

Assessing the level of awareness of and adherence to WHO “High Alert Medication Without Harm protocol among health professionals in a district in Ghana

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Abstract

Background: Evidence suggests that adherence to medication safety guidelines among health professionals is still inconsistent and context-dependent. This study was conducted to assess the level of awareness adherence to the WHO Medication Without Harm among health professionals in the Bosomtwe District.

Methods: A cross-sectional study was conducted among 250 health professionals to assess their level of awareness and adherence to medication without harm. A census sampling method was used and structured questionnaire was used to gather data. Data were analyzed using Stata version 17. Descriptives, univariate and multiple regression analysis were performed.

Results: In total, 58.8% (n=147) of respondents are aware of the WHO protocol, while 41.2% (n=103) are not. The majority of health professionals (64.8%) demonstrated adherence to the WHO Medication Without Harm policy, with physicians recording the highest adherence rate (81.8%) compared to nurses (61.7%) and pharmacists (71.9%). The statistically significant association between profession and adherence ($\chi^2 = 11.847$, $p = 0.008$) with a small-to-moderate effect size (Cramér's $V = 0.22$) suggests that professional cadre meaningfully influences medication safety compliance.

Conclusions: The study conclude that effective implementation of the World Health Organization medication safety protocol depends on both individual understanding and the strength of the health system environment, as gaps in recognition of high-risk situations and uneven support structures limit consistent practice. Therefore, policy efforts must go beyond awareness and adherence campaigns and focus on strengthening training, staffing, resources, and institutional expectations in order to achieve meaningful and sustained improvements in medication safety

Introduction

Medication safety constitutes the cornerstone of patient safety, which continues to be one of the most important aspects of healthcare quality. Across all levels of healthcare delivery, unsafe medication practices and medication errors are a major cause of avoidable injury and death, globally (Aubin et al., 2022; Jessurun et al., 2023). Approximately 1.3 million injuries and 7,000 to 9,000 deaths are attributed to medication-related harm in the United States alone. These figures indicate a staggering financial burden of more than US\$42 billion in additional healthcare costs annually (World Health Organization, 2023).

An estimated 83 million patients in low- and middle-income countries (LMICs) have adverse medication events annually, many of which are completely avoidable, indicating that LMICs bear a disproportionate amount of the global burden (de Moura Pedro et al., 2024; World Health Organization, 2023).. It was against this backdrop, the World Health Organization (WHO) introduced the Third Global Patient Safety Challenge, officially named "Medication Without Harm," during the Second Global Ministerial Patient Safety Summit in Bonn, Germany, in March 2017 (Donaldson et al., 2017). The global health agenda underwent a historic shift as a result of this dilemma, which elevated pharmaceutical safety to a priority requiring coordinated commitment from academic institutions, professional associations, health ministries, and frontline health providers (Aubin et al., 2022; Donaldson et al., 2017).

In Ghana, dispensing and prescribing errors are commonly reported in public health institutions, indicating systemic deficiencies in drug management policies. Studies in Ghana have revealed concerning rates of medication errors in both primary and tertiary care settings (Jumanne et al., 2021). Collectively, the highlighted evidence affirm that medication errors are far from isolated incidents. They reflect deeply entrenched failures in healthcare systems that demand comprehensive policy responses and rigorous professional adherence to established safety frameworks. This study is to assess the level of awareness and adherence to

Materials and methods

We conducted a cross-sectional study among 250 health professionals assess the level of awarenss and adherence to WHO Medication Without Harm policy in the Bosomtwe District of Ghana. (Slater & Hasson, 2024). (Setia, 2016). (Levin, 2006; Setia, 2016).

Sampling procedure

This study utilized census to select all the 250 licensed health professionals in the to participate. All the eligible health professionals (physicians, nurses, and pharmacists) across all health facilities (Kuntenase Government Hospital, St Michael's Hospital (pramso), Jackie Health Centre, Akokofe CHIPs, Aputugya CHIPs, Oyoko CHIPs, Adequate CHIPs, Adwumam CHIPs, Piase CHIPs, Abono CHIPs, Pipie CHIPs, Mim CHIPs, Feyiase CHIPs, Aputuogya CHIPs and Aboantem CHIPs) in the Bosomtwe District were enumerated.

