

The Informal Health Sector in Tuberculosis Infection Prevention and Control: A Case Study of the Knowledge and Awareness of Patent Medicine Vendors in a Semi-urban Setting in South-west Nigeria

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**THE INFORMAL HEALTH SECTOR IN TUBERCULOSIS INFECTION
PREVENTION AND CONTROL: A CASE STUDY OF THE KNOWLEDGE AND
AWARENESS OF PATENT MEDICINE VENDORS IN A SEMI-URBAN SETTING IN
SOUTH-WEST NIGERIA.**

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ABSTRACT

Background/Objective: Patent Medicine Vendors (PMVs) are the first line of care for most suspected tuberculosis patients in resource-limited settings, given their proximity and familiarity with the community. This study was conducted among PMVs to evaluate their knowledge, attitudes, and preventive practices (KAP) regarding tuberculosis patients, with the aim of enhancing tuberculosis care in Nigeria.

Methods: This study used a validated structured questionnaire, adapted from the WHO-KAP study guide, to elicit responses from PMVs. The data generated were analysed using the SPSS statistical package.

Results: A total of 349 PMVs participated in the study, comprising 104 (29.8%) males and 245 (70.2%) females. Most respondents were 21-30 years old (134/38.4%) and had never been trained for tuberculosis infection prevention and control (207/59.3%). A good number of the respondents had adequate knowledge (196/56.2%), good attitude (199/57%) and good preventive practices (279/79.9%). However, we obtained the following KAP scores: an overall adequate knowledge score of 56.1%, an overall good attitude score of 66.9%, and an overall good preventive practices score of 79.5%. The differences between the two study sites regarding knowledge ($P=0.012$), attitude ($P<0.001$), and preventive practices ($P=0.039$) were statistically significant. Location, gender, age, education, work experience, tuberculosis training, and the frequency of seeing tuberculosis patients were the predictors of good KAP scores.

Conclusions: The existence of KAP gaps among the informal health sector, represented by PMVs, has negative implications for tuberculosis prevention and control. However, these gaps reinforced the need for a more robust, focused awareness campaign to enhance tuberculosis care.

KEYWORDS: Knowledge attitude and practice; Patent medicine vendors; Tuberculosis; Infection prevention and control; Nigeria.

1.0 INTRODUCTION

Over the years, tuberculosis (TB) has persisted as a serious public health threat of global concern, ravaging all human populations, with more problems for the populations of developing countries like Nigeria. TB, caused by *Mycobacterium tuberculosis*, has remained a significant cause of ill health and the leading cause of death, ranking above HIV/AIDS, with almost one-fourth of the world's population affected by the infectious agent [1,2]. TB cure and transmission of infection are expected to be curtailed with timely diagnosis and treatment and an appropriate antibiotic regimen [3]. However, early detection of infectious TB cases will decrease the number of infectious individuals in the community and limit transmission [4]. According to the WHO, TB prevention and control comprises a combination of measures intended to curtail the risk of TB transmission within the community and is categorised into three hierarchies: administrative, environmental, and respiratory protection controls [3].

In 2021, Nigeria ranked sixth among the eight global countries and first in Africa, contributing two-thirds of the global TB cases with an incidence rate of 219 per 100,000 population, a treatment coverage of 44%, and a case fatality ratio of 28% [3]. Nigeria is also ranked among the ten countries that contributed the most significant gaps between notifications of new and relapse (incident) TB and the best estimates of TB incidence in 2020. The WHO has also classified Nigeria among the thirty (30) countries on the list of high-burden countries for TB, HIV-associated TB, and MDR/RR-TB [5].

Making progress toward achieving Universal Health Coverage (UHC), which stipulates health for all, is crucial to attaining TB infection control [1]. This achievement is expected to facilitate the Sustainable Development Goals (SDGs) targets for 2030, which aim to achieve a 90% reduction in the number of TB deaths and 80% reduction in TB incidence rate compared with levels in 2015 [6,7]. Therefore, there is a need to prioritise TB awareness programs for all, especially at the community level, and engage in multi-sectoral activities geared towards enhancing TB care.

However, poor implementation of UHC, barriers to healthcare access, patients' knowledge and beliefs, healthcare costs, and weak health and social infrastructure in many developing countries, including Nigeria, are significant factors impeding the effective utilisation of TB care services. The combined effect of these factors gravitates individuals in the community towards patronising the informal private health sector, such as the Patent Medicine Vendors (PMVs) [2,7,8].

