

Original Research Article

Perspectives on siting community pharmacies at fuel stations in Nigeria: A cross-sectional survey

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Abstract

Purpose: To explore stakeholder perceptions of co-locating pharmacies and fuel stations and their implications for service delivery and regulation.

Methods: A cross-sectional mixed-method survey was conducted among 615 pharmacists, 37 regulators, 524 fuel station customers, and 27 fuel station managers across Nigeria's six geopolitical zones and the Federal Capital Territory. Using multistage sampling, data were collected through a validated questionnaire, document review, and interviews with 11 regulators. Quantitative data were analyzed using descriptive statistics, Kruskal–Wallis, Mann–Whitney U, and Chi-square tests ($p < 0.05$), while qualitative data were thematically analyzed.

Results: Pharmacists generally supported the concept but expressed concerns about medicines' integrity ($H = 590.66$, $p < 0.001$). Customers and managers supported the innovation, perceiving no workflow disruption ($\chi^2 = 11.450$, $p = 0.022$). Regulators acknowledged international precedents and showed cautious openness, emphasizing strict safety measures and operational guidelines ($H = 7.851$, $p = 0.02$).

Conclusion: Stakeholders broadly supported the co-location of community pharmacies and fuel stations, albeit with safety concerns. Clear policy direction, context-appropriate regulatory frameworks, and safety guidelines are needed before implementation in Nigeria.

Keywords: Community pharmacy, Fuel stations, Pharmacy location, Stakeholder perception, Policy reforms, Nigeria

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INTRODUCTION

Community pharmacies and fuel stations are essential elements of modern built environments. While community pharmacies provide pharmaceutical products and services under the statutory oversight of registered pharmacists, fuel stations have evolved beyond fuel dispensing into multipurpose commercial hubs offering a range of retail and service outlets [1,2]. Their

high visibility, accessibility, and customer traffic make fuel stations potentially attractive locations for community pharmacy services. The siting of community pharmacies is usually guided by considerations of accessibility, visibility, patient safety, and commercial viability [3]. In Nigeria, pharmacy practice is regulated by the Pharmacy Council of Nigeria (PCN) [4], which currently does not permit the establishment of community pharmacies within fuel stations. Although no

section in the Pharmacy Council Act 2022 specifically prohibits such co-location, a more recent PCN regulatory guideline does not permit such arrangements [5]. This apparent divergence between statutory legislation and practice guideline creates uncertainty about the acceptability of the model and underscores the need for evidence to inform policy and regulatory decision-making. Consequently, there is limited empirical evidence of the feasibility, desirability, and potential implications of co-locating community pharmacies and fuel stations in Nigeria.

Siting community pharmacies within fuel stations would entail regulatory compliance with multiple regulatory mandates, including those of the PCN, the Petroleum Industry Act, the Nigeria Midstream and Downstream Petroleum Regulatory Authority (NMDPRA), and the National Environmental Standards and Regulations Enforcement Agency [6,7]. Concerns regarding patient safety, medicines quality, environmental health, and regulatory oversight highlight the need for evidence-based policy guidance.

Evidence from other health systems, including Spain and the United Kingdom, indicates that regulatory authorisation for pharmacy location is influenced by considerations of access, equity, efficiency, and service quality [8]. Access relates to availability, affordability, accessibility, and acceptability of pharmacy services, while equity seeks to ensure balanced distribution of service points and reduce healthcare disparities. Efficiency and quality are reflected in operational performance, patient outcomes, and professional standards.

Since the success of any policy innovation depends on stakeholder support, this study explored stakeholders' perceptions of siting community pharmacies within fuel stations in Nigeria, assessed its potential implications for service quality, and sought to inform the development of an appropriate regulatory framework.

METHODS

Study design

The study was a cross-sectional survey of stakeholders (including community pharmacists, fuel station customers, fuel station owners/managers, and industry regulators) using a mixed method for primary data collection. A set of validated questionnaires was administered to selected stakeholders, while in-depth interviews

were conducted with leaders of regulatory bodies. Additionally, document reviews were conducted on relevant laws guiding pharmacy practice and fuel station operations.