The use of census eliminates sampling error, maximises statistical power, and ensures the representativeness of findings without the need for probability-based sample selection procedures (Etikan & Bala, 2017). The use of the census design was relevant in that, the study's analytical plan included subgroup analyses disaggregated by professional category (physicians, nurses, pharmacists). Therefore, including all eligible health professionals in the population guaranteed sufficient numbers within each professional subgroup for valid chi-square and logistic regression analyses.

Data Collection Techniques and Tools

Data for this study was collected using a structured self-administered questionnaire. The self-administered format was chosen to minimize the social desirability bias that could have arise when sensitive items about awareness and adherence failures and error reporting were administered face-to-face by an interviewer. This is because it enabled respondents to complete the questionnaire at their own pace and in privacy (Creswell & Creswell, 2017). This is especially crucial in Ghana, where health workers may be unwilling to report non-adherence if they are actively watched or under pressure due to a punitive safety culture (Abuosi et al., 2022).

Validity and Reliability of Data Collection Instruments

Through a systematic expert review procedure, content validity, which refer to the degree to which the questionnaire items accurately reflect the domains they are meant to measure (Creswell & Creswell, 2017),

was determined. Using a content validity index (CVI) framework, a panel of five subject-matter experts including two pharmacists with clinical and academic backgrounds, one doctor with experience in health quality management, one nurse educator with expertise in patient safety, and one health policy researcher independently assessed each item for relevance, clarity, and representativeness. Only items with a content validity index of ≥ 0.80 was kept in the final instrument after being scored on a 4-point scale (Polit & Beck, 2021).

Face validity was also ensured via a pre-test (pilot study) in which the questionnaire was administered to 15 health professionals (5 physicians, 5 nurses, and 5 pharmacists) working at KNUST Hospital in the Oforikrom Municipal Assembly which shares comparable characteristics with the Bosomtwe District but is not included in the main study. Pilot participants were also invited to comment on the clarity, length, and intelligibility of each item. Feedback informed final revisions to item wording and questionnaire layout before the main data collection.

Reliability, specifically internal consistency was assessed using Cronbach's alpha coefficient computed from the pilot study data. A Cronbach's alpha of ≥ 0.70 was the accepted threshold for adequate internal consistency in health research instruments, and ≥ 0.80 is considered good to excellent (Tavakol & Dennick, 2011).

Data Handling and Management

The collected data was handled with care to ensure accuracy, confidentiality, and security. In each day, completed questionnaires were checked in the field to ensure they are filled out before being stored safely. Data from the questionnaires was coded and entered into a Stata version 17. To minimize errors, double-entry and consistency checks were done. Incomplete questionnaires or missing data were handled using pairwise deletion, in which the researchers used available data for each analysis rather than dropping the entire case. Electronic data was kept on a password-protected computer, and backup copies were stored on an external drive. Names and personal identifiers were excluded from the analysis; instead, ID codes were used.

Data Analysis

Analysis of the quantitative data was done with a statistical tool (the Stata Statistical Software). Descriptive statistics including frequencies, percentages, means and standard deviations, were used to summarize the Socio- demographic characteristics of the participants and their levels of awareness and adherence. Chi-square test was used to determine the association between demographic factors (such as years of experience and facility type) and level of awareness. For each statistically significant bivariate association, the magnitude of the association was described using Cramér's V as the effect size measure. Binary logistic regression was used to identify the independent predictors of adherence. To ensure that all theoretically important TPB-aligned variables included irrespective of their bivariate significance, the model was built using the forced entry method (Enter). Model fitness was assessed using the Hosmer-Lemeshow goodness-of-fit test. Multicollinearity between independent variables were assessed using the variance inflation factor

(VIF), with a VIF > 10 used as the threshold for exclusion of a collinear variable. Results were presented using tables for clarity, with a significant level set at $P \leq 0.05$ to determine the statistical weight of the findings.