PMVs operate in the informal private health sector (known as drug shops or chemists) for profit without formal pharmacy or medical training. The Pharmacist Council of Nigeria (PCN) licenses them to retail proprietary and over-the-counter medications, and they have become a household name in many parts of Nigeria. Their services have become acceptable to many who patronise them for different types of drugs ranging from over-the-counter (OTC) medications and prescription drugs, including antibiotics and family planning pills, and for various health needs, including suspected TB cases [8,9].

The patronage of the PMVs is high in rural and semi-urban regions of the country as compared to the urban centres, and they constitute the first point of care for many residents of these communities [9,10]. It is well documented that the PMVs account for well over 40% of private healthcare sector operations and outnumber other cadres of private healthcare workers in the country [9]. They are reported to be closer to individuals in communities than any other healthcare sector service providers, and they serve as one of the channels for accessing healthcare among the Nigerian population [11]. This study was designed to assess the informal healthcare providers (PMV) knowledge of TB, their attitude towards TB and TB-infected patients, and their practices with TB patients, which is expected to facilitate the formulation of recommendations for enhancing TB infection prevention and control (IPC) in the South-West region of Nigeria.

2.0 MATERIALS AND METHODS

2.1 Eligibility

Male and female registered PMVs aged 18 years and above willing to participate were included in the study, and all of them had their shops in the sampled communities and operated for at least one (1) year prior to the study. Mobile PMVs, those unwilling to participate, and those who did not return or complete their questionnaires were excluded from the study.

2.2 Study location

The study was conducted in Ede district of Osun State. Ede comprises two Local Government Areas (LGAs): Ede North and Ede South. The region has about 8 pharmacies and numerous PMVs, serving a combined population of 159,866 according to the 2006 population census, and a landmass of 330 square kilometres. The inhabitants are predominantly farmers, artisans and petty traders.

2.3 Sample Size and Sampling Technique

The study participants were selected through a two-level multi-stage sampling technique. In stage one, we used a simple random method to select one region from the ten identified semi-urban areas of Osun State. Ede region, which comprised two LGAs, was randomly selected for the study. In stage two, the PMVs were grouped by political ward within the two LGAs for ease of sampling, and a systematic sampling method was used to select two of the three PMVs to meet the sample size requirements.

The number of eligible participants was determined by the formula ($n = Z^2PQ/d^2$) for sample size determination in a cross-sectional study [12], where n represents the sample size; Z represents the standard normal value (1.96); P represents good knowledge of TB among the PMVs; Q represents $1-P$, while d represents the margin of error (0.05). Therefore, P was set at 67.9%, corresponding to the prevalence of respondents demonstrating adequate knowledge in a previous study [13]; this yielded a sample size of 335. However, 370 questionnaires were distributed, considering a 10% non-response rate, while 349 were returned complete, giving a response rate of 94.3%.

2.4 Study Design and Data Collection

The study used a cross-sectional descriptive design to collect responses from informal healthcare providers, specifically PMVs. The data collection instrument was adapted from the WHO-KAP study guide, with some adjustments to align with the purpose of this study. The tool was validated by a senior Pharmacist, who is conversant with PMV operations, and a Professor, who is familiar with KAP studies. Thereafter, the tool was pretested among PMVs outside the study area, and the feedback received from the pretest was used to revise the questionnaire. The instrument was designed and administered in English and interpreted to the participants who preferred using Yoruba by trained research assistants fluent in Yoruba language.

The questionnaire was divided into four (4) sections; section 1 included respondents' social-demographic characteristics, while section 2 elicited responses on the PMVs' general knowledge of TB, TB treatment, and TB diagnosis. Section three involved questions on the PMVs attitudes, care-seeking behaviour and stigma towards TB patients, while section four was to generate responses on TB preventive practices. The study was conducted between February and April, 2025.

2.5 Statistical Analysis

Data generated from the fieldwork were captured and cleaned in Excel 2013, then exported and analysed using SPSS Statistics 23 (IBM SPSS Inc.). P-values of less than 0.05 were considered significant at 95% confidence interval. Frequency, percentages, chi-square, bivariate analysis and odds ratio were performed on the data to determine the occurrence, significance, KAP score and the association between independent variables and KAP.

3.0 RESULTS

3.1 Social Demographic Characteristics of the Respondents

A total of 349 PMVs participated in the study, comprising 104 (29.8%) males and 245 (70.2%) females. The predominant social demographic characteristics included young people between 21-30 years age group (157/45%), married PMVs (289/82.3%), secondary level education (237/67.9%), and work experience of 1-10 years (255/73.1%), while almost three-fifth (207/59.3%) of the PMVs had never been trained on TB IPC. The social demographic characteristics of the respondents are shown in **Table 1**.

