the other hand demonstrated more commitment when they saw the interest the students had in their well-being. One 58 year old man who came once for the control visit but never showed up for the last two said

“My children, I was never going to come for another visit, but your interest in my health has boosted my willingness to be committed to this programme”

E. Challenges

1) Resistance from lab technicians:

Commonly, POCT devices are major diagnostic tools in health center laboratories in Cameroon. The technicians frowned at the fact that tests for which they usually ask patients to pay a fee were being conducted free of charge; and saw the aspect of students (nurses) conducting tests as a challenge. They felt the students (nurses) have no role in performing tests. However, the students constantly went to them for solutions and as they tried to provide solutions to these problems, they gradually became committed to the project with significant contributions. Though this model did not initially consider the lab technicians, the students recognized the need for lab technicians to provide technical inputs with the use of the POCT devices.

2) Compliance problem:

Some clients did not keep to the appointments. They preferred to go to their farms or to the market. Others said they could handle their problem traditionally (using herbal therapies). The students had to visit this category of clients in their houses and hold one-on-one conversations with them. This gave the students time to better educate them with most of them finally complying.

3) Medication dependence

Most of the clients insisted they wanted medications even though their conditions did not warrant any medications. The problem became so serious that the students had to provide a placebo (sterile water). Notwithstanding there were some cases who required diabetic medications that were not available as the health center does not provide such medications. The students had to request for these medications from the referral diabetic centers in the city.

4) Lack of a self-care diabetic education guide for patients

The student nurses had a hard time educating the clients without a patient self-care guide. Most of the patients complained they forgot the instructions they were given by the time they got home. To manage this, the students encouraged them to bring their caregivers to the visits so they could have someone who can remind them of some of the issues discussed. They also designed a simple guide which they handed to the clients.

Initially we thought of the use of a diabetic guide; but those that were available were too general and not contextualized to include our local realities. Within the constraints of time and resources, we were unable to produce a local guide. Based on this experience, it is highly recommended that a local diabetic guide be produced to strengthen this model.

F. Sustainability Strategy

As with all innovative models, sustainability of the current model is of paramount importance. The major challenges

observed in the current pilot provide opportunities for identification of areas that need to be strengthened. Strategies going forward include:

1. Production of a contextualized (low literacy) diabetes self-care guide to reinforce patient education and promote self-care. The guide will make generous use of local images and simple language tailored to literacy levels in targeted communities.
2. Continuous supply of POCT equipment. It has been shown that patients take their care seriously when they take some financial commitment. Considering the low socioeconomic level of those living in rural areas, a proposed fee of \$1 for each control visit will help maintain POCT supplies.
3. Promoting integration of present model in school curricular. This will also entail selling the idea to other schools for health personnel. Each year students may be introduced to organize screening campaigns to identify new cases, in addition to implementing innovative solutions to the challenges faced by the nurses in the course of the year.
4. Concrete collaboration with the health ministry to encourage the inclusion of diabetes management in the minimum package of activities of rural health centres. This will also include an effective referral system build to link these rural health centres to diabetic clinics in big cities and potential addition of diabetic medications on the list of essential drugs.

V. CONCLUSION

Just like in many countries, rural areas previously reported to be less affected by diabetes are currently experiencing a rise, with the situation aggravated by lack of control measures. With the use of point-of-care testing devices nurses can organize screening and management programs to redress the situation. Such a measure can be initiated by trained-student nurses during their community placement. The student nurses work with the nurses to screen and manage patients with all benefiting in the process. The process can be sustained by the nurses after the students leave.

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Profile: Maboh Michel Nkwati



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Leke holds a BSc in medical laboratory science, a masters in chemical pathology and is a graduate of the FAIMER Fellowship in PA-USA. With a passion for health professions education and research Mr. Leke has blended his years of teaching of nurses and other health care professionals with innovations in health education research that relate to direct improvement in health. Currently he holds the post of Assistant Director at the St Francis School of Health sciences-Buea Cameroon and is a 2nd year PhD Candidate at the University of Ulster-UK.

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