Ethical Consideration

Ethical approval

for this study was sought and obtained from the Committee on Human Research, Publications and Ethics (CHRPE), KNUST with the reference number CHPRE/AP/267/26. In the context of this study, the researchers provided participants with comprehensive information about the study, including its purpose, procedures, potential risks and benefits, and their rights as participants using an information sheet. Participants who were willing to partake in the study were asked to sign a consent form. The researcher ensured that participants' personal information and responses were kept confidential and anonymous to protect their privacy. This involved assigning codes or pseudonyms to participants instead of using their real names and securing data storage to prevent unauthorized access.

Results

Socio-Demographic Characteristics of the Respondents

In Table 1 The sample was predominantly female (72.8%, $n = 182$), consistent with Ghana's feminised nursing workforce (Ghana Health Service, 2022). In terms of age, the respondents are concentrated in the 31–40-year age bracket (59.6%, $n = 149$). The majority of respondents were nurses (78.4%, $n = 196$). Regarding educational qualification, over four in five held either a Diploma (43.6%) or a first Degree (40.8%). The majority (65.6%) were based at the district hospital, with health centres (26.4%) and CHPS compounds (8.0%) constituting the remainder. Nearly two-thirds (64.0%) had been in the service for five years or fewer.

Table 1
Socio-Demographic Characteristics of
the Respondents

Variable N = 250	Frequency (%)
Sex	
Female	182 (72.8%)
Male	68 (27.2%)
Age	
20–30 years	50 (20.0%)
31–40 years	149 (59.6%)
41–50 years	48 (19.2%)
51–60 years	3 (1.2%)
Marital Status	
Married	137 (54.8%)
Single	109 (43.6%)
Divorced	3 (1.2%)
Prefer not to say	1 (0.4%)
Profession	
Nurse	196 (78.4%)
Physician	22 (8.8%)
Pharmacist	18 (7.2%)
Others	14 (5.6%)
Level of Education	
Diploma	109 (43.6%)
Degree	102 (40.8%)
Advanced Diploma	14 (5.6%)
Masters' Degree	25 (10.0%)
Type of Facility	
District Hospital	164 (65.6%)
Health Centre	66 (26.4%)
CHPS Compound	20 (8.0%)

Variable N = 250	Frequency (%)
Sex	
Years of Experience	
1–5 years	160 (64.0%)
6–10 years	40 (16.0%)
11–15 years	35 (14.0%)
16 + years	14 (5.6%)

Level of Awareness of and Adherence to the WHO “High Alert Medication Without Harm Protocol Among Health Professionals

As presented in Table 2, level of awareness in terms of knowledge and attitudinal dimensions related to the WHO 'Medication Without Harm' protocol among health professionals is depicted. In total, 58.8% (n = 147) of respondents are aware of the WHO protocol, while 41.2% (n = 103) are not. The majority of health professionals (64.8%) demonstrated adherence to the WHO Medication Without Harm policy, with physicians recording the highest adherence rate (81.8%) compared to nurses (61.7%) and pharmacists (71.9%). The statistically significant association between profession and adherence ($\chi^2 = 11.847$, $p = 0.008$) with a small-to-moderate effect size (Cramér's $V = 0.22$) suggests that professional cadre meaningfully influences medication safety compliance. The dominant source of awareness across all 250 respondents was formal schooling (79.6%), rather than post-qualification mechanisms such as in-service training (7.2%), workshops (8.4%), or WHO-affiliated outreach. Regarding training depth only 8.4% held advanced or specialised certification, while 58.0% reported only normal training typically routine, school-integrated instruction. With this, physicians and pharmacists were more likely to report advanced-level training, compared to nurses predominantly clustered in introductory and normal categories ($\chi^2=26.25$, $V = 0.24$, $p < 0.001$). Majority (41.2%) of the respondents are not familiar with the WHO '5 Moments for Medication Safety' tool, and only 10.8% were proficient enough to train others. Significant profession-level variation existed ($\chi^2=21.89$, $V = 0.22$, $p = 0.001$). Physicians showed the highest proficiency, with 27.3% able to train others and 45.5% having heard of the tool though not yet applied it. Nurses were distributed across all familiarity levels, with 38.3% never having heard of the tool. Among Pharmacists, most of them (61.1%) had never heard of the tool despite their professional mandate centring on medication management, a disjuncture that points to a structural gap in continuing education for this cadre within the Bosomtwe District.