3.2 General Knowledge of TB among Study Participants

The majority (289/82.8%) of the respondents opined that TB is a very serious infection, while almost one-third (103/29.5%) agreed that TB is very serious in their community. Meanwhile, 171 (49%) of the respondents had good knowledge of TB signs and symptoms. However, 188 (53.9%) of the respondents could not identify the disease's mode of transmission, while 161 (46.1%) recognised the pathogen's airborne transmission. Regarding TB prevention, 120 (34.4%) respondents knew the method, while 229 (65.6%) could not identify the correct method.

Meanwhile, 147 (42.1%) and 335 (96%) of the respondents, respectively, knew that anybody could be infected and that TB is a curable disease. However, more than half (193/55.3%) of the respondents could not identify the Directly Observed Treatment Short-course (DOTS) as the means of curing the disease. About three-fourths of the respondents understood that TB treatment regimen lasts for 6-8 months (256/73.3%) and that therapy should be continued after symptoms subside (266/76.2%), while about two-fifths (139/39.9%) believe that TB diagnosis and treatment are for a fee. Most respondents (309/88.7%) agreed that failure to complete the regimen could lead to more severe TB infection, whereas one-fifth (70/20.1%) knew the correct number of drugs for the treatment. However, in the case of

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Table 1: Socio-Demographic Characteristics of Study Participants

Variable	Ede South	Ede North	Total	P-
value	N (%)	N (%)	N (%)	
Gender				0.005
Male	42 (23.2)	62 (36.9)	104 (29.8)	
Female	139 (76.8)	106 (63.1)	245 (70.2)	
Age				0.001
21-30	97 (53.6)	60 (35.7)	157 (45)	
31-40	62 (34.3)	62 (36.9)	124 (35.5)	
41-50	18 (9.9)	34 (20.2)	52 (14.9)	
>50	4 (2.2)	12 (4.8)	16 (3.4)	
Marital status				0.434
Single	30 (16.6)	22 (13.1)	52 (14.9)	
Married	149 (82.3)	140 (83.3)	289 (82.3)	
Divorced	2 (1.1)	4 (2.4)	6 (1.7)	
Widow/Widower	--	2 (1.2)	2 (0.6)	
Education				0.025
Primary	10 (5.5)	4 (2.4) --	14 (4.0)	
Secondary	113 (62.4)	124 (73.8)	237 (67.9)	
Tertiary	58 (32)	40 (23.8)	98 (28.1)	
Work experience (years)				<0.001
1-10	151 (83.4)	104 (61.9)	255 (73.1)	
11-20	24 (13.3)	42 (25)	66 (18.9)	
>20	6 (3.3)	22 (13.1)	28 (8)	
TB Training (years)				0.261
≤5	52 (28.7)	60 (35.8)	112 (32.1)	
6-10	16 (8.8)	14 (8.3)	30 (8.6)	
Never	113 (62.4)	94 (56)	207 (59.3)	
TB Patient frequency				0.036
Weekly	18 (9.9)	14 (8.3)	32 (9.2)	
Monthly	36 (19.9)	24 (14.3)	60 (17.2)	
Quarterly	38 (21)	22 (13.1)	60 (17.2)	
Yearly	89 (49.2)	108 (64.3)	197 (56.4)	

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Table 2: General TB Knowledge of the Study Participants

