

Peer Teaching for Positive Change: Evaluating the Effectiveness of Glucose Monitor Training for Nigerian Pharmacy Students

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ABSTRACT

With the trend of global diabetes projected to increase by 2 to 3-fold in future decades, the need to improve diabetes care is more crucial now than ever. The use of a glucose monitor to assess patient's blood glucose values has been shown to significantly improve the clinical outcomes and is less costly than laboratory monitoring. Currently there are no studies assessing the knowledge of glucose monitor use among pharmacy students in Nigeria. To assess the knowledge, technique, and confidence of glucose monitor use among pharmacy students in Nigeria, before and after a glucose monitor training workshop led by a team of fourth year pharmacy students from the United States. A 16-question pre-and post-survey was used to assess pharmacy students' at Nnamdi Azikiwe University Pharmacy School (NAU) knowledge and perceived comfort level following a glucose monitor training workshop delivered by pharmacy students from a United States pharmacy school. The program contained both didactic and practice active learning techniques. Of the 153 students who participated in the study, 135 (88%) completed both the pre- and post-test surveys. The training significantly improved students' confidence, increasing those who felt "very comfortable" performing a fingerstick test from 18% to 74% and those comfortable teaching glucometers use from 29% to 83%. This interactive glucose monitor training workshop positively impacted NAU pharmacy students' knowledge and confidence in performing glucose monitoring and teaching patients.



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1. INTRODUCTION

In recent decades, global diabetes prevalence has reached epidemic proportions with approximately 589

million adults currently living with diabetes [1- 3]. Uncontrolled diabetes, one of the leading causes of chronic kidney failure, amputations, cardiovascular disease, and blindness, causes a high economic burden. These preventable complications significantly contribute to diabetes treatment costs, which average hundreds of billions of dollars annually based on global reports. [1] The World Health Organization estimates the prevalence of diabetes in Nigeria to be 4.3% representing approximately 9.7 million people, which has more than doubled since 2000. [4], [5] A recent systematic review and meta-analysis analyzed 60 studies and found the pooled prevalence of type 2 diabetes in Nigeria was higher at 7%, with highest in the South-south zone. [6] This increase can be attributed to a number of social and economic factors. With the increased adaptation of western lifestyles resulting in higher rates of obesity with less physical activity, the number of patients diagnosed with diabetes will continue to escalate at alarming rates.

Frequent monitoring of blood glucose can contribute to significant clinical improvement and reduction in the long-term complications of diabetes. Ezenwaka and colleagues found that self-monitoring of blood glucose (SMBG) can significantly decrease the 10-year cardiovascular heart disease risk of women with diabetes in Trinidad and Tobago. [7] The benefits of SMBG over laboratory monitoring include immediate feedback for patients following eating (food composition or quantity) or exercise impact on blood glucose, low-cost production, portability, and easy use, making it ideal for use in developing countries.

Complex diseases such as diabetes require education and guidance for patients on proper management which starts with knowledge. Pharmacists are well positioned and trained to provide this role. Pharmacist patient care has expanded to include a more interactive approach to patient care from comprehensive medication management to provision of screenings for common chronic diseases to vaccination administration, just to name a few. Pharmacists are the most accessible health care provider to patients, making them prime candidates to educate patients in disease prevention as well as management. Training student pharmacist trainees in Nigeria about diabetes and how to monitor glucose may be a positive step in helping manage the diabetes epidemic.

Currently, no studies assess the knowledge of glucose monitor training among student pharmacists in Nigeria. Understanding the high prevalence, cost and concern of diabetes in Nigeria, we built upon our previous work of providing a pre-recorded e-learning workshop on diabetes self-care education program for student pharmacists in Nigeria. [8] In this study two fourth-year student pharmacists from University of California (UC) San Diego Skaggs School of Pharmacy and Pharmaceutical Sciences (SSPPS) taught an in-person glucose monitor training workshop to student pharmacists in class levels two through five (U200 – U500) at Nnamdi Azikiwe University (NAU). The objective of this pilot study was to evaluate the knowledge and technique of glucose monitor use among student pharmacists attending NAU, before and after a peer-to-peer glucose monitor training workshop led by two fourth-year student pharmacists from the US during their international advanced experiential education opportunity.