From the multiple responses, nearly half of respondents correctly identified key high-risk situations in medication safety such as polypharmacy (122; 48.8%), look-alike/sound-alike drugs (113; 45.2%), and transitions of care (102; 40.8%). Regarding attitudes toward preventability, significant professional differences emerge ($\chi^2=39.107$, $V = 0.288$, $p < 0.001$). Thus, pharmacists are more likely to view it as entirely preventable (94.4%), compared to Physicians (40.9%) and nurses (29.1%), even though most respondents (39.2% n = 98) overall see harm as minimally preventable, indicating a more proactive safety mindset among pharmacists. Despite this variation, there is strong consensus on safety culture where 87.6% (n = 219) consider near-miss reporting important, with a significant association across professions ($\chi^2=13.299$, $V =$

0.170, $p = 0.010$), and full agreement among Physicians (100%). While 61.2% ($n = 153$) are confident and 29.2% ($n = 73$) very confident in identifying and managing high-alert medications, a notable 8.8% ($n = 22$) remain not confident, mostly among nurses (10.2%).

Table 2
Level of Awareness of and Adherence to the WHO High Alert Medication Without Harm Protocol Among Health Professionals

Variable	Overall N = 250 (%)	Profession			χ^2	Cramér's V	p- Value
		Nurse (%)	Physician (%)	Pharmacist			
Overall Awareness							
Not Aware (No)	103 (41.2%)	78 (39.8%)	5 (22.7%)	14 (77.8%)	13.215	0.23	0.004
Aware (Yes)	147 (58.8%)	118 (60.2%)	17 (77.3%)	4 (22.2%)			
Overall Adherence							
Adherent	162 (64.8%)	121 (61.7%)	18 (81.8%)	23 (71.9%)	11.847	0.22	0.008
Non-adherent	88 (35.2%)	75 (38.3%)	4 (18.2%)	9 (28.1%)			
Source of First Awareness of Medication Without Harm							
School/Academic training	199 (79.6%)	157 (80.1%)	14 (63.6%)	17 (94.4%)			
Workshop	21 (8.4%)	12 (6.1%)	6 (27.3%)	1 (5.6%)			
In-service Training	18 (7.2%)	16 (8.2%)	2 (9.1%)	0 (0.0%)			
Lecture	12 (4.8%)	11 (5.6%)	0 (0.0%)	0 (0.0%)			
Level of Training on WHO 'Medication Without Harm' Principles							
Introductory/Basic	51 (20.4%)	40 (20.4%)	5 (22.7%)	1 (5.6%)	26.247	0.236	< 0.001
Normal Training	145 (58.0%)	114 (58.2%)	10 (45.5%)	12 (66.7%)			
Moderate/Intermediate	33 (13.2%)	32 (16.3%)	1 (4.5%)	0 (0.0%)			
Advanced/Specialized	21 (8.4%)	10 (5.1%)	6 (27.3%)	5 (27.8%)			
Familiarity with WHO '5 Moments for Medication Safety' Tool							
Never heard of it	103 (41.2%)	75 (38.3%)	5 (22.7%)	11 (61.1%)	21.889	0.218	0.001

