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Pneumonia, oxygen therapy, and amoxicillin dispersible tablets: a practice awareness study among Health Care Workers in three districts in the Eastern Region of Ghana

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Abstract

Background: The safe administration of Oxygen Therapy (OT) with appropriate monitoring is an integral component of the Health Care Workers' (HCWs) role. However, research suggests that HCWs lack adequate knowledge and practice on how to use oxygen delivery equipment appropriately.

Objective: To assess practice awareness (i.e., Knowledge, Attitude and Practice) of Health Care Workers (HCWs) regarding pneumonia, OT, and awareness of Amoxicillin Dispersible Tablets (Amox DT) in case management of children aged below five years

Methods: The study employed a cross-sectional study design involving 356 randomly selected HCWs in public and private (self-financing and faith-based) health facilities in three districts (i.e., New Juaben North, New Juaben South, and Lower Manya Krobo) in the Eastern Region of Ghana. The study adopted both univariate and multivariate data analysis involving Robust Ordinary Least Square and Logistic regression analysis for continuous and binary outcomes, respectively. All analyses were performed using Stata 16.1, and $p < 0.05$ was deemed statistically significant.

Results: The age of the participants ranged from 22 - 79 years, and the mean ± SD was 31.4 ± 1.7 years. There were more females (approximately 80% versus 17%) than males. The overall levels of practice awareness related to oxygen therapy were 45.8% (95% CI = 42.2 - 49.3), 41.4% (95% CI = 39.9 - 42.9), and 32.9% (95% CI = 30.2 - 35.7), respectively for knowledge, attitude and practice. Likewise, the overall practice awareness related to pneumonia was 69.2% (95% CI = 67.5 - 70.7), 89.2% (95% CI = 87.2 - 91.2) and 66.0% (95% CI = 63.7 - 68.3), respectively. Practice awareness regarding OT and pneumonia was significantly influenced by the level of the facility, category, and education level of the HCW. The Integrated Management of Neonatal and Childhood Illnesses (IMNCI) training workshop did not have a significant influence on the practice awareness regarding OT and pneumonia.

Conclusion: The level of practice awareness on the management of pneumonia in children was low (approximately one-third of HCW). In-service training on IMNCI increased the level of awareness of Amox DT but not on OT for the management of pneumonia.

Keywords: Oxygen therapy, pneumonia, amoxicillin dispersible tablets, knowledge, attitude, practice, awareness

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INTRODUCTION

Administration of oxygen therapy (OT) is an essential element of appropriate management for a wide range of clinical conditions, including pneumonia [1]. The use of OT has been established to improve patients' health outcomes when critically needed and used appropriately [2]. In view of this, oxygen has been classified as an essential medicine by the World Health Organization (WHO) and is one of the most effective and safe drugs used by Health Care Workers (HCWs) to treat

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respiratory illnesses like pneumonia in healthcare settings [3]. Pneumonia is a major cause of death in children under the age of five years, accounting for 18% of all deaths in this age group [4]. In every 39 seconds, a child dies of pneumonia globally, killing more children than any other infectious disease, claiming the lives of over 800,000 children under five every year (approximately 2,200 every day), including 153,000 newborns [5]. The United Nations Children's Fund (UNICEF) and WHO Global Action Plan for Pneumonia and Diarrhoea (GAPPD) by 2025 seek to reduce the incidence of severe pneumonia in children under five by 75%, and by 2030, ensure that 90% of cases receive proper antibiotic treatment such as Amoxicillin 250mg Dispersible Tablets (Amox DT) [6].

Unfortunately, access to these products is very challenging for many health systems, especially in Africa. Poor children and those who live in rural regions are less likely than their richer and urban counterparts to receive treatment for pneumonia [5]. Some older formulations of antibiotics (Amoxicillin OS) require manual mixing, measuring, and refrigeration, which may be compromised depending on the caregiver's ability to follow the instructions and whether or not they have a refrigerator. These difficulties may be more common in rural areas where health literacy and asset ownership are lower. Poor storage conditions resulting in exposure to light, heat, and humidity common to tropical areas can contribute to the loss of drug potency [7]. Additionally, if healthcare workers (HCWs) are not familiar with the use of oxygen delivery equipment, it may not be administered effectively to infants who need it, even if gas cylinders were available. A significantly high proportion of pneumonia deaths in young children is due to a lack of oxygen, thereby making oxygen administration a life-saving therapy among children [8]. In 2014, UNICEF recommended the replacement of generic Cotrimoxazole with Amox DT as a first-line treatment for pneumonia in children under five years due to ease of prescription and administration, no requirement for refrigeration, and lower costs because this was a different concept being introduced and was not necessarily linked to the storage conditions [9].