Setting

The study was conducted among registered community pharmacists in their practice settings, fuel stations, and regulators of the petroleum and pharmaceutical industries. The study area covered the six geopolitical zones of Nigeria. A stratified sampling technique was applied to split the study area into six strata representing the six geopolitical zones of Nigeria. One State per stratum was purposively selected based on high community pharmacy density, urbanization, fuel station population, and feasibility of data collection; namely Gombe (Northeast), Kano (Northwest), Kwara (Northcentral), Lagos (Southwest), Enugu (Southeast), Rivers (South-south), as well as Abuja Federal Capital Territory (FCT).

Participants

The study participants comprised community pharmacists, fuel station managers and customers, principal officers of the Pharmacy Council of Nigeria (PCN) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) in selected States and Abuja FCT.

Sample size determination

The sample size of community pharmacists was calculated from their population in the register of PCN using the Taro Yamane (1967) sample size formula for finite populations. There were 18432 community pharmacists in Nigeria as of December 31, 2022. This population of interest was used to calculate the sample size (377) for participants, with an overage of 10% added (in anticipation of possible non-responders), giving a total sample size of 415. Due to perceived difficulty in reaching fuel station owners while their managers would likely decline to take the surveys, the sample size for this group was purposively set at 3 per State, giving a total of 18, provided each selected State was represented. The sample size for fuel station customers – a large population with unknown size was determined using Cochran (1963) formula ($n = \frac{z^2pq}{e^2}$) with n as the required sample size, $z = 1.96$ being the standard normal deviate corresponding to 95 % confidence level, $P = 0.5$ as estimated proportion, $q = 1 - p$, and $e = 0.05$ margin of error. With 10 % overage for non-response, a sample size of 106 was

obtained. The target sample size for regulators (for questionnaire surveys/in-depth interviews) was 14, comprising the principal officers for the two key regulatory agencies (PCN and NMDPRA) in selected States (plus Abuja FCT).

Ethical approval

Ethical approval (Ref. no. IPH/OAU/12/2387) was obtained from the Health Research Ethics Committee of the Institute of Public Health at Obafemi Awolowo University, Ile-Ife, Nigeria. The study was carried out in line with the principles of the 1975 Helsinki Declaration as revised in 2013 [9], ensuring respondents' confidentiality, while written informed consent was obtained from all respondents.

Sampling technique

Multistage sampling was applied in this study. First, stratified sampling was used in which the 36 States were divided into six strata in line with the six geopolitical zones of Nigeria. Then, one State was purposively selected per geopolitical zone based on considerations of the presence of larger cities, expectedly with more fuel stations, feasibility of data collection, and security perceptions. Simple random sampling was used to select pharmacist respondents, while accidental sampling was applied for fuel station managers and customers based on those present and consenting at the time research assistants visited the outlets. Purposive sampling technique was used to select regulators who were principal officers in charge of their States.

Development and validation of instruments

Items on the questionnaire were developed from a detailed review of relevant literature as well as evidence from other health systems [10-12]. The questionnaires comprised two sections: Section 1 sought information on relevant demographic characteristics of respondents, such as age, sex, educational qualifications, and practice setting. Section 2 contained items designed to elicit information on the perception of four stakeholders (pharmacists, customers, fuel station managers and regulators) on a five-point Likert scale of agreement with response weights of 1-5, regarding the appropriateness of siting community pharmacies in fuel stations. The same literature sources were used to develop items on the structured interview guide but adapted to suit the interview format for qualitative data collection. The draft instruments were interrogated at two sequential brainstorming sessions of the research team and thereafter subjected to the expert scrutiny of two senior

faculty members who have significant expertise in pharmacy services development research. Further validation was carried out using a pilot study.

Pilot study

The research instruments were deployed in two Local Government Areas (one in an urban, and the other in a rural setting) in Osun State for a pilot study to validate the instruments. A total of 40 community pharmacists and 12 customers were surveyed in the pilot study. The dataset from this pilot test yielded a Cronbach's alpha reliability coefficient of 0.78 for the perception scale.