Variable	Ede South N (%)	Ede North N (%)	Total N (%)	P-value	OR	95%CI
TB seriousness				0.349		
Very serious	145 (80.1)	144 (85.7)	289 (82.8)			
Somewhat serious	14 (7.7)	8 (4.8)	22 (6.3)			
Not very serious	22 (12.2)	16 (9.5)	38 (10.9)			
Community TB seriousness				0.001		
Very serious	39 (21.5)	64 (38.1)	103 (29.5)			
Somewhat serious	50 (27.6)	28 (16.7)	78 (22.3)			
Not very serious	92 (50.8)	76 (45.2)	168 (48.1)			
Knowledge of Signs & Symptoms				0.434		
Good	75 (41.4)	96 (57.1)	171 (49)			
Poor	106 (58.6)	72 (42.9)	178 (51)			
Knowledge of TB Transmission				<0.001		
Good	89 (49.2)	72 (42.9)	161 (46.1)			
Poor	146 (50.8)	96 (57.1)	188 (53.9)			
Knowledge of TB Prevention				<0.001		
Good	84 (46.4)	36 (21.4)	120 (34.4)			
Poor	97 (53.6)	132 (78.6)	229 (65.6)			
Who can be infected				0.261		
Good	95 (52.5)	52 (31)	147 (42.1)			
Poor	86 (47.5)	116 (69)	202 (57.9)			
Can TB be cured				0.871		
Yes	173 (95.6)	162 (96.4)	335 (96)			
No	8 (4.4)	6 (3.6)	60 (17.2)			
Knowledge of TB Cure				<0.001		
Good	64 (35.4)	92 (54.8)	156 (44.7)			
Poor	117 (64.6)	76 (45.2)	193 (55.3)			
Treatment duration				0.383		
Good	134 (74)	122 (72.6)	256 (73.3)			
Poor	47 (26)	46 (27.4)	93 (26.7)			
Drugs continuation				0.206		
Correct response	136 (75.1)	130 (77.4)	266 (76.2)			
Wrong response	45 (24.9)	38 (22.6)	83 (23.8)			
Failure to complete regimen can lead to more severe TB infection				0.006		
Correct response	151 (83.4)	158 (94)	309 (88.7)			
Wrong response	30 (16.6)	10 (6)	40 (11.3)			
Cost of TB diagnosis/treatment				0.110		
Free	114 (63)	96 (57.1)	210 (60.1)			
With fee	67 (37)	72 (42.9)	139 (39.9)			
Number of drugs for TB treatment				0.115		
Correct response	34 (18.8)	36 (21.4)	70 (20.1)			
Wrong response	147 (81.2)	132 (78.6)	301 (79.9)			
knowledge of TB detection				0.5		
Good	74 (40.9)	66 (39.3)	140 (40.1)			
Poor	107 (59.2)	102 (60.7)	209 (59.9)			
Overall Knowledge Scores				0.012	1.73	1.13-2.65
Good	90 (49.7)	106 (63.1)	196 (56.2)			
Poor	91 (50.3)	62 (36.9)	153 (43.8)			
Score (N=12)	6.46 (53.8)	6.99 (58.3)	6.73 (56.1)			

OR: Odds Ratio; CI: Confidence Interval

TB detection, about two-fifths (140/40.1%) of the respondents had good knowledge of the methods (GeneXpert, sputum smear microscopy and chest X-ray) for diagnosing TB. The respondents' general knowledge of TB is shown in **Table 2**.

3.3 TB Attitudes and Care-seeking Behaviour of the Respondents

A large number (257/73.6%) of the respondents do not believe they can be infected with TB. However, the respondents opined that they would express different reactions if they were infected with TB, including fear (84/24.1%), surprise (60/17.2%), embarrassment (53/15.2%), and sadness (64/18.3%). Conversely, about one-fourth (88/25.2%) of the respondents opined that they would be calm if they were infected with TB. 263 (75.4%) of the respondents reported a positive attitude toward seeking care at a health facility for TB symptoms, while 50 (14.4%) reported they would consider self-treatment. We requested to know the points at which the respondents would go to a health facility in the event they had symptoms of TB and we got responses such as: 'when self-treatment fails' (68/19.5%), 'when TB symptoms last for 3-4 weeks' (88/25.2%) while 193 (55.3%) of the respondents opined that they would go to the health facility as soon as they realized they have TB symptoms.

Regarding the attitudes of PMVs towards TB patients, we first asked why suspected TB patients do not seek care at designated TB health facilities. We got the following responses: cost-related issues (112/32.1%), transportation difficulties (88/25.2%), suspected TB patients are not sure where to go (74/21.2%), attitudes of health care workers (38/10.9%), and suspected TB patients do not want to know that something is wrong (37/10.6%). Secondly, we requested to know the first thing the respondents would do to a patient with a 'prolonged cough' who came to their facility for medical help, most of the PMVs (265/75.9%) opined that they would refer the patient to a health facility, while 72 (20.6%) of the respondents opined that they would vend drugs to the patient, while 12 (3.4%) stated that they had never had such patients. Finally, we asked whether the PMVs had referral centres for suspected TB patients and whether they followed up on such patients. However, 227 (65%) agreed they had TB referral centres, while 269 (77.1%) agreed they usually follow up on suspected TB patients. The respondents' TB attitudes and care-seeking behaviour are presented in **Table 3**.

3.4 TB Preventive Practices of the Respondents

Here, we sought to know the PMVs' preventive practices towards suspected TB patients. The majority of the respondents had good practices, such as 'always instructing suspected TB patients to cover their mouths when coughing' (293/84%), 'always instructing suspected TB patients to cover their noses/mouths when sneezing' (315/90.3%), and 'always instructing suspected TB patients to ensure cross-ventilation in their homes' (280/80.2%). Meanwhile, about two-thirds (223/63.9%) of the respondents accurately identified the objects suspected TB patients can use to cover their mouths/noses when coughing or sneezing. TB preventive practices of the respondents are listed in **Table 4**.

