



PHARMACY STUDENTS' INVOLVEMENT IN PUBLIC HEALTH INTERVENTIONS: A CROSS-SECTIONAL STUDY IN THREE NIGERIAN TERTIARY UNIVERSITIES

KOSISOCHI CHINWENDU AMORHA^{1,*}, CHIAMAKA MARYANN ASOGWA¹, NKIRUKA CHIAMAKA IBEKWE^{1,2}

1. Department of Clinical Pharmacy and Pharmacy Management, Faculty of Pharmaceutical Sciences, University of Nigeria Nsukka, PMB 410001, Enugu State, Nigeria.
 2. Chamzo Pharmacy, 116, Hob & Hog Plaza, Moshalashi Bus Stop, Shasha Road, Shasha, Lagos.
-

ABSTRACT

Pharmacists should engage in preventive care services that promote public health and prevent disease. Pharmacy education is recognizing the potential for pharmacists in public health. This study assessed Nigerian pharmacy students' involvement with public health interventions. The cross-sectional survey was conducted in the University of Nigeria Nsukka (UNN), University of Jos (UNIJOS) and University of UYO (UNIUYO). Data were collected with a 47-item structured, self-administered questionnaire and analyzed using the IBM SPSS Version 25.0, with statistical significance set as $P < 0.05$. Most of the respondents were between 21 to 26 years old ($n = 299, 82.4\%$) and claimed to have received sufficient training in pharmacy school to efficiently participate in public health activities ($n = 269, 74.1\%$). After categorization, about a quarter of the respondents had *good knowledge* of public health ($n = 97; 26.7\%$) while less than half of them were sufficiently involved with public health activities ($n = 151, 41.6\%$) or willing to get involved ($n = 97; 26.7\%$). More respondents from UNN were more willing to participate in public health activities compared to respondents from UNIJOS and UNIUYO (41.9% vs. 29.9% vs. 21.5% ; $\chi^2 = 2.483$; $P = 0.002$). Respondents who were members of any health-related association/club on campus were more willing to participate in public health activities compared to those who were not (42.0% vs. 28.4% ; $\chi^2 = 7.367$; $P = 0.007$). Level of pharmacy students' involvement with public health activities could be influenced by the university, membership of health-related associations/clubs on campus, participation in clinical outreaches, public health courses. The university can serve as a springboard for pharmacists' active involvement in public health.

KEYWORDS: Interventions; Pharmacy students; Public health; Nigeria.

INTRODUCTION

Pharmacists' roles are expanding from product-oriented to more holistic, patient-centered services [1]. The emerging responsibility for pharmacists includes the provision of public health services [2]. Interdisciplinary collaborations of local, state, and/or federal public health departments with schools of pharmacy expose pharmacy students to

opportunities to use their training and skills to affect public health [3].

To adequately prepare young pharmacists to fit into the evolving transition of care and achieve optimal patient outcomes, pharmacy education needs to keep developing [4]. Training programmes should cover courses not only related to pharmacotherapy, but also to epidemiology, health promotion, community outreach, health education in areas such as tobacco control, emergency preparedness,

*Corresponding author: kosisochi.amorha@unn.edu.ng; +2348038539349
ajopred.com

chronic disease, drug abuse, immunizations, medication therapy management, and effective communication with patients [3,5]. The scope of pharmacists as public health professionals can be enhanced through targeted education and training. Pharmacists should further integrate with interdisciplinary public health teams [6].

Pharmacy students, the future of the pharmacy profession, can be involved in the provision of health promotion counselling services [7]. This study aimed to assess Nigerian pharmacy students' involvement with public health interventions.

METHODS

Study design/setting

This cross-sectional study was conducted between January 2021 to March 2021, among final year pharmacy students in three Nigerian Universities: University of Nigeria Nsukka (UNN), University of Uyo (UNIUYO) and University of Jos (UNIJOS). The number of final year students in UNN, UNIUYO and UNIJOS were 336, 110 and 84, respectively.