Data collection

For the quantitative data, a mix of paper questionnaires and online Google Forms was used to survey the selected respondents. A default setting of "limit to 1 response" was applied to the online forms to prevent double responses from participants. While selected pharmacists and regulators were surveyed or interviewed at their work settings, meeting venues and via their verified telephone numbers, fuel station customers were surveyed by accidental sampling, depending on who was present at the fuel stations at the time of visit by research assistants. Six research assistants were recruited and trained in data collection for one day (4 hours) and worked under the direct supervision of the principal investigator and the Deans of Pharmacy Schools in public universities in the selected States, whose involvement lent credibility to the study and improved participation of selected respondents in interrogating the novel concept.

For qualitative data, interview guides were used to conduct semi-structured interviews with eleven (11) purposively selected regulators, namely State Officers of the Pharmacy Council of Nigeria (PCN) and the Nigeria Midstream and Downstream Petroleum Regulatory Authority (NMDPRA), as these were the principal officers in charge of their States. The items on the interview guides were carefully drafted in line with the study objectives and presented in open-ended question formats. Two of the researchers, Author 2 (Ph.D., male) and Author 4 (PharmD., female), conducted the face-to-face interviews in the privacy of the respondents' offices, with three refusing to be interviewed. Both interviewers are pharmacists with considerable experience in qualitative research.

Respondents were first contacted via telephone, given a brief description of the study and the interviewers, and they all gave their consent before interviews were conducted. One of the interviewers asked the questions while the other provided prompts and took notes. Interview sessions, which lasted approximately 30 - 45 minutes each, were tape-recorded, with permission, and transcribed verbatim for data analysis. Document reviews focused on specifications regarding PCN requirements for the approval of locations for community pharmacies, as contained in the Pharmacy Council of Nigeria Act, 2022; as well as specific aspects of the NMDPRA Act, 2021, relevant to the study.

Data analysis

The IBM SPSS Statistics (version 26) was used for data analysis. Demographic data of respondents were summarised using descriptive statistics, including median and range, frequency, and percentages. Respondents' perceptions of appropriateness of siting community pharmacies in fuel stations were measured on a 5-point Likert scale in which scores of 1 to 5 were sequentially assigned to responses of "Strongly Disagree", "Disagree", "Unsure", "Agree", and "Strongly Agree" respectively, with 3 (the mid-point) as the cut-off score between positive (> 3) and negative (< 3) perceptions. Median (interquartile range) perception scores were computed, while a Kruskal-Wallis H test was used to compare scores across the respondent groups (with Mann-Whitney U test for 2-group comparisons) at the $p < 0.05$ level of significance. Pairwise comparisons using the Mann-Whitney U test were performed following the significant Kruskal-Wallis test. Bonferroni correction was applied to adjust for multiple comparisons. The Pearson Chi-Square test was used to examine the association of perceptions with demographic characteristics of respondents.

Qualitative data from in-depth interviews with selected regulators were subjected to thematic analysis guided by Braun and Clarke's six steps: familiarization with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and generating the final report. The ATLAS.ti version 9 software was used for qualitative data analysis. Two members of the research team (Authors 2 and 3) read through the transcript and did a quality check to ensure fidelity. They also independently developed codes for three transcripts while the Principal Investigator (Author 1) refined the

codes and developed the coding framework that was subsequently applied to all the transcripts.

RESULTS

Enrolment analysis

A total of 615 pharmacists, 524 customers, 37 regulators, and 27 fuel station managers were enrolled for the study, while 11 principal officers of the regulating agencies (including those from FCT) were interviewed.