2. METHODS

Student pharmacists attending NAU from different grade levels (NAU200–NAU500) were invited to participate in the study on a voluntary basis. All student pharmacists were identified by NAU faculty and asked to volunteer. Informed consent was obtained from all participants. This study was reviewed and approved by the UC San Diego Human Research Protections Program. Afterwards, participants were provided a 15-question glucose monitor training pre-survey prior to the training workshop to collect participants' demographics and baseline knowledge of glucose monitor use and confidence of SMBG. [Appendix A] Following pre-survey collection, a workshop ensued comprising an educational presentation based of the Diabetes Self-Care Education Program (DSEP) offered to first year pharmacy students at UC San Diego

Skaggs School of Pharmacy and Pharmaceutical Sciences (SSPPS). [9], [10] The glucose monitor workshop was designed to give student pharmacists hands-on experience with SMBG. Overseen by NAU Pharmacy faculty, the workshop featured peer-to-peer training led by two fourth year student pharmacists from SSPPS. The program began with a 30-minute presentation covering diabetes (i.e. epidemic, differences between Type 1 and Type 2 diabetes, risk factors, long term complications, signs and symptoms, diagnostic criteria, treatment and management) and the principles of SMBG, followed by a 30-minute interactive, hands-on training session. After the presentation, NAU student pharmacists were divided into small groups of 5 to 7 and used donated WaveSense Presto glucose monitor kits (manufactured by AgaMatrix Inc.). Each kit included one glucose monitor, 10 test strips, a lancet device, 10 lancets, alcohol swabs, and Band-Aids. Each student pharmacist reviewed a one-page instruction guide, set up their monitor, and performed at least one SMBG reading. SSPPS student pharmacists, drawing on their own DSEP training, evaluated device usage and offered individualized guidance to ensure proper technique. The workshop not only allowed NAU students to gain familiarity with glucose monitor selection and operation but also prepared them to teach peers and patients. Moreover, it offered them an opportunity to develop empathy for patients who manage diabetes daily. Following the workshop, NAU student pharmacists completed a modified post-survey that included the original knowledge and confidence questions, plus an additional question assessing their likelihood of recommending a glucose monitor to patients with diabetes.

2.1 Statistical Analysis

A paired t-test was conducted to analyze the mean change in correct scores between the pre- and post-training questionnaires. Correct responses were assigned a score of 1, while incorrect responses received a score of 0. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

A total of 153 students participated in the study with 144 completing the pre-test survey and 135 completing the post-test survey. The sample size constituted 58.1% males and 41.8% females with majority of participants from the class of U200 level (58.8%) (Table 1).

Table 1: NAU Pharmacy Students Baseline Demographics

Demographics	No.	Percent (%)
Male	89	58.1
Female	64	41.8
Age		
19-29	146	95.4
30-39	6	3.9
40-49	1	0.6
NAU School Class Level		
U200	90	58.8
U300	43	34.6
U400	12	7.8
U500	8	5.2

Of the 153 students who participated in the study, 135 (88%) completed both the pre- and post-surveys. The training significantly improved students' confidence, increasing those who felt "very comfortable" performing a fingerstick test from 18% to 74% and those "very comfortable" teaching glucometers use from 29% to 83% (Figures 1 and 2).

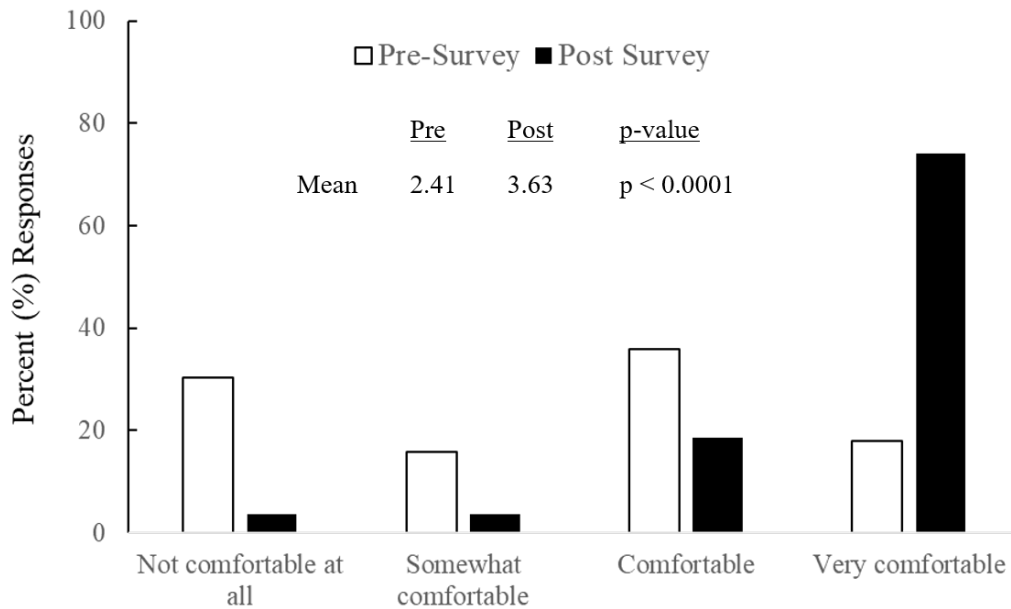


Figure 1. NAU student pharmacist reported comfort with performing a fingerstick comparison from pre- to post-training (N=135).