Ethical approval

The study protocol was approved by the Health Research and Ethics Committee (HREC) of University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla on 4th December, 2020 (NHREC/05/01/2008B-FWA00002458-1RB00002323). Participation was voluntary, as participants were informed that they could withdraw from the study even after providing consent.

Eligibility criteria

All final year students of the three aforementioned pharmacy schools who were willing to participate in the study were included. The exclusion criteria comprised those who were not undergraduate pharmacy students as well as pharmacy students who were not in final year in UNN, UNIUYO or UNIJOS.

Sample size and selection

The recommended minimum sample size using the Raosoft® sample size calculator, at 5% margin of error, 95% confidence interval and assuming 50% response distribution was 223. Convenience sampling was employed.

Data collection

Data were collected by administering questionnaires to the participants. Both oral and written consent were obtained from the participants. The study

instrument was a 47-item structured, self-administered questionnaire with four domains.

Clinical Pharmacists of the Department of Clinical Pharmacy and Pharmacy Management, University of Nigeria Nsukka (UNN) scrutinized the items of the questionnaire, making suggestions for its improvement. A pilot study was conducted with ten pharmacy students who were excluded from the main study. It provided information about the average time to fill the questionnaire as well as eliminated irrelevances and ambiguities. Confidentiality was maintained throughout the study. The first domain comprised the demographic details of the pharmacy students. The second domain tested the pharmacy students' knowledge of public health. The third domain identified pharmacy students' involvement in public health interventions while the fourth domain focused on the barriers that limit pharmacy students' involvements in public health activities.

The *total knowledge score* was obtained by the summation of the scores from the participants' responses to the 10 items in the second domain. The maximum possible score was '10'. Thus, a higher score indicated better knowledge of public health. The median score was '6'. A score above '6' was considered good knowledge score while scores that were 'less than or equal to 6' were poor knowledge scores.

The *total involvement score* was obtained by the summation of the scores for the individual items in the third domain, with a maximum possible score of '20'. Thus, a higher score indicated better involvement in public health activities. A score above '10' was considered *good involvement score* while scores that were 'less than or equal to 10' were *poor involvement scores*.

Willingness to participate in public health activities was coded as '1'. No willingness was coded as '0'. The *total willingness score* was obtained by the summation of the scores for the different items in the fourth domain. The maximum possible score was '9'. Thus, a higher score indicated better willingness to participate in public health activities. The median score was '5'. A score above '5' was considered *good willingness score* while scores that were 'less than or equal to 5' were *poor willingness scores*.

Data analysis

Data were analyzed using the IBM SPSS Version 25.0. Descriptive statistics were used to summarize data. Pearson's Chi-Square test was used to test the association between variables, with statistical significance set as $P < 0.05$.

RESULTS

Three hundred and sixty-three (363) questionnaires were completed and returned from the three universities. This represented an overall participation rate of 68.5 % (363/530).

For the individual schools, the participation rate was 60.4% (203/336) for UNN; 79.8% (67/84) for UNIJOS; 84.5% (93/110) for UNIUYO. Most of the respondents were between 21 to 26 years old (n = 299, 82.4%), single (n = 336, 92.6%) and claimed to have received sufficient training in pharmacy school to efficiently participate in public health activities (n = 269, 74.1%), Table 1.

More than half of the respondents (n = 347, 95.6%) claimed to know that public health is concerned with the health of the entire populations. However, only two-fifths (n = 148, 40.8%) of them knew that the public health approach does not focus on individuals. Less than half of the respondents (n = 24, 6.6%) knew that the micro level of public health pharmacy does not involve planning/policy making. After categorization, about a quarter of the respondents had *good knowledge* of public health (n = 97; 26.7%), Table 2.

Majority of the respondents (n = 214, 85.3%) claimed to be involved in screening for hypertension. About four-fifths of them claimed to provide advice about healthy eating (n = 203, 80.9%) and check body mass index (n = 201, 80.1%) during clinical outreaches. Less than a fifth of the respondents claimed to be involved in screening for dyslipidaemia (n = 36, 14.3%). After categorization, less than half of the respondents had good involvement with public health services (n = 151, 41.6%), Table 3.