Demographic characteristics of respondents

With respect to respondents' sex, Table 1 shows that males were dominant for three groups of stakeholders, including the pharmacists (390; 63.4 %), regulators (22; 59.5 %) and fuel station managers (25; 92.6 %), but not for the customers (196; 37.4 %). The fuel station managers have the highest median age (39 years) and the customers the lowest (34 years). The modal highest educational qualification for all stakeholders is the tertiary-bachelor's with 74.1 % for fuel station managers, 66.2 % for customers, 60.2 % for pharmacists, and 51.4 % for regulators. Only the customers and fuel station managers have more than 20 % in the secondary educational qualification level and only the pharmacists (245; 39.8 %) and regulators (14; 37.8 %) have among them those in possession of tertiary-postgraduate certificates. The majority of the pharmacists (413; 87.7 %) and fuel station managers (20; 74.1 %) reside in urban centres, with pharmacists in the Southwestern geopolitical zone having the modal value (155; 25.2 %).

Stakeholders' perception on appropriateness of siting community pharmacies in fuel stations

The responses of stakeholders to the questionnaire items are presented in Table 2. The results of Kruskal-Wallis H tests to compare median perception scores of the groups, including the asymptotic significance (2-sided test) and the post hoc pairwise comparisons using the Mann-Whitney U test with Bonferroni corrections for multiple comparisons ($\alpha = 0.05/6 = 0.0083$), are presented in the last two columns. The first two items (i - ii) had all four stakeholders interrogated. Whereas two of the groups (pharmacists and customers) reported "can't say" (Median (Mdn) 3), the other two groups (fuel station managers and regulators) reported "agree" (Mdn 4) with the item "*There is nothing wrong with siting community pharmacies within fuel stations.*"

Table 1: Demographic characteristics of respondents

Variable	Categories	Pharmacists f (%)	Customers f (%)	FS Managers f (%)	Regulators f (%)
Sex	Male	390 (63.4)	196 (37.4)	25 (92.6)	22 (59.5)
	Female	225 (36.6)	328 (62.6)	2 (7.4)	15 (40.5)
	Total	615	524	27	37
Age (Yrs.)	Median (Min-Max)	37 (24-69)	34.5(21-72)	39 (24-55)	NA
	Primary	0 (0.0)	0 (0.0)	1 (3.7)	0 (0.0)
	Secondary	0 (0.0)	117 (33.8)	6 (22.2)	0 (0.0)
Highest Educ. Qual.	Tertiary- Diploma	0 (0.0)	0 (0.0)	0 (0.0)	4 (10.8)
	Tertiary-Bachelor	370 (60.2)	347 (66.2)	20 (74.1)	19 (51.4)
	Tertiary-Postgrad	245 (39.8)	0 (0.0)	0 (0.0)	14 (37.8)
	Total	615	524	27	37
Length of Practice Experience (years)	Median (Min-Max)	5.5 (1-31)	4 (1-16)	2.5 (1-5)	3.5 (1-7)
Geopolitical zone	Southwest	155 (25.2)	129 (24.6)	9 (33.3)	13 (35.1)
	Southeast	43 (7.0)	43 (8.2)	4 (14.8)	6 (16.2)
	Southsouth	72 (11.7)	69 (13.2)	4 (14.8)	4 (10.8)
	Northeast	95 (15.5)	64 (12.2)	2 (7.4)	4 (10.8)
	Northwest	78 (12.7)	47 (9.0)	2 (7.4)	2 (5.4)
	Northcentral	71 (11.5)	79 (15.1)	2 (7.4)	3 (8.1)
	Abuja FCT	101 (16.4)	93 (17.7)	4 (14.8)	5 (13.5)
	Total	615 (100)	524 (100)	27 (100)	37 (100)
Location of Practice/Residence	Urban	413 (87.7)	NA	20 (74.1)	NA
	Rural	58 (12.3)		7 (26.0)	
	Total	471		27	

F = frequency, NA = Not available

The Kruskal-Wallis H test shows that there were significant differences across the groups ($H(3) = 20.097$; $p = 0.000$) while the post hoc U tests show that the pharmacists reported significantly different agreement scores compared with only that of the managers' group ($U = 4494.5$; $p = .000$). Furthermore, only the pharmacists "agree" (Mdn 4) that "*The environment of a fuel station will pose a significant risk to the integrity of pharmaceutical products*". All three others, including the customers, fuel station managers and the regulators, reported: "can't say" (Mdn 3). The Kruskal-Wallis H tests comparing median perception scores show that there were significant differences ($H(3) = 590.66$; $p = 0.000$) in perceptions across the groups while the post hoc tests show that the pharmacists reported significantly higher agreement scores compared with the other three groups of managers ($U = 5816.5$; $z = -8.122$; $p = 0.000$), customers ($U = 99923$; $z = -24.081$; $p = 0.000$) and the regulators ($U = 6481$; $z = -4.522$; $p = 0.000$), indicating greater concern among pharmacists. The next six items (iii - viii) had three of the four groups of stakeholders assessed, while the last five (ix - xiii) had only two of the stakeholders interrogated.