Variable	Overall N = 250 (%)	Profession			χ^2	Cramér's V	p- Value
		Nurse (%)	Physician (%)	Pharmacist			
Overall Awareness							
Heard but never used	64 (25.6%)	49 (25.0%)	10 (45.5%)	1 (5.6%)			
Use occasionally	56 (22.4%)	49 (25.0%)	1 (4.5%)	3 (16.7%)			
Proficient/can train others	27 (10.8%)	20 (10.2%)	6 (27.3%)	0 (0.0%)			
Identified High-Risk Medication Situations (Multiple Response, n = 337)							
Polypharmacy (> 5 medications)	122 (48.8%)						
Look-alike/sound-alike drugs	113 (45.2%)						
Transitions of care	102 (40.8%)						
Perspective on Preventability of Medication Harm (50% statistic)							
Minimally Preventable	98 (39.2%)	89 (45.4%)	3 (13.6%)	0 (0.0%)	39.107	0.288	< 0.001
Somehow Preventable	63 (24.8%)	49 (25.0%)	10 (45.5%)	1 (5.6%)			
Entirely Preventable	89 (35.6%)	57 (29.1%)	9 (40.9%)	17 (94.4%)			
Clinical Importance of Near-Miss Reporting (n = 242)							
Important/Necessary	219 (87.6%)	172 (87.8%)	22 (100%)	16 (88.9%)	13.299	0.17	0.01
Not very necessary	19 (7.6%)	15 (7.7%)	0 (0.0%)	2 (11.1%)			
Not necessary at all	4 (1.6%)	2 (1.0%)	0 (0.0%)	0 (0.0%)			
Confidence in Managing High-Alert Medications (n = 248)							
Not Confident	22 (8.8%)	20 (10.2%)	1 (4.5%)	0 (0.0%)	14.604	0.177	0.006
Confident	153 (61.2%)	126 (64.3%)	8 (36.4%)	10 (55.6%)			

Variable	Overall N = 250 (%)	Profession			χ^2	Cramér's V	p- Value
		Nurse (%)	Physician (%)	Pharmacist			
Overall Awareness							
Very Confident	73 (29.2%)	48 (24.5%)	13 (59.1%)	8 (44.4%)			

Socio-Demographic Characteristics associated with WHO protocol awareness

In Table 3, the Chi-square analyses revealed statistically significant associations between awareness and four socio-demographic variables: sex ($\chi^2=9.22$, $V = 0.19$, $p = 0.002$), profession ($\chi^2=13.22$, $V = 0.23$, $p = 0.004$), type of facility ($\chi^2=10.94$, $V = 0.21$, $p = 0.004$), and years of experience ($\chi^2=17.81$, $V = 0.27$, $p < 0.001$). All effect sizes were small (Cramér's $V < 0.30$), indicating that while the associations were statistically significant, none of these variables alone strongly determines awareness. Age, marital status, and level of education showed no significant associations with awareness ($p > 0.05$). However, male respondents exhibited a higher awareness level (75.0%) compared to female respondents (52.7%), a disparity that warrants consideration given the female-dominant composition of the workforce. Also, pharmacists recorded the lowest awareness rate (22.2%), compared to physicians (77.3%) and nurses (60.2%), despite pharmacists being the cadre most directly engaged in medication-related professional work. In addition, awareness was highest among health workers with 1–5 years of experience (66.2%) and dropped sharply to 14.3% among those with 16 or more years of service, suggesting that longer-tenured professionals have not been reached by more recent WHO guidance and that continuing education mechanisms are largely absent in the district system.