More than half of the respondents (n = 231, 63.6%) agreed that financial constraints could hinder public health interventions. Less than half of the respondents (n = 154, 42.5%) agreed that some clients do not trust the recommendations of pharmacy students because they are not yet pharmacists. After categorization, less than half of the respondents fell within the *good willingness* category (n = 97; 26.7%), Table 4.

A larger proportion of UNN students had good knowledge of public health (n = 72; 35.5%) compared to students in UNIJOS (n = 19; 28.4%) and UNIUYO (n = 6; 6.5%) ($\chi^2 = 27.537$; $P < 0.001$). A larger proportion of respondents who were members of health-related associations or clubs on campus (n = 95; 58.6%) were more involved in public health activities compared to those who were not in any (n = 56; 27.9%) ($\chi^2 = 34.985$; $P < 0.001$). A larger proportion of respondents who had participated in clinical outreaches (n = 151; 59.7%) were more involved in public health activities compared to those

who had not (n = 0; 0.0%) ($\chi^2 = 112.414$; $P < 0.001$). A larger proportion of respondents who had taken any public health course (n = 103; 50.5%) were more involved in public health activities compared to those who had not (n = 48; 30.2%) ($\chi^2 = 15.159$; $P < 0.001$), Table 5.

A larger proportion of respondents from UNN were more willing to participate in public health activities (n = 85; 41.9%) compared to students of UNIJOS (n = 20; 29.9%) and UNIUYO (n = 20; 21.5%), ($\chi^2 = 12.483$; $P = 0.002$). A larger proportion of respondents who were members of any health-related association/club on campus (n = 68, 42.0%) were more willing to participate in public health activities compared to those who were not in any (n = 57; 28.4%) ($\chi^2 = 7.367$; $P = 0.007$). A larger proportion of the respondents who claimed to have received sufficient training in pharmacy school to participate in public health activities, (n = 105, 39.0%) were more willing to participate in public health activities compared to those who reported that they had not received sufficient training (n = 20; 21.3%) ($\chi^2 = 9.728$; $P = 0.002$), Table 5.

DISCUSSION

Majority of the students reported that they had received sufficient training in pharmacy school to efficiently participate in public health activities. About two-thirds of them indicated that they had participated in clinical outreach programmes. Only about a quarter of the respondents had *good knowledge* of public health while less than half of them had *good involvement* with public health services. This is similar to a study conducted among pharmacists in Enugu metropolis where about one-third of the participants had satisfactory knowledge of public health. This poor knowledge could result in a low level of engagement in public health activities [8].

A larger proportion of UNN students had *good knowledge* of public health and were more willing to participate in public health activities compared to their UNIJOS and UNIUYO counterparts. This could be dependent on how public health is taught in the schools or the level of promotion of public health-related activities by lecturers. The inclusion of public health concepts in the pharmacy curriculum may help to stimulate the students' eagerness to participate in public health activities [9]. Students should be engaged in public health inside and outside of the classroom through experiential learning. Clinical clerkship provides an ample opportunity for pharmacy students to develop health promotion counselling skills [7]. The services of

Table 1: Demographic details, N = 363

Variables	n (%)
Age (in years)	
18 - 20	14 (3.9)
21 - 23	131 (36.1)
24 - 26	168 (46.3)
27 - 29	42 (11.6)
>29	8 (2.2)
Gender	
Male	174 (47.9)
Female	189 (52.1)
University	
UNN	203 (55.9)
UNIJOS	67 (18.5)
UNIUYO	93 (25.6)
Marital status	
Single	336 (92.6)
Married	27 (7.4)
Involvement with public health activities	
Member of any health-related association/club on campus (Yes)	162 (44.6)
Participated in a clinical outreach (Yes)	253 (69.7)
Taken a course on public health (Yes)	204 (56.2)
Received sufficient training in pharmacy school to efficiently participate in public health activities (Yes)	269 (74.1)

UNN = University of Nigeria Nsukka; UNIJOS = University of Jos; UNIUYO = University of Uyo