3.5 KAP Scores of Respondents

We observed that 196 (56.2%) respondents had good knowledge comprising 106 (63.1%) respondents from Ede North and 90 (49.7%) from Ede South LGAs, and the respondents had overall adequate knowledge score of 56.1%, comprising 53.8% and 58.3% in Ede South and North LGAs respectively (**Table 2**); and this difference was statistically significant ($P=0.012$; $OR=1.73$; $95\%CI=1.13-2.65$). Also, Ede North had 73% overall good attitude score,

214 **Table 3: TB Attitudes and Care-Seeking Behaviour of the Respondents**

Variable	Ede South N (%)	Ede North N (%)	Total N (%)	P-value	OR	95%CI
Can you get TB				<0.001		
Yes	66 (36.5)	26 (15.5)	92 (26.4)			
No	115 (63.5)	142 (84.5)	257 (73.6)			
Your reaction if you had TB				<0.001		
Fear	44 (24.3)	40 (23.8)	84 (24.1)			
Surprise	27 (14.9)	33 (19.6)	60 (17.2)			
Embarrassment	26 (14.4)	27 (16.1)	53 (15.2)			
Sad/hopeless	26 (14.4)	38 (22.6)	64 (18.3)			
Calmness	58 (32)	30 (17.9)	88 (25.2)			
Who would you talk to if you had TB				0.005		
HCW	165 (91.2)	160 (95.2)	325 (93.2)			
Family members	10 (5.5)	4 (2.4)	14 (3.9)			
No one	6 (3.3)	4 (2.4)	10 (2.9)			
What would you do in case you had TB symptoms				0.025		
Self-treatment	22 (12.2)	28 (16.7)	50 (14.4)			
Go to H/F	143 (79)	120 (71.4)	263 (75.4)			
Others	16 (8.8)	20 (11.9)	36 (10.3)			
At what point would you go to H/F if you had symptoms of TB				<0.001		
When self-treatment fails	38 (21)	30 (17.9)	68 (19.5)			
After 3-4wks of TB symptoms	62 (34.3)	26 (15.5)	88 (25.2)			
As soon as I realized I have TB symptoms	81 (44.8)	112 (66.7)	193 (55.3)			
Why do patients with cough not like going to H/F				<0.001		
Not sure where to go	44 (24.3)	30 (17.9)	74 (21.2)			
Cost	46 (25.3)	66 (39.3)	112 (32.1)			
Transportation difficulty	38 (21)	50 (29.8)	88 (25.2)			
Attitude of HCW	20 (11)	18 (10.7)	38 (10.9)			
Don't want to know						
Something is wrong	33 (18.2)	4 (2.4)	37 (10.6)			
Your response with patient with prolong cough				0.008		
Give drugs	48 (26.5)	24 (14.3)	72 (20.6)			
Refer to H/F	125 (69.1)	140 (83.3)	265 (75.9)			
No such patient	8 (4.4)	4 (2.4)	12 (3.4)			
Do you have a TB referrer center for your patients				0.009		
Yes	105 (58)	122 (72.6)	227 (65)			
No	76 (42)	46 (27.4)	122 (35)			
Do you follow up on your suspected TB patients				<0.001		
Yes	123 (68)	146 (86.9)	269 (77.1)			
No	46 (25.4)	20 (11.9)	66 (18.9)			
Not necessary	12 (6.6)	2 (1.2)	14 (4)			
Overall Attitude Scores				<0.001	3.58	2.29-5.61
Good	77 (42.5)	122 (72.6)	199 (57)			
Poor	104 (57.5)	46 (27.4)	150 (43)			
Score (N=7)	4.25 (60.7)	5.11 (73)	4.68 (66.9)			