Table 3
Socio-Demographic Characteristics associated with WHO protocol awareness

Variable N = 250	Awareness		χ^2	Cramér's V	p-value
	No (%)	Yes (%)			
Sex					
Female	86 (47.3%)	96 (52.7%)	9.221	0.192	0.002
Male	17 (25.0%)	51 (75.0%)			
Age					
20–30 years	16 (32.0%)	34 (68.0%)	4.567	0.135	0.206
31–40 years	66 (44.3%)	83 (55.7%)			
41–50 years	21 (43.8%)	27 (56.2%)			
51–60 years	0 (0.0%)	3 (100.0%)			
Marital Status					
Married	56 (40.9%)	81 (59.1%)	0.828	0.058	0.843
Single	46 (42.2%)	63 (57.8%)			
Divorced	1 (33.3%)	2 (66.7%)			
Prefer not to say	0 (0.0%)	1 (100.0%)			
Profession					
Nurse	78 (39.8%)	118 (60.2%)	13.215	0.23	0.004
Physician	5 (22.7%)	17 (77.3%)			
Pharmacist	14 (77.8%)	4 (22.2%)			
Others	6 (42.9%)	8 (57.1%)			
Level of Education					
Diploma	41 (37.6%)	68 (62.4%)	2.114	0.092	0.549
Degree	44 (43.1%)	58 (56.9%)			
Advanced Diploma	5 (35.7%)	9 (64.3%)			
Masters' Degree	13 (52.0%)	12 (48.0%)			
Type of Facility					
District Hospital	67 (40.9%)	97 (59.1%)	10.943	0.209	0.004
Health Centre	34 (51.5%)	32 (48.5%)			
CHPS Compound	2 (10.0%)	18 (90.0%)			

Variable N = 250	Awareness		χ^2	Cramér's V	p-value
	No (%)	Yes (%)			
Sex					
Years of Experience					
1–5 years	54 (33.8%)	106 (66.2%)	17.805	0.267	< 0.001
6–10 years	18 (45.0%)	22 (55.0%)			
11–15 years	19 (54.3%)	16 (45.7%)			
16 + years	12 (85.7%)	2 (14.3%)			

Discussions

In 2017, a release from the World Health Organization (WHO) third Global Patient Safety Challenge, Medication Without Harm (the Challenge) which was aiming to reduce severe avoidable medication-related harm by 50% globally over the ensuing five years, marking a significant uplift in medication safety initiatives. Since then a lot of studies have been conducted in areas of patients adherence. The study was carried out to assess the level of awareness and adherence to WHO "Medication Without Harm" protocol among health professionals in a district in Ghana.

This study found a moderate level of awareness of the WHO "Medication Without Harm" protocol among health professionals in Bosomtwe District, with just over half of the health professionals are aware of the protocol. Pharmacists recorded the lowest awareness, despite their profession being most centrally engaged in medication management. Awareness was highest among those with one to five years of work experience. The current finding of moderate awareness relates to the WHO Medication Without Harm Framework (World Health Organization, 2017) which emphasises improving awareness and knowledge as a foundational prerequisite for safe prescribing, dispensing, and administration.

On the other hand, the heavy reliance on formal schooling as the primary source of awareness suggests that post-qualification knowledge reinforcement mechanisms, a pillar of the framework's "Medicines" domain, are structurally absent in Bosomtwe District. Given that, the framework targets high-alert medications as a priority concern, requiring active engagement by all cadres which is particularly troubling. In relation to the Theory of Planned Behaviour (Ajzen, 1991), behavioural intentions toward safe medication practices are shaped by attitudes, subjective norms, and perceived behavioural control. Moreover, the inadequate awareness, particularly among pharmacists and long-tenured staff, undermines all three components. Thus, professionals cannot form accurate intentions without sufficient knowledge. The gender gap, where males showed higher awareness than females also suggests that access to updated information is inequitably distributed, with structural and contextual factors mediating awareness levels.

Empirically, Parand et al. (2014) and Sammer et al. (2010) support the current finding on the moderate level of awareness, noting that health professionals in low- and middle-income countries (LMICs) exhibit

knowledge

gaps in patient safety protocols. Donaldson et al. (2017) similarly reported in the landmark WHO global patient safety report that awareness of WHO safety tools remains low in sub-Saharan Africa, attributable to inadequate institutionalisation of continuing education. Also, a large cross-sectional study among 847 Pakistani physicians report that approximately 46.4% possessed only moderate knowledge of HAM administration and regulation (Mustafa et al., 2022). Conversely, Mekonnen et al. (2018) found that pharmacists in Ethiopia generally demonstrated higher medication safety knowledge than nurses, which contradicts the current finding that pharmacists in Bosomtwe District recorded the lowest awareness. This discrepancy may be explained by the small pharmacist sample ($n = 18$) in the present study, limiting representativeness. Also, reliance on self-report and potential recall bias may inflate or misrepresent true awareness levels. Moreover, while the study found that sex, profession, type of facility, and years of experience are significantly associated with awareness of WHO "High Alert Medication Without Harm" protocol among health professionals, age, marital status, and level of education showed no significant associations with awareness ($p > 0.05$).