Table 2: Knowledge of public health, N = 363

Variables (correct option)	n (%)
1. † Public health is a science not an art (No)	72 (19.8)
2. Public health is concerned with the health of the entire populations (Yes)	347 (95.6)
3. †The micro level of public health pharmacy involves planning/policy making (No)	24 (6.6)
4. † The public health approach focuses on individual (No)	148 (40.8)
5. All sectors of society are responsible for the public health (Yes)	246 (67.8)
6. An epidemic is a disease occurrence among a population that is in excess of what is expected for a given time and place (Yes)	301 (82.9)
7. Health is a fundamental human right protected by law (Yes)	302 (83.2)
8. † The biomedical model of health views health as the product of social, economic and environmental determinants (No)	24 (6.6)
9. † Public health decisions should not be evidence-based (No)	228 (62.8)
10. Public health campaigns are designed to raise public consciousness about important health issues (Yes)	337 (92.8)

'Yes' was coded as 1; 'No' was coded as 0.

† The code for the correct option was reversed such that 'Yes' (incorrect option) was coded as 0; 'No' (correct option) was coded as 1.

The *total knowledge score* was the sum of the correct options for the items testing knowledge of public health with a maximum score of '10'. Thus, a higher score indicated better knowledge of public health.

Knowledge was classified as *good* or *poor* such that *good knowledge* of public health referred to those with total knowledge scores above the median score of '6'. Scores ≤ 6 were *poor knowledge scores*.

About a quarter of the respondents had *good knowledge* of public health (n = 97; 26.7%)

Table 3: Levels of involvement in public health interventions, N = 251

Variables	n (%)
1. Screening for hypertension	214 (85.3)
2. Screening for diabetes	181 (72.1)
3. Screening for dyslipidaemia	36 (14.3)
4. Screening for depression	49 (19.5)
5. Screening for malaria	188 (74.9)
6. Counselling on smoking cessation	126 (50.2)
7. Counselling on alcohol consumption	150 (59.8)
8. Body mass index measurement	201 (80.1)
9. Advice on healthy eating	203 (80.9)
10. Counselling on family planning	83 (33.1)
11. Advise against drug abuse	169 (67.3)
12. Testing for HIV	81 (32.3)
13. Advice on regular aerobic exercise	150 (59.8)
14. Advice on immunization	109 (43.4)
15. Advice on hygiene	197 (78.5)
16. Education on sexually transmitted diseases	147 (58.6)
17. Education on cancer	78 (31.1)
18. Education on asthma	119 (47.4)
19. Education about herbal medicines	121 (48.2)
20. Education about oral health	119 (47.4)

A total of 112 respondents had not participated in any clinical outreach and were excluded from this analysis.

Involvement in public health intervention was coded as '1'; No involvement was coded as '0'.

The *total involvement score* was the sum of the scores for the individual items with a maximum possible score of '20'.

Good involvement was classified as those that provided at least '10' of these public health services during any medical outreach;

Poor involvement was for less than '10' of these services.

Less than half of the respondents had good involvement with public health services (n = 151; 41.6%)

Table 4: Barriers that limit involvement in public health activities, N = 363

Variables	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)
1. I do not have sufficient training for public health activities	54 (14.9)	108 (29.8)	79 (21.8)	96 (26.4)	26 (7.2)
2. I am not interested in participating in public health activities	137 (37.7)	122 (33.6)	54 (14.9)	37 (10.2)	13 (3.6)
3. There is no time for me to participate in public health activities	64 (17.6)	98 (27.0)	86 (23.7)	88 (24.2)	27 (7.4)
4. Being a member of an association/club on campus decreases the chances of participating in public health activities	122 (33.6)	120 (33.1)	83 (22.9)	29 (8.0)	9 (2.5)
5. Financial constraints could hinder public health interventions	36 (9.9)	43 (11.8)	53 (14.6)	163 (44.9)	68 (18.7)
6. I am not confident to render public health services	110 (30.3)	135 (37.2)	60 (16.5)	45 (12.4)	13 (3.6)
7. Some clients do not trust the recommendations of pharmacy students because they are not yet pharmacists	45 (12.4)	76 (20.9)	88 (24.2)	116 (32.0)	38 (10.5)
8. We do not receive sufficient support from lecturers	47 (12.9)	82 (22.6)	112 (30.9)	82 (22.6)	40 (11.0)
9. Pharmacy students cannot deliver successful public health interventions without the participation of students from other health-related disciplines	109 (30.0)	114 (31.4)	79 (21.8)	45 (12.4)	16 (4.4)

SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

Willingness to participate in public health activities was coded as 1; No Willingness was coded as 0

The total willingness score had a maximum score of 9.