OR: Odds Ratio; CI: Confidence Interval; H/F: Health Facility

217 **Table 4: TB Preventive Practices of the Respondents**

Variable	Ede South	Ede North	Total	P-value	OR
95%CI	N (%)	N (%)	N (%)		
Mouth covering when coughing				0.012	
Not at all	8 (4.4)	4 (2.4)	12 (3.4)		
Sometimes	14 (7.7)	30 (17.9)	44 (12.6)		
Always	159 (87.7)	134 (79.8)	293 (84)		
Mouth/Nose covering when sneezing				0.010	
Not at all	6 (3.3)	2 (1.2)	8 (2.3)		
Sometimes	20 (11)	6 (3.6)	26 (7.4)		
Always	155 (85.6)	160 (95.2)	315 (90.3)		
Mouth covering object				0.257	
Good	107 (59.1)	116 (69)	223 (63.9)		
Poor	74 (40.9)	52 (31)	126 (36.1)		
Cross Ventilation				0.006	
Not at all	9 (5.0)	2 (1.2)	11 (3.2)		
Sometimes	38 (21.0)	20 (11.9)	58 (16.6)		
Always	134 (74)	146 (86.9)	280 (80.2)		
Overall Practice Scores				0.039	1.75
1.02-3.01					
Poor	44 (24.3)	26 (15.5)	70 (20.1)		
Good	137 (75.7)	142 (84.5)	279 (79.9)		
Score (N=4)	3.05 (76.3)	3.31 (82.8)	3.18 (79.5)		

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while Ede South had 60.7%. In the same vein, 122 (72.6%) respondents from Ede North had a good attitude score as against 77 (42.5%) from Ede South, and the difference between the two LGAs in terms of attitude score was statistically significant ($P<0.001$; $OR=3.58$; $95\%CI=2.29-5.61$) as shown in **Table 3**. As for practice scores, the respondents had a good practice score of 79.5% (Ede South 76.3% and Ede North 82.8%), while 279 (79.9%) of the respondents had good preventive practice (Ede South 75.7% and Ede North 84.5%) towards suspected TB patients. The two study sites showed a significant difference ($P=0.039$; $OR=1.75$; $95\%CI=1.02-3.01$) in their preventive practices towards suspected TB patients (**Table 4**).

3.6 Effects of Social-Demographic Characteristics on KAP

Location was the only independent variable that significantly affected respondents' levels of knowledge ($P=0.01$; $OR=1.87$), attitudes ($P<0.01$; $OR=3.87$), and practices ($P=0.03$; $OR=1.97$). Other independent variables, such as 'educational status' of the respondents and their 'frequency of seeing TB patients', significantly affected the level of knowledge ($P<0.01/OR=3.04$ and $P=0.01/OR=2.02$) and attitudes ($P=0.01/OR=2.05$ and $P<0.01/OR=2.29$) of the respondents towards TB IPC, respectively. However, independent variables such as gender ($P=0.02$; $OR=2.32$), age ($P<0.01$; $OR=0.22$), and work experience ($P<0.01$; $OR=5.12$) of the respondents significantly affected the preventive practices of the respondents towards TB IPC, while TB training significantly ($P=0.02$; $OR=0.55$) affected the respondents' knowledge of TB (**Table 5**).

4.0 DISCUSSION

PMVs operate in the informal private health sector and serve as the first point of care for most suspected TB patients, given their proximity and familiarity with community members. Consequently, their importance to TB infection prevention and control (IPC) in resource-limited countries cannot be undermined [11,13-15]. Therefore, we conducted this study among PMVs to evaluate the knowledge, attitudes, and preventive practices of informal healthcare providers in a resource-limited setting such as Nigeria to enhance TB IPC.

The social demographic characteristics of the respondents showed a male-to-female ratio of about 3:7, which may suggest a female-dominated workforce [11], mostly in their productive age of less than 40 years (80.5%). The high level of PMVs (207/59.3%) who have never been trained in TB IPC may constitute a barrier to effective infection management. However, we found a significant

statistical difference between the two study sites among the following social demographics: gender (P=0.005), age (P=0.001), education (P=0.025), and work experience (P<0.001).

Many respondents (51%) could not accurately identify the five signs and symptoms of TB included in this study. This display of poor knowledge of signs and symptoms of TB among the majority of the respondents would mean that many of the PMVs as health practitioners in the informal health sector would be unable to correctly identify the signs and symptoms of TB, and this may impede the effectiveness of community TB case findings [15]; which perhaps may be the reason why some of the respondents (72/20.6%) would sell drugs to such patients when they present in their shops [15]. However, this inappropriate practice of PMVs could be one of the causes of TB drug resistance [15-17].