In the area of adherence, this study found majority of health professionals demonstrating adherence to the WHO Medication Without Harm policy, with physicians recording the highest adherence rate. Formal schooling was the dominant source of adherence. The current findings that knowledge of the WHO policy, training, resource availability, staffing level, peer/institutional expectations, and workload are significantly associated with the WHO protocol adherence, correlate with the Theory of Planned Behaviour (Ajzen, 1991). Suh (2021) explained that the TPB predicts that a clinician's adherence to medication safety protocols (the behaviour) will be determined by their belief that protocol adherence is beneficial (attitude), their perception that peers, supervisors, and institutional norms endorse such behaviour (subjective norms), and their confidence that they possess the knowledge, skills, and resources to adhere (perceived behavioural control) (Suh, 2021).

Training depth was predominantly basic as fewer staff were holding advanced or specialised certification. Proficiency with the WHO "5 Moments for Medication Safety" tool was also low were not familiar with the tool. Also, the sample com where females dominate may account for these variations. In contrast with the current high adherence, evidence in Nigeria found that fewer than 35% of nurses demonstrated adequate adherent to high-alert medication protocols, while only 28% of hospital pharmacists routinely conducted medication reconciliation during patient transfers in Tanzania (Jafaru & Abubakar, 2022; Mwita et al., 2024).

Limitation

While these findings remain pertinent to scholarship, the methodological limitations of the study are of concern. Thus, the cross-sectional survey design and reliance on self-reported data introduce recall and social desirability biases, which can affect the accuracy of responses and the strength of associations. In addition, the use of the chi-square test restricts analysis to bivariate relationships and does not control for confounding variables such as training exposure, access to clinical information systems, workload, and time pressure that may independently drive awareness level. The use of a cross-sectional design limits the ability to establish causal relationships between socio-demographics and awareness level. As a result, the

observed associations reflect patterns of preference rather than cause-and-effect relationships. Despite the limitations, the findings call for the institutionalisation of mandatory continuing professional development (CPD) programmes focused on WHO medication safety protocols across all cadres in the Bosomtwe District Health Directorate. The Ghana Health Service should mandate regular training updates particularly targeting pharmacists and long-tenured staff and integrate the "5 Moments for Medication Safety" tool into routine induction and refresher curricula. Future studies should adopt longitudinal or mixed-methods designs to more accurately assess knowledge retention and its behavioral translation and should include larger stratified samples of pharmacists to enable meaningful professional comparisons.

Conclusion

The implementation of the World Health Organization medication safety protocol depends on both individual understanding and the strength of the health system environment, as gaps in recognition of high-risk situations and uneven support structures limit consistent practice. Therefore, policy efforts must go beyond awareness and adherence campaigns and focus on strengthening training, staffing, resources, and institutional expectations in order to achieve meaningful and sustained improvements in medication safety.

Declarations

Ethics approval and consent to participate

Ethical clearance for the study was obtained from the Committee on Human Research, Publications and Ethics (**CHRPE**) at Kwame Nkrumah University of Science and Technology, under approval ID:

CHRPE/AP/740/24. Written informed consent was obtained from all participants prior to their inclusion in the study. Participation was voluntary, and respondents were assured of anonymity, confidentiality, and their right to withdraw at any stage without penalty. Data were stored securely and used solely for research purposes, in accordance with standard ethical guidelines for human subjects' research.

Consent for publication

All authors have agreed to publish in BMC Public Health

Data sharing Statement

All data generated or analysed during this study are included in this manuscript

Competing interests

Authors declares no competing interest

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Authors' contributions

All authors made adequate contributions as indicated in the submission

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