Good willingness was classified as those with score > 5; *Poor willingness* was for those with score ≤ 5.

Less than half of those involved with public health activities fell within the *good willingness* category (n = 125; 34.4%).

Table 5: Association between the demographic variables and the knowledge of public health, levels of involvement in public health and willingness to participate in public health

Variables	Knowledge		χ^2	P	Involvement		χ^2	P	Willingness		χ^2	P
	Good	Poor			Good	Poor			Good	Poor		
Age (in years)			9.424	0.051			2.233	0.693			3.581	0.466
18 - 20	4 (28.6)	10 (71.4)			5 (35.7)	9 (64.3)			5 (35.7)	9 (64.3)		
21 - 23	33 (25.2)	98 (74.8)			57 (43.5)	74 (56.5)			43 (32.8)	88 (67.2)		
24 - 26	38 (22.6)	130 (77.4)			66 (69.9)	102 (60.7)			54 (32.1)	114 (67.9)		
27 - 29	18 (42.9)	24 (57.1)			18 (42.9)	24 (57.1)			19 (45.2)	23 (54.8)		
>29	4 (50.0)	4 (50.0)			5 (62.5)	3 (37.5)			4 (50.0)	4 (50.0)		
Gender			0.014	0.905			1.435	0.231			0.041	0.839
Male	47 (27.0)	127 (73.0)			78 (44.8)	96 (55.2)			59 (33.9)	115 (66.1)		
Female	50 (26.5)	139 (73.5)			73 (38.6)	116 (61.4)			66 (34.9)	123 (65.1)		
University			27.537	<0.001**			2.222	0.329			12.483	0.002*
UNN	72 (35.5)	131 (64.5)			79 (38.9)	124 (61.1)			85 (41.9)	118 (58.1)		
UNI JOS	19 (28.4)	48 (71.6)			33 (49.3)	34 (50.7)			20 (29.9)	47 (70.1)		
UNIUYO	6 (6.5)	87 (93.5)			39 (41.9)	54 (58.1)			20 (21.5)	73 (78.5)		
Marital status			0.651	0.420			0.250	0.617			5.763	0.016
Single	88 (26.2)	248 (73.8)			141 (42.0)	195 (58.0)			110 (32.7)	226 (67.3)		
Married	9 (33.3)	18 (66.7)			10 (37.0)	17 (63.0)			15 (55.6)	12 (44.4)		
A6			0.418	0.518			34.985	<0.001**			7.367	0.007*
Yes	46 (28.4)	116 (71.6)			95 (58.6)	67 (41.4)			68 (42.0)	94 (58.0)		
No	51 (25.4)	150 (74.6)			56 (27.9)	145 (72.1)			57 (28.4)	144 (71.6)		
A7			0.382	0.537			112.414	<0.001**			0.869	0.351
Yes	70 (27.7)	183 (72.3)			151 (59.7)	102 (40.3)			91 (36.0)	162 (64.0)		
No	27 (24.5)	83 (75.5)			0 (0.0)	110 (100.0)			34 (30.9)	76 (69.1)		
A8			0.354	0.552			15.159	<0.001**			2.979	0.084
Yes	57 (27.9)	147 (72.1)			103 (50.5)	101 (49.5)			78 (38.2)	126 (61.8)		
No	40 (25.2)	119 (74.8)			48 (30.2)	111 (69.8)			47 (29.6)	112 (70.4)		
A9			1.244	0.265			11.751	0.001			9.728	0.002*
Yes	76 (28.3)	193 (71.7)			126 (46.8)	143 (53.2)			105 (39.0)	164 (61.0)		
No	21 (22.3)	73 (77.7)			25 (26.6)	69 (73.4)			20 (21.3)	74 (78.7)		

*P < 0.05, **P < 0.001

UNN – University of Nigeria Nsukka; UNI JOS – University of Jos; UNIUYO – University of Uyo; A6 = Member of any health- related association on campus; A7 = Participated in any clinical outreach; A8 = Taken any course on public health; A9 = Received sufficient training in pharmacy school to efficiently participate in public health activities.

students in health-related disciplines might be needed during public health crises [10].