Reasons why Amox DT is preferred include not requiring refrigeration facilities, clear and easy instructions for prescribing and administering, cheaper compared to Amox OS, and logistic advantages in terms of weight and volume [10]. It has been recommended that community health workers should be trained to treat less severe pneumonia cases at the community level using Amox DT, depending on the child's age [9]. With this understanding, the SPRINT (Scaling Pneumonia Response InnovaTions) project was launched by UNICEF in 2019 and has since 2019 been applied by experts in Senegal and Ghana to make the recommended paediatric formulation of Amoxicillin dispersible tablets available at the community level and to scale up oxygen therapy which has been found to effectively avert pneumonia deaths in children [9]. The safe administration of OT with appropriate monitoring is an integral component of the HCWs' role. In Ghana, specifically at the Korle Bu Teaching Hospital, it is estimated that approximately 600 m^3 of cylinder oxygen is used per month among patients who require critical care [11]. However, research suggests that HCWs lack adequate knowledge and practice on how to appropriately use oxygen delivery equipment, as well as requisite training and competence in the practical administration of oxygen [8,12-16]. Further knowledge of pneumonia case management by HCWs has also been estimated to be very low in Western Turkey [17]. Therefore, it is crucial to study the practice awareness of HCWs related to pneumonia, oxygen therapy, and Amox DT to identify gaps in these treatment modalities, which would help improve the quality of care outcomes for children under five in Ghana.

MATERIALS AND METHODS

Study design and sites

The study was a cross-sectional study involving healthcare workers across three SPRINT-implementing districts in the Eastern region of Ghana. The study was conducted in three districts in the Eastern region, namely New Juaben North (NJN), New Juaben South (NJS), and Lower Manya Krobo (LMK). These districts were the sites for the pilot implementation of the SPRINT project in Ghana. The SPRINT project aims to strengthen health systems at all levels by scaling up Oxygen therapy and Amoxicillin Dispersible Tablets (Amox-DT) to manage pneumonia cases among children under five years. The study participants involved HCWs drawn from 99 public and private (i.e., self-financing and faith-based organisations) healthcare facilities in the three districts. The category of healthcare professions involved in this study were medical doctors, general and community nurses, and midwives, while the levels of health facilities involved were the regional hospital, district hospitals (which were mostly owned by the Christian Health Association of Ghana (CHAG), public and private clinics, health centres, and Community-based Health Planning and Services (CHPS) compounds (community clinics).

Sample size estimation

This study hypothesised that there would be a statistically significant difference in the outcome mean scores among the HCWs compared with an assumed mean of 50%. The study, therefore, employed a power sample size calculation for a one-sample mean test, as shown below [18]: $\left(\frac{Z_{1-\alpha/2}+Z_{1-\beta}}{\frac{|\mu_1-\mu_0|}{\delta}}\right)^2$ where $Z_{1-\alpha/2} = 1.96$ (alpha level z-score for a two-tailed test), $Z_{1-\beta} = 0.84$ (statistical power), $\mu1 - \mu0 = 0.015$ (assume the difference in mean scores) and $\delta = 0.1$ (assumed standard deviation). Additionally, a 2% non-response rate was added, and the estimated sample size was 356 HCWs stratified across the three districts.

Sampling and data collection procedure

The sample size was stratified by districts to estimate the sample size needed from each district. Within each district and in each health facility, the daily duty roster was accumulated, and a sampling frame was established. This enabled researchers to adopt a simple random sampling

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strategy proportionate to the facility and subject to HCWs on duty. HCWs who were willing to participate in the study consented after the purpose of the study was thoroughly explained to their satisfaction. A questionnaire-based survey was conducted. A questionnaire comprising four sections (i.e. sections A - D) was self-administered. Researchers were available to provide clarity to the respondents as and when required; section A collected information on the socio-demographic characteristics of the participants. Sections B and C collected information on practice awareness about oxygen therapy and pneumonia, respectively, while section D collected information on the level of awareness about the use of Amox DT in the district.