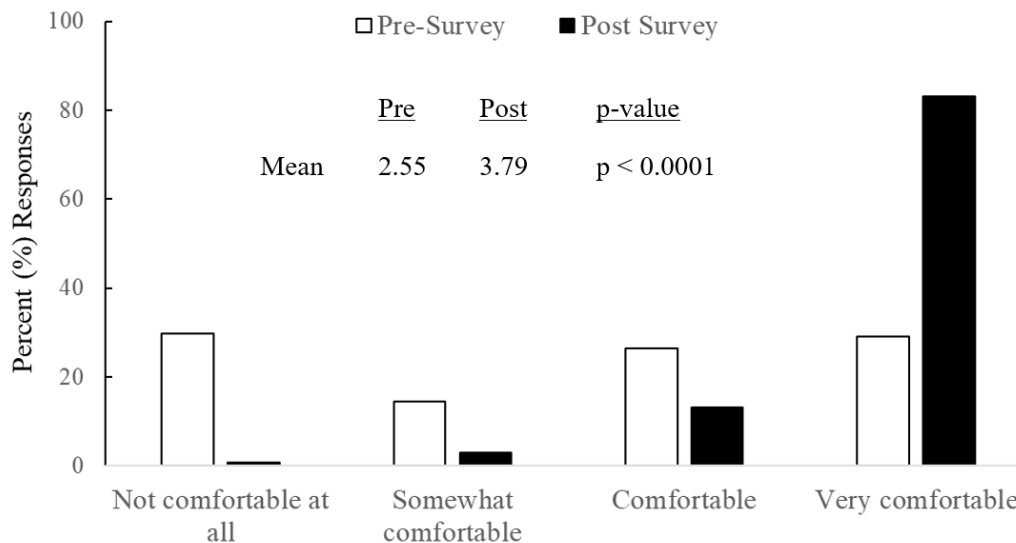


Figure 2: NAU student pharmacist reported comfort level of teaching someone how to use a glucose monitor comparison from pre- to post-training

Table 2. Overall knowledge and technique correct percentage scores: pre- compared to post-training

Questions	Pre (%) (N=135)	Post (%) (N=135)	p-value
Where on the test strip should you place the drop of blood?	53.6	99.3	p < 0.001
Aside from the fingertip, what other area of the body can you use to test blood glucose using a glucose monitor?	42.5	87.4	p < 0.001
What is considered fasting blood glucose?	37.3	94.1	p < 0.001
How long should test strips be kept after opening the test strip vial?	9.8	85.2	p < 0.001

Severe dehydration can affect your glucose reading?	93.4	94.0	p = 0.835
Where can you store your test strips?	62.1	96.3	p < 0.001
What is the fasting glucose goal for an adult with diabetes?	52.3	67.9	p < 0.01
It is okay to use any test strips for any glucose monitor?	80.4	91.8	p < 0.01
When should you perform a quality control test on your glucose monitor?	26.1	65.7	p < 0.001
Overall average percentage scores	50.83	86.86	p < 0.01

4. DISCUSSION

This pilot study evaluated the knowledge and technique of glucose monitor use among student pharmacists in years U200 to U500 attending NAU, before and after an in-person peer-to-peer glucose monitor training workshop taught by two US fourth-year student pharmacists from UC San Diego SSPPS. More than three-quarters of participants (84.3%) reported never being trained on the use of a glucose monitor prior to participating in workshop.

The training significantly improved students' perceived confidence in feeling "very comfortable" performing a fingerstick test, increasing fourfold from baseline. Similar improvement was observed in reported comfort with teaching patients how to use glucose monitors, which tripled from baseline following the training. With the increasing prevalence of diabetes in Nigeria, this training program is a first step in increasing the number of pharmacists equipped to educate patients on how to perform SMBG to aid in achieving glycemic control. The overall knowledge and technique of glucose monitor use among NAU pharmacy students improved significantly after the interactive training session. The one area that did not reach significance was students' understanding of severe dehydration's impact on glucose changes. Although there was a lack of training on glucose monitor use in the NAU curriculum prior to this pilot program, the perceived value of SMBG in patients with diabetes remained high before and after the glucose monitor training session (94% and 99.7%, respectively), indicating that students already recognized the importance of SMBG and that the training primarily reinforced rather than changed their perception of its value.