Public health education is an important component for behavioural change among pharmacy students [11]. Respondents who were members of health-related associations/clubs on campus, those who had participated in clinical outreaches, and those who had taken any public health course were more involved in public health activities. Similarly, respondents who were members of health-related associations/clubs on campus and those who reported that they had received sufficient training in pharmacy school to participate in public health activities were more willing to participate in public health activities. The findings from a study conducted among pharmacy students in the University of Gondar, a public university in Northwest Ethiopia, to investigate their provision of health promotion counselling services after completion of a two-week community pharmacy clerkship, revealed the importance of community pharmacy clerkship in developing skills of the pharmacy student on health promotion counseling practices [7].

Although more than half of the respondents claimed to know that public health is concerned with the health of the entire population, only two-fifths of them knew that the public health approach does not focus on individuals. The concept of public health interventions is seen as population-based, as interventions may be directed at the entire population within a community, the systems that affect the health of those populations, and/or the individuals and families within those populations known to be at risk [12].

Majority of the participants said they were involved in screening for hypertension, diabetes, and malaria, as well as body mass index measurement and providing advice on healthy eating. This could be due to the prevalence of these diseases and ailments related to weight and choice of food. Several studies have indicated a rising prevalence of hypertension, diabetes mellitus, and obesity in Nigeria, recorded as 41.8% in women and 31.8% in men (overall 38.1%) for hypertension; 1.7% for diabetes among adults aged 20–69 years; and 14.4% and 12.1% for obesity among urban dwellers and rural dwellers respectively [13-16].

Less than half of the respondents screened for depression, dyslipidaemia, provided counselling on family planning, tested for HIV, provided advice on immunization, provided education on cancer, asthma, herbal medicines, and oral health. It is possible that the respondents felt they lacked sufficient confidence or expertise to provide counselling on these services. This is similar to a

study where cancer-related health promotion service was the least performed because the students lacked sufficient training [7]. With recent advancement in technology, point-of-care tests (POCT) make it possible for disease screening and prevention to be conducted for different health conditions, in virtually any setting. Pharmacists are well-positioned to conduct and interpret POCT results, counsel or refer patients, appropriately [17]. Training and support are needed in order to increase the pharmacists' confidence in providing public health services [8]. Relating to participation in public health services, less than half of the respondents had *good involvement*. Schools of pharmacy need to engage their faculty members and students to assume roles in public health [7,10, 17, 18].

More than half of the respondents agreed that financial constraints could hinder public health interventions and pharmacy students cannot deliver successful public health interventions without the participation of students from other health-related disciplines. This is similar to a survey conducted where more than half of the community pharmacists reported inadequate funds as a barrier to the offering of public health services [8]. Other barriers documented in the literature include the lack of time, insufficient human resources and funds, difficult access to patients' physicians, lack of skills and facilities, lack of space, lack of community engagement, resistance to change, and socio-cultural norms of the community [19-21]. Inter-professional collaborations between pharmacy students and students in other health-related disciplines is not easily feasible in Nigerian undergraduate schools, as there is rarely inter-professional education in the professional years. However, pharmacy students can interact with healthcare specialists in various public health departments during their trainings outside the classroom [3].

Our findings revealed that less than half of the respondents were highly willing to participate in public health activities, in the face of the barriers that limit involvement. In a study conducted in Yemen, community pharmacists had a positive attitude towards public health activities as health education and routine POCT were important practices of the community pharmacists [22]. Pharmacy students can benefit from interactions with pharmacists involved in public health activities, either in their practice settings or by joining them on clinical outreaches. These pharmacists can serve as mentors. If these pharmacists embrace the concept of collaborative care, where there is team work with other health professionals, the students will learn

that public health activities can be performed and enhanced by working together [22].