The findings of this study revealed that almost half (161/46.1%) of the respondents identified the correct method of TB infection transmission. In contrast, over half (53.9%) of the respondents had poor knowledge of TB infection

262 **Table 5: Effects of Social-Demographic Characteristics on KAP**

Variable	Knowledge		Attitude		Practice	
	OR(95%CI) P-value		OR(95%CI) P-Value		OR(95%CI) P-value	
Location						
Ede South						
Ede North	1.87(1.15-3.04)	0.01	3.87 (2.36-6.35)	<0.01	1.97 (1.08-3.58)	0.03
Gender						
Male						
Female	1.14 (0.63-2.05)	0.67	0.69 (0.38-1.25)	0.22	2.32 (1.17-4.59)	0.02
Age						
≤40						
>40	0.50 (0.23-1.08)	0.08	0.69 (0.32-1.48)	0.34	0.22 (0.09-0.58)	<0.01
Marital status						
Married						
Not married	1.57 (0.83-2.97)	0.17	1.21 (0.63-2.30)	0.57	1.12 (0.52-2.42)	0.77
Education						
Low Edu						
High Edu	3.04 (1.76-5.24)	<0.01	2.05 (1.20-3.50)	0.01	1.58 (0.81-3.11)	0.18
Work experience (years)						
≤10						
>10	1.78 (0.88-3.59)	0.11	1.00 (0.50-2.00)	0.99	5.12 (1.90-14.16)	<0.01
TB Training (years)						
No						
Yes	0.55 (0.34-0.91)	0.02	0.72 (0.44-1.18)	0.19	0.98 (0.54-1.77)	0.95
Frequency of seeing TB patients						
Rarely						
Frequent	2.02 (1.18-3.46)	0.01	2.29 (1.32-3.95)	<0.01	1.08 (0.57-2.03)	0.82

263 **KAP:** Knowledge, Attitude and Practice; **OR:** Odds Ratio; **CI:** Confidence Interval; **Edu:**
264 Education
265
266

transmission. This finding agrees with a similar study conducted in Osogbo, Nigeria [13,18]. The inadequate knowledge of the majority of the respondents regarding infection transmission ((53.9%)), prevention (65.6%) and cure for TB (55.3%), respectively, is, however, significantly relevant considering that PMVs are considered as HCWs in the informal sector [18], who are involved in the fight against TB infection and play an important role in the provision of essential healthcare services, especially to the rural and semi-urban communities [19].

On the vital aspect of TB infection management, it was observed that less than half (44.7%) of the respondents had adequate knowledge of TB cure and knew clearly that TB could be cured through the DOTS strategy. DOTS is a crucial part of TB IPC, which was introduced by the WHO and adopted in Nigeria in 1993 [20-22]. The implementation of DOTS has reformed TB management [6], and the inability of the PMVs to recognise DOTS for TB cure can be considered a barrier to TB management in Nigeria. However, the PMVs may also be unable to provide adequate guidance to suspected TB patients, which may explain their poor referral system; this is supported by a similar study [13].

The proportion of respondents who understood the duration of TB treatment (256/73.3%) and the need to continue therapy after symptoms subside (266/76.2%) is encouraging. Still, improvement is needed to effectively support TB IPC. Many respondents (309/88.7%) agreed that failure to complete the treatment regimen could lead to a more severe TB infection. The good knowledge of the PMVs regarding treatment duration and completion of therapy even after symptoms subside is crucial to achieving TB reduction and mitigating against the emergence and spread of TB drug resistance.

About two-fifths (139/39.9%) of the respondents believed that TB diagnosis and treatment are for a fee; this belief of the respondents negates the practice of TB management in Nigeria, where diagnosis and treatment are free for those accessing TB care [23]. Conversely, reports of some hidden out-of-pocket payments have been documented previously [24], which may have contributed to respondents' reports. However, this study's findings are similar to a recent study conducted in South-East Nigeria [15]. The implication of this lack of knowledge of some of the PMVs may lead to poor referral of suspected TB patients to DOTS facilities, where management of TB is free [15]. It may also lead the PMVs to attempt to treat such patients, thereby leading to improper use of antibiotics that can initiate drug resistance, and may also negatively influence the

297 health-seeking behaviour of suspected TB patients [15]. However, there is a need for a more public
298 enlightenment on the 'no cost' management of TB across DOTS facilities in Nigeria.

299 Regarding the number of drugs required for TB treatment, only 70 respondents (20.1%) knew the
300 correct number of medications. In this regard, insufficient knowledge of PMVs can lead to
301 treatment gaps and poor-quality TB treatment, which can be considered an impediment to TB IPC
302 [20], as diagnosis and treatment are vital components of TB infection prevention and control [3].
303 A study conducted in South-South Nigeria [11] reported similar findings of PMVs (20%) who
304 knew the correct number of drugs required for TB treatment.