Association of demographic characteristics with stakeholders' perceptions

A summary of the Chi-square test of differences for the effects of the demographic variables on the main objective items is presented in Table 3.

Only four of the items have their scores significantly affected by demographic variables.

Qualitative data from semi-structured interviews with Regulators

The qualitative component of the research is presented in line with the Consolidated Criteria for Reporting Qualitative Research framework. Thematic analysis of the interview data from selected regulators emphasized the following common themes:

General impressions

Sub-themes here were excitement, indifference, and surprise. Many respondents were struck by the novelty of the idea of co-locating community pharmacies and fuel stations, with varied impressions of such an innovation. "It will be interesting to see how the stakeholders will receive such an innovation in Nigeria" A respondent from PCN.

"There is nothing wrong with siting community pharmacies within fuel stations" Two respondents from PCN, and one from NMDPRA. "I do not foresee any significant conflict of interest between PCN and NMDPRA in terms of regulating community pharmacies sited in fuel stations. Issues that may arise can easily be resolved by discussions among regulators" Two respondents from PCN.

Table 2a: Stakeholders' perception on siting community pharmacies in fuel stations

S/N	Statement	Mdn (IQR) Perception Scores				Kruskal-Wallis H {H(df), P-value}	Post Hoc Test results
		Pharmacists	Customers	FS Managers	Regulators		
i	There is nothing wrong with siting CPs within FSs	3 (3-4)	3 (3-4)	4 (4-5)	4 (4-5)	Asymptotic Sig. (2-sided test), H (3) = 20.097, $p = 0.000$	The pharmacists reported significantly different agreement scores compared with the FS managers' group ($U = 4494.5$, $z = -4.136$, $p = .000$). Comparison with those of customers ($U = 158269$, $z = -0.53$, $p = 0.596$) and the regulators ($U = 9356.5$, $z = -0.178$, $p = 0.859$) was not significant.
ii	The environment of an FS will pose a significant risk to the integrity of pharmaceutical products	4 (4-5)	3 (3-4)	3 (2-4)	3 (3-4)	Asymptotic Sig. (2-sided test), H (3) = 590.66, $p = 0.000$	The pharmacists reported significantly higher agreement scores compared with the other three groups of managers ($U = 5816.5$, $z = -8.122$, $p = .000$), customers ($U = 99923$, $z = -24.081$, $p = .000$) and the regulators ($U = 6481$, $z = -4.522$, $p = .000$).
iii	Siting Pharmacies at Fuel Stations will improve Community access to pharmacy services	4 (4-5)	4 (4-5)	4 (4-5)	NI	Asymptotic Sig. (2-sided test), H = 5.579, $df = 2$, $p = 0.061$; $N = 1113$	Post hoc tests are not performed since the overall test does not show significant differences across samples.
iv	Siting of CPs in FSs will make medicines less affordable to patients	3 (3-4)	4 (4-5)	4 (3-4)	NI	Asymptotic Sig. (2-sided test), H = 44.513, $df = 2$, $p = 0.000$, $N = 834$	Mann-Whitney Post hoc test shows that the significant difference is between the pharmacists and the managers ($U = 2523$, $p = 0.002$, $N = 312$)
v	CPs in FSs can open for longer hours and on weekends	4 (4-5)	4 (4-5)	4 (4-5)	NI	Asymptotic Sig. (2-sided test), H = 12.995, $df = 2$, $p = 0.002$, $N = 1166$	Mann-Whitney Post hoc test shows significant differences between pharmacists and managers. ($U = 5366.5$, $p = 0.001$, $N = 642$) and between the managers and customers ($U = 4419$, $p = 0.000$, $N = 551$) but not between the pharmacists and the customers ($U = 154041$, $p = 0.183$, $N = 1139$)
vi	Siting CPs within FSs will likely cause conflicts between regulators of the pharmaceutical and petroleum industries	3 (2-4)	NI	3 (2-4)	4 (4-5)	Asymptotic Sig. (2-sided test), $N = 642$, (H = 7.851, $df = 2$, $p = 0.02$).	A multiple comparisons Mann-Whitney Post hoc test shows that significant differences exist between pharmacists and regulators ($U = 6026$, $p = 0.013$) and between managers and regulators ($U = 208.5$, $p = 0.005$). The result of the test between the pharmacists and the managers was not significant ($U = 7215.5$, $p = 0.237$)
vii	Special safety measures are necessary for the safe operation of Community Pharmacies within Fuel Stations	5 (4-5)	4 (4-5)	NI	5 (4-5)	No significant difference in the Kruskal-Wallis's test (H = 0.801, $df = 2$, $p = 0.67$)	Post hoc tests are not performed since the overall test does not show significant differences across samples.
viii	I support that Pharmacies should be sited at fuel Stations	NI	4 (4-5)	4 (4-5)	4 (2-4)	Asymptotic Sig. (2-sided test), $N = 642$, (H = 23.131, $df = 2$, $p = 0.000$).	Multiple comparisons using the Mann-Whitney U Test show that there is a significant difference between customers and managers ($U = 3300.5$, $p = 0.000$) and between managers and regulators ($U = 279$, $p = 0.008$). Post hoc test for customers and regulators was not significant ($U = 8420$, $p = 0.807$)