Study variables

The study considered three main domains of outcomes (i.e., knowledge, attitude and practice) that correspond to the survey questionnaire. The three domains were compounded as practice awareness involving knowledge, attitude and practice (KAP). For the knowledge assessment on oxygen therapy, general questions were framed on six themes: oxygen administration treatment, normal range of oxygen saturation, oxygen therapy contraindication, movement of air through lungs, the passive process in respiratory physiology, and the normal breathing rate in adults. A mark was awarded to a correct answer, and scores ranging from 0 - 6 were estimated. A five-point Likert scale questionnaire (6 questions) with reversed scores ranging from 1 - 5 (1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly agree) was used for the attitude assessment. The overall oxygen therapy attitude score ranged from 6 - 35. For oxygen therapy practices, 11 questions were asked, and a mark was awarded to a correct answer, with the overall scores ranging from 0 – 11. Knowledge of pneumonia was assessed using three domains (pneumonia definition, signs, and symptoms). Participants were asked questions about the definition of pneumonia, some signs, and symptoms with a respective 6, 5, and 6 series of statements (multiple choice) with a correct answer corresponding to 1 mark. A total score ranging from 0 - 17 was generated to assess knowledge about pneumonia. Five positive series of questions were asked to assess the attitude of pneumonia with “Yes, No or Not Sure” responses. An overall score ranging from 0 - 5 was generated. For practice towards the management of pneumonia, five modalities of treatment of pneumonia in children were asked, and participants were to select the correct answer. A mark was awarded for a correct answer, and a score ranging from 0 - 5 was generated to assess the pneumonia practice level.

All practice awareness assessments were converted to percentages. For Amox DT awareness level, participants were asked; Have you heard of dispersible Amoxicillin? And is it used in treating pneumonia? Overall awareness was generated if participants answered Yes to both questions, which were coded as 1 and 0 if otherwise.

Demographic characteristics involved: sex (male versus female), age, marital status (never married, married, divorced), taking care of children under 5 (no or yes), category of the profession (Community Health Nurse, Gen. Nurse, Doctor, Physician Assistant, Midwife), religion (Christian, Islam, or Other), and educational level (Certificate, Diploma, Bachelor, or Master’s degree and above), and attended the training workshop (no or yes). Facility characteristics included the level of health facility (regional hospital, district hospital, CHAG, Health Centre, Clinic, CHPS, and private self-financing facility) and district where the facility is located (New Juaben North (NJN), New Juaben South (NJS), and Lower Manya Krobo (LMK)).

Data Analysis

Three approaches to data analysis were carried out which comprised: univariate descriptive, bivariate, and inferential. For continuous outcomes (practice awareness scores), bivariate data analysis involving a t-test or ANOVA was performed to assess the significant mean difference based on the response category. Before assessing mean equality, skewness and kurtosis test and Shapiro-Wilk test of normality were performed individually (p-value > 0.05 depicting not violating the normal distribution rule of thumb). For binary outcome (awareness), the chi-square test was adopted to assess the significant difference in proportion. The study adopted both univariate and multivariate data analysis involving Robust Ordinary Least Square regression and Logistic regression analysis for continuous and binary outcomes, respectively. Robust estimation was appropriate to control for heteroskedasticity. For multivariate data analysis, the study adopted a stepwise forward selection regression analysis model, setting a p-value ≤ 0.2 as the significance level in addition to the model. For all multiple regression analyses, a specification link test was performed to test for specification errors in all models. Analysis showed no specification error with a p-value > 0.050. All analyses were performed using Stata Statistical Software: Release 16.1 (February 2020), and $p < 0.05$ was deemed statistically significant.

RESULTS

The study achieved a 100% response rate. The proportion of HCWs involved in the study from the three districts was approximately 21%, 38%, and 40%, respectively, for NJN, NJS, and LMK. Ages ranged from 22 to 79 years, and the mean ± SD was 31.4 ± 1.7 years. The sample showed a higher percentage of females (approximately 80% versus 17%). A high proportion of respondents were from the district hospitals (that were owned by CHAG) (29.5%) and the CHPS (29.5%). Most participants were HCWs with two years of certificate educational level (47.2%) (Table 1). The overall level of practice awareness for OT among HCWs in NJN, NJS, and LMK was 45.8% (95% CI = 42.2 - 49.3), 41.4% (95% CI = 39.9 - 42.9), and 32.9 (95%CI = 30.2 - 35.7) respectively. In all three domains, mean differences were statistically significant between the outcome and the level of the facility, category of the profession, and educational level ($p < 0.050$). Meanwhile, the mean

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differences in knowledge and attitude were statistically significant between the sexes ($p < 0.050$). Knowledge scores for oxygen therapy were statistically associated with sex, level of facility, category of profession, and educational level ($p < 0.050$). Mean values for attitude and practice differed significantly between the sexes. The location (i.e., the district where the facility is located) of the facility was a significant contributing factor to the mean differences in HCWs' attitude towards oxygen therapy at NJN (41.9%) (Table 2). Table 3 demonstrates factors associated with practice awareness related to oxygen therapy among HCWs. Univariate analysis of knowledge assessment showed that the level of the facility, category of profession, educational level, and the district in which the facility is located significantly influenced knowledge scores. The analysis showed that knowledge scores on oxygen significantly decreased among HCWs practising in all other levels of the facility compared with those practising at the regional hospital.