This study had some limitations. The data collection phase was delayed by the coronavirus pandemic (COVID-19) lockdown. On resumption, some of the students declined participation as they claimed they were busy due to the shorter semesters caused by the pandemic. This might have affected the response rate. In addition, the disrupted academic calendar made it difficult to distribute questionnaires in UNIJOS and UNIUYO. Most of the students complained about the frequent filling of e-questionnaires during the pandemic lockdown and this discouraged the use of that mode of delivery. Furthermore, this study was cross-sectional and conducted in only three Nigerian universities. The results may not apply to other settings.

CONCLUSION

Level of pharmacy students' involvement with public health activities could be influenced by the university, membership of health-related associations/clubs on campus, participation in clinical outreaches, public health courses. The university can serve as a springboard for pharmacists' active involvement in public health.

ACKNOWLEDGMENT

The authors appreciate the students (2019/2020 Session) of University of Nigeria Nsukka (UNN), University of Jos (UNIJOS) and University of Uyo (UNIUYO) who participated in the study.

REFERENCES

1. Manning DH, Kristeller JL. Pharmacy transitions of care and culture. *Hospital Pharmacy*, 52(8), 2017, 520-521. doi: [10.1177/0018578717724887](https://doi.org/10.1177/0018578717724887).
2. Osemene KP, Erhun WO. Evaluation of community pharmacists' involvement in public health activities in Nigeria. *Brazilian Journal of Pharmaceutical Sciences*, 54(3), 2018, e17447. doi: [10.1590/s2175-97902018000317447](https://doi.org/10.1590/s2175-97902018000317447).
3. DiPietro Mager NA, Ochs L, Ranelli PL, Kahaleh AA, Lahoz MR, Patel RV, et al. Partners in public health: public health collaborations with schools of pharmacy, 2015. *Public Health Reports*, 132(3), 2017, 298-303. doi: [10.1177/0033354917698126](https://doi.org/10.1177/0033354917698126).
4. Mohiuddin AK. Pharmacists in public health: scope in home and abroad. *SOJ Pharmacy and Pharmaceutical Sciences*, 6(1), 2019, 1-23.
5. Raczkiewicz D, Kobuszewski B, Sarecka-Hujar B, Pawelczak-Barszczowska A, Bojar I. Polish pharmacy students' readiness, qualifications, competences, relevance, motivation and effectiveness to promote health in community pharmacies. *International Journal of Environmental Research and Public Health*, 18(24), 2021, 13227. doi: [10.3390/ijerph182413227](https://doi.org/10.3390/ijerph182413227).
6. Aruru M, Truong HA, Clark S. Pharmacy emergency preparedness and response (PEPR): a proposed framework for expanding pharmacy professionals' roles and contributions to emergency preparedness and response during the COVID-19 pandemic and beyond. *Research in Social and Administrative Pharmacy*, 17(1), 2021, 1967-1977. doi: [10.1016/j.sapharm.2020.04.002](https://doi.org/10.1016/j.sapharm.2020.04.002).
7. Gelayee DA, Mekonnen GB. Pharmacy students' provision of health promotion counseling services during a community pharmacy clerkship: a cross sectional study, Northwest Ethiopia. *BMC Medical Education*, 18, 2018, 95. doi: [10.1186/s12909-018-1216-0](https://doi.org/10.1186/s12909-018-1216-0).
8. Offu O, Anetoh M., Okonta M, Ekwunife O. Engaging Nigerian community pharmacists in public health programs: assessment of their knowledge, attitude and practice in Enugu metropolis. *Journal of Pharmaceutical Policy and Practice*, 8, 2015, 27. doi: [10.1186/s40545-015-0048-0](https://doi.org/10.1186/s40545-015-0048-0).
9. American Association of Colleges of Pharmacy Center for the Advancement of Pharmacy Education (CAPE), *Educational Outcomes 2013*, <https://www.aacp.org/sites/default/files/2017-10/CAPEoutcomes2013.pdf>. Published October 16, 2017. (Accessed July 1, 2022).
10. Bauchner H, Sharfstein J. A bold response to the COVID-19 pandemic: medical students, national service, and public health. *Journal of American Medical Association*, 323(18), 2020, 1790-1791. doi: [10.1001/jama.2020.6166](https://doi.org/10.1001/jama.2020.6166).
11. Arlinghaus KR, Johnston CA. Advocating for behavior change with education. *American Journal of Lifestyle Medicine*, 12(2), 2017, 113-116. doi: [10.1177/1559827617745479](https://doi.org/10.1177/1559827617745479).
12. Minnesota Department of Health Center for Public Health Practice. *Public health interventions, definitions, and practice levels*, July, 2019. <https://www.health.state.mn.us/communities/pr>