The P4 SSPPS student pharmacist experience in Nigeria demonstrates a need for additional education in diabetes care in this country. The successful outcome of this study was not due only to the study design but also to the eagerness and openness of NAU student pharmacists to learn new methods in diabetes care. SMBG is a low cost, high impact skill that can greatly benefit low resource regions such as Nigeria. Due to time restraints the study was limited to one site. Future studies could incorporate other university in nearby states and yearly consecutive follow up to assess knowledge retention. Additionally, as Nigeria is ethnically diverse, enlarging the size by including different regions would also allow for comparison knowledge between different groups. Overall, the study was a success in increasing the short-term knowledge NAU student in performing and educating on SMBG.

This pilot study had several limitations. While the sample size was sufficient, the majority of participants were from the Level 200 class. NAU has 5 class levels (100-500). Students who graduate from level 500 receive a Bachelor of Pharmacy degree. Given that participants were mainly from a lower grade level and have not had in depth training in therapeutic courses, these results cannot be generalized to all NAU pharmacy students. In addition, the US student pharmacists incurred costs of travel and program supplies. For future, NAU students in the upper classes who received training may consider training the lower classes for a more realistic peer-to-peer training.

5. CONCLUSION

Results of the pilot study indicate that an interactive glucose monitor training session significantly improves student pharmacists' knowledge of self-monitoring blood glucose and the proper technique for using a glucose

monitor at NAU. Furthermore, participation in the training session increased their confidence in performing a fingerstick test to monitor blood glucose levels and in teaching patients how to use a glucose monitor.

As the pharmacy profession continues to expand and pharmacists play a greater role in patient care, it is essential to train student pharmacists on current monitoring devices so they can properly educate their patients. In countries where the clinical pharmacy profession has evolved more slowly, it is even more important to demonstrate the full potential of the profession to students. Training sessions such as these are beneficial not only for improving understanding but also for building confidence in practical performance.

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8. FIGURE LEGENDS

Figure 1: Significant increase in students' comfort with performing a fingerstick after the intervention, as measured on a 4-point Likert scale ranging from 1 ("Not comfortable at all") to 4 ("Very comfortable") ($p < 0.00001$).

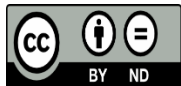
Figure 2: Significant increase in students' comfort with teaching someone how to use a glucose monitor after the intervention, as measured on a 4-point Likert scale ranging from 1 ("Not comfortable at all") to 4 ("Very comfortable") ($p < 0.0001$).

10. APPENDIX

Appendix A: Glucose Monitor Training Pre-Questionnaire

1. Are you female or male?	a. Male b. Female
2. What is your age?	a. 18-29 b. 30-39 c. 40-49 d. 50 or older
3. Please indicate your grade level at NAU:	a. 200 b. 300 c. 400 d. 500
4. Have you ever been trained on how to use a glucose meter before?	a. Yes b. No c. I am not sure
5. How comfortable are you in teaching someone how to use a glucometer?	a. Not comfortable at all b. Somewhat comfortable c. Comfortable d. Very comfortable
6. How comfortable are you in performing a fingerstick test to measure blood glucose on a patient?	a. Not comfortable at all b. Somewhat comfortable c. Comfortable d. Very comfortable
7. How important is for diabetic patients to self-monitor their blood glucose?	a. Not important b. Somewhat important c. Important d. Very important
8. Where on the test strip should you place the drop of blood?	a. It does not matter. They will all give the same results b. Directly on top of the test strip c. At the tip of the test strip d. You should not get blood on the test strip
9. Aside from the fingertip what other area of the body can you use to test blood glucose using a glucometer?	a. Forearm b. Abdomen c. Thigh d. Foot
10. What is considered fasting blood glucose?	a. 2 hours since your last meal

	<ul style="list-style-type: none"> b. 5 hours since your last meal c. 8 hours since your last meal d. Anytime before a meal
11. How long should test strips be kept after opening the test strip vial?	<ul style="list-style-type: none"> a. They can be used as long as they are clean b. Until the expiration date labeled on the vial c. 120 days after opening the vial d. 60 days after opening the vial
12. Severe dehydration can affect the your glucose reading	<ul style="list-style-type: none"> a. True b. False
13. Where can you store your test strips?	<ul style="list-style-type: none"> a. In a hot environment b. Refrigerator c. Room temperature d. Anywhere
14. What is the fasting glucose goal for a diabetic adult?	<ul style="list-style-type: none"> a. <70mg/dL (<3.5mmols/L) b. 70-130mg/dL (3.5-7.2mmols/L) c. 130-150mg/dL (7.2-8.3mmols/L) d. <200mg/dL (<11.1mmols/L)
15. It is okay to use any test strips for any glucometer	<ul style="list-style-type: none"> a. True b. False



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