H = Kruskal Wallis-H test statistic; U = Mann Whitney U test statistic; χ^2 = Chi square; CP = Community Pharmacy; FS – Fuel Station; NI = Not Interrogated

Table 2b: Stakeholders' Perception on Siting Community Pharmacies in Fuel Stations *Continued*

S/N	Statement	Mdn (IQR) Perception Scores				Kruskal-Wallis H {H(df); P-value}	Post Hoc Test results
		Pharmacists	Customers	FS Managers	Regulators		
ix	Siting CPs in FSs will improve customer convenience	4 (2-4)	NI	4 (4 - 4)	NI		A Mann-Whitney U Test of the difference between the pharmacists and managers shows a significant difference between them (U = 6434.5, $p = 0.042$)
x	The environment of a Fuel Station will not affect the quality of care given by my pharmacist	3 (2-4)	3 (3-4)	NI	NI		A Mann-Whitney U Test shows a significant difference (U = 144489, $p = 0.002$, N = 1139)
xi	Siting of CPs in FSs will reduce the quality of patient care rendered by the pharmacist	3 (2-4)	3 (3-4)	NI	NI		A Mann-Whitney U Test shows a significant difference (U = 144489, $p = 0.002$).
xii	The presence of a pharmacy will not disturb the normal operations of my fuel station.	NI	NI	4 (4-4)	4 (2-4)		A Pearson Chi-Square Test of difference between the managers and regulators shows that the difference is significant ($X^2 = 11.450$, $df = 4$, $p = 0.022$)
xiii	The environment of an FS will pose a significant risk to the quality of pharmaceutical products	4 (4-5)	3 (2-4)	NI	NI		A Chi-square test shows a significant difference N = 32, $X^2 = 12.808$, $df = 4$, $p = 0.012$

H = Kruskal Wallis-H test statistic; U = Mann Whitney U test statistic; X^2 = Chi square; CP = Community Pharmacy; FS – Fuel Station; NI = Not Interrogated

Table 3: Associations of respondents' perceptions with their demographic characteristics