- [actice/research/phncouncil/docs/PHInterventionsHandout.pdf](#) (Accessed July 1, 2022).
13. Odili AN, Chori BS, Danladi B, Nwakile PC, Okoye IC, Abdullahi U, et al. Prevalence, awareness, treatment and control of hypertension in Nigeria: data from a nationwide survey 2017. *Global Heart*, 2020; 15(1), 2020, 47. doi: 10.5334/gh.848.
 14. International Diabetes Federation, *Diabetes atlas*. 8th ed. Brussels: International Diabetes Federation; 2017, https://diabetesatlas.org/upload/resources/previous/files/8/IDF_DA_8e-EN-final.pdf (Accessed May 19, 2022).
 15. Uloko AE, Musa BM, Ramalan MA, Gezawa ID, Puepet FH, Uloko AT, et al. Prevalence and risk factors for diabetes mellitus in Nigeria: a systematic review and meta-Analysis. *Diabetes Therapy*, 9(3), 2018, 1307-1316. doi: 10.1007/s13300-018-0441-1.
 16. Adeloye D, Ige-Elegbede JO, Ezejimofor M, Owolabi EO, Ezeigwe N, Omoyele C, et al. Estimating the prevalence of overweight and obesity in Nigeria in 2020: a systematic review and meta-analysis. *Annals of Medicine*, 53(1), 2021, 495-507. doi: 10.1080/07853890.2021.1897665.
 17. Albasri A, Van den Bruel A, Hayward G, McManus RJ, Sheppard JP, Verbackel JYJ. Impact of point-of-care tests in community pharmacies: a systematic review and meta-analysis. *BMJ Open*, 10, 2020, e034298. doi: 10.1136/bmjopen-2019-034298.
 18. McKeirnan K, Czapinski J, Bertsch T, Buchman C, Akers J. Training student pharmacists to perform point-of-care testing. *American Journal of Pharmaceutical Education*, 2019; 83(7), 2019, 7031. doi: 10.5688/ajpe7031.
 19. Boti Sidamo N, Hussien S, Shibiru T, Girma M, Shegaze M, Mersha A, et al. Exploring barriers to effective implementation of public health measures for prevention and control of COVID-19 pandemic in Gamo zone of Southern Ethiopia: using a modified tanahashi model. *Risk Management and Healthcare Policy*, 14, 2021, 1219-1232. doi: 10.2147/RMHP.S297114.
 20. Scott DM, Strand M, Undem T, Anderson G, Clarens A, Liu X. Assessment of pharmacists' delivery of public health services in rural and urban areas in Iowa and North Dakota. *Pharmacy Practice (Granada)*, 14(4), 2016, 836. doi: 10.18549/PharmPract.2016.04.836.
 21. Laliberté MC, Perreault S, Damestoy N, Lalonde L. Ideal and actual involvement of community pharmacists in health promotion and prevention: a cross-sectional study in Quebec, Canada. *BMC Public Health*, 12, 2012, 192.
 22. Yousuf SA, Alshakka M, Badulla WFS, Ali HS, Shankar PK, Ibrahim MIM. Attitudes and practices of community pharmacists and barriers to their participation in public health activities in Yemen: mind the gap. *BMC Health Services Research*, 19, 2019, 304. doi: 10.1186/s12913-019-4133-y.