305 Even though TB transmission is airborne [18], a large number (257/73.6%) of the respondents do
306 not believe they can contract the disease; this may be attributable to misconceptions about the TB
307 scourge and may also be the reason why many of the respondents opined that they would express
308 unusual feelings (fear {84/24.1%}, surprise {60/17.2%}, embarrassment {53/15.2%},
309 sadness/hopelessness {64/18.3%}) in the event they had TB. About one-fifth (72/20.6%) of the
310 respondents opined that they would rather give drugs to suspected TB patients on presentation to
311 their shops than refer such patients to DOTS treatment facilities; this agrees with the findings of a
312 similar study [13]. Meanwhile, some respondents (122/35%) do not have TB referral centres for
313 suspected TB patients. These attitudes of the PMVs will most likely lead to mismanagement of
314 TB patients, delays in diagnosis, and affect the care-seeking behaviour of such patients, which can
315 bring about the development of TB drug resistance and slow down the progress of TB IPC in the
316 country [13,16].

317 On TB preventive practices, the majority of the respondents displayed excellent practices towards
318 TB patients, such as 'instructing suspected TB patients to cover their mouths always when
319 coughing' (293/84%), 'cover their mouths/nose when sneezing' (315/90.3%), and to 'always ensure
320 cross ventilation' (280/80.2%) in their homes. These good practices of the PMVs are germane to
321 TB IPC. However, only 70 (20.1%) could identify the three objects appropriate for mouth/nose
322 covering when coughing or sneezing.

323 In this study, less than three-fifths of the PMVs had adequate knowledge (196/56.2%) and good
324 attitude (199/57%), while almost four in every five PMVs had good preventive practices
325 (279/79.9%). This follows an overall adequate knowledge score of 56.1% (Ede North: 58.3%, Ede
326 South: 53.8%), an overall good attitude score of 66.9% (Ede North: 73%, Ede South: 60.7%), and

an overall good preventive practices score of 79.5% (Ede North: 82.8%, Ede South: 76.3%). In all these, Ede North PMVs performed better than their Ede South counterparts; this may be attributable to the effects of some independent variables such as age, work experience and TB training. In terms of age, Ede North had more respondents greater than 40 years old (25%) compared to Ede South (12.1%); as for work experience, Ede North had 38.1% of respondents who had greater than ten years experience compared to 16.6% of respondents in Ede South, while Ede North had 56% respondents who had never been trained for TB IPC compared to the 62.4% respondents of Ede South extraction.

However, the inadequate knowledge and poor attitude scores of the PMVs can negatively affect the management of TB IPC in Nigeria and slow the achievement of TB reduction. It has been reported previously [6,25] that excellent knowledge and attitudes among HCWs, including PMVs, are needed to combat the TB scourge, including the structural and cultural barriers that mitigate against the effective utilisation of TB services in the country. The excellent preventive practices score of the PMVs is encouraging and should be sustained. At the same time, more targeted awareness campaigns would be needed to improve PMVs' knowledge and attitudes, accelerating progress toward achieving the 2030/2035 SDG targets in Nigeria.

5.0 CONCLUSION

The findings of this study revealed the existence of KAP gaps among the informal healthcare providers (PMVs), which is particularly pronounced in their inability to accurately identify the signs and symptoms of TB, inability to identify DOTS as the means of curing TB, inability to identify the number of drugs needed for TB treatment, inability to identify the accurate methods of TB detection and accepting that TB diagnosis/treatment is for a fee. The identified gaps portend negative implications for TB infection prevention and control, reinforcing the need for a more robust, focused awareness campaign for PMVs, geared towards enhanced TB management in South-West Nigeria. The awareness campaign should also be extended to involve the inclusion of PMVs in community TB case findings.

Limitation

This study relied on self-reported data; respondents may have exaggerated or misrepresented their responses, making the findings susceptible to recall and social desirability biases. Furthermore, as

the study was conducted in Osun State, the results may not be generalizable to all regions of Nigeria.

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Declarations

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Conflict of Interest

The authors have no relevant financial or non-financial interests to disclose.

Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki. Ethical clearance for the study was granted by the Osun State Specialist Hospital Institutional Review Committee (HREC/27/2015/SSHO/060).

Consent to participate

All participants provided written consent before they were included in the study, and the authors ensured their privacy and confidentiality by de-identifying the data collection tool.

Consent for publication

Not applicable

Availability of Data and Materials

All data and materials used in this study are available upon reasonable request.

Code Availability

Not applicable.

Authors' Contributions

All authors contributed to the study conception and design. Material preparation and data collection were performed by Onaiwu T. Ohiengbomwan, Ibukun T. Sossou and Victoria O. Kolawole. Data analysis was performed by Onaiwu T. Ohiengbomwan and Nosakhare L.

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386 authors commented on previous versions. All authors read and approved the final manuscript.

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