Item	Demographics	Chi-Square outputs	P-value
There is nothing wrong with siting CPs within FSs	Male vs Female pharmacists	$X^2 = 10.161$, $df = 4$	0.038*
The environment of a FS will pose a health risk to CP	Highest Educational Qualification of pharmacists	$X^2 = 72.151$, $df = 28$	0.000*
Siting CPs in FSs will reduce the quality of patient care rendered by the pharmacist	Highest Educational Qualification of pharmacists	$X^2 = 43.107$, $df = 28$	0.034*
The presence of a Pharmacy will not disturb the normal operations of the fuel station	FS managers vs regulators	$X^2 = 11.450$, $df = 4$	0.022*

"I support the idea of siting community pharmacies within fuel stations" Three respondents from PCN and two from NMDPRA

Impact on product and service quality

Sub-themes here include uncertainty, curiosity, and improved access. Most respondents agreed that siting community pharmacies in fuel stations will significantly improve visibility and access to community pharmacy products and services. They felt that evidence of the impact of such an innovation can only be known after some reasonable period of implementation.

"Only fuel stations with adequate space between the tank farm/pump island and sales rooms should be authorised to host community pharmacies" Three respondents from NMDPRA

"Dispensing tablets in unsealed multiple doses 'counting' forms should be discouraged in community pharmacies within fuel stations. All tablets should be dispensed in strips or blister packs, protected from direct exposure to the air" Four respondents from PCN.

“Siting community pharmacies in fuel stations will significantly improve customers’ access to pharmaceutical products and services” ... Two respondents from PCN and one from NMDPRA

“All pharmacies within fuel stations must have functional air conditioners to ensure good air quality” ... Three respondents from PCN.

“Special safety arrangements such as fire extinguishers, safety drills, back doors for emergency exit, and muster points must be put in place for pharmacies to operate within fuel stations” ... Two respondents from NMDPRA.

Comparison with other health systems

Sub-themes here include changing business models, and willingness to explore. Some respondents expressed awareness of similar situations in other countries. The majority were willing to explore, noting that changing business models was an inevitable part of national development.

“I know that community pharmacies are sited within fuel stations in some other climes such as the United States, United Kingdom, and Saudi Arabia” One respondent from PCN and two from NMDPRA

“I do not see why we cannot explore this novel business model in Nigeria.” - a respondent from PCN.

Summary output of document reviews

A detailed review of relevant extant laws, namely the Poison and Pharmacy Act Cap 535 LFN 1990; Food, Drugs, and related Products Registration Act 19 of 1993 (Cap F. 33 LFN, 2004); Dangerous drugs Act Cap D. 1 LFN 2004; Foods and drugs Act Cap F.33 LFN, 2004; National Agency for Food and Drug Administration and Control (NAFDAC) Act 15 of 1993 (Cap N. 1 LFN, 2004); Pharmacy Council of Nigeria (PCN) Act 2022, revealed that they all made no provisions for siting community pharmacies in fuel stations. None of these statutes specifically prohibits co-locating community pharmacies and fuel stations, but in practice there is a ban on such initiatives in practice guidelines [5].

DISCUSSION

This study aggregated perspectives from multiple stakeholders in examining the feasibility of siting community pharmacies in fuel stations in Nigeria, as multi-stakeholder engagement has been shown to provide a robust evidence base in

policy and practice reform initiatives [13]. The number of respondents was well above the minimum calculated sample sizes for the various stakeholder categories, thereby ensuring data saturation for possible generalisation of the findings. The demographic characteristics of pharmacist respondents in this study were mostly in line with extant evidence regarding the distribution of pharmacists in Nigeria [14].

The pharmacists demonstrated a positive perception of the co-location of community pharmacies and fuel stations, yet with concerns for the integrity of pharmaceutical products. This positive perception is significant as it suggests a certain readiness to accept a possible reform to the long-standing ban on siting community pharmacies in fuel stations, a norm probably reflecting concerns for professional standards and safety, particularly regarding the storage and handling of medications in environments where inflammable materials are present [13]. Stakeholders’ perspectives on the influence of the fuel station environment on quality and integrity of pharmaceutical products and hence patient safety largely aligned with their different technical expertise, as shown in the significant difference in their median scores. However, the greatest concern among pharmacists is not surprising but rather aligns with emerging trends in global literature in which community pharmacists currently emphasize quality in terms of access, environment, safety, person-centered care, competence, and integration within local healthcare systems [15].

Pharmacists, customers, and regulators were unanimous in emphasizing the need for special safety measures to ensure the safe operation of community pharmacies within fuel stations. These concerns align with a growing global awareness and attention to health, safety, and environmental (HSE) practices in community pharmacy settings, as these have been shown to directly impact patient safety [16]. It also suggests that Nigerian community pharmacists will be willing to adopt any additional safety measures proposed by regulators in the likely event that approval is given for siting community pharmacies in fuel stations. Hence, in weighing the evidence adduced by this study, there is a need to pay close attention to these safety concerns.

Internationally, pharmacy services have been integrated into some fuel station retail environments. For example, in South Africa, Pharmashop24 has partnered with Shell South Africa to provide 24/7 pharmacy vending solutions across participating Shell Stores [17].

However, the unique contextual realities of the Nigerian practice environment must be considered in implementing such innovations locally. While the different regulatory bodies envisage no significant conflicts (beyond what mutual dialogue can resolve) in executing their oversight mandates, their positive perceptions must be seen, not as an end but as an impetus to understudy the regulatory guidelines that underpin the successful co-location of community pharmacies and fuel stations in other climes. At the end, the ultimate measure of the relevance of regulations, as applicable in Europe and elsewhere, remains the guarantee of improved economic, clinical, and humanistic outcomes for the consumers [18], and in the present scenario, the responsibility lies with the pharmacists and their regulators.

There was convergence of quantitative and qualitative evidence from pharmacists, regulators, and customers to the effect that “there was nothing wrong in co-locating community pharmacies and fuel stations”. As demonstrated in similar patient-centred studies [11,15], this consensus signals a likely successful uptake of the practice innovation. This finding is strengthened by the evidence that pharmacists, customers, and fuel station managers all strongly agreed that siting community pharmacies in fuel stations would increase consumer access to pharmacy products and services, a critical consideration in location analysis and regulatory authorization for siting community pharmacies globally [8,10]. The stakeholders agreed that fuel stations will give greater visibility to community pharmacies and did not see how siting community pharmacies in fuel stations would increase operational costs or disturb normal operational workflows. This finding can be said to strengthen the argument for enhanced operational efficiency of community pharmacies located in fuel stations [11]. It is noteworthy that there was no significant difference in the opinions of urban and rural-based respondents, which seems to suggest that siting community pharmacies in fuel stations would ultimately contribute to reducing the disparity in customers’ access to pharmacy products and services [8,10].

The significant associations between higher educational qualifications of the pharmacists and their sensitivity to environmental health risks and service quality seem to suggest that specialization tends to align their practice priorities with global trends and best practices. Recent reports indicate that most health systems currently emphasize patient safety, reduced medication errors and improved service quality, with pharmacists assuming central roles in

driving these goals within the medicines ecosystem [12,15].

Limitations of this study

This study did not collect and analyse air and particulate samples from fuel stations to enable definite scientific determination of the possible reactions with different pharmacological classes of medicines and human subjects who will operate the pharmacy premises located within fuel stations.

CONCLUSION

Relevant stakeholders have demonstrated a positive perception of the siting of community pharmacies in fuel stations, though with safety concerns. Policy reforms backed by a fit-for-context regulatory framework and enhanced health, safety, and environmental guidelines are recommended before implementation in Nigeria.

DECLARATIONS

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Conflicts of interest

No conflict of interest is associated with this work.

Ethical approval

Ethical approval (Ref. no. IPH/OAU/12/2387) was obtained from the Health Research Ethics Committee of the Institute of Public Health at Obafemi Awolowo University, Ile-Ife, Nigeria.

Contribution of authors

We declare that this work was done by the author(s) named in this article, and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. MOA: conceptualization, investigation, supervision, writing- review and editing, fund acquisition, project administration. MRI: methodology, investigation, data curation, writing-original draft, review and editing. OJO: formal analysis,

validation, data curation, writing- review and editing. MOO: investigation, writing- review and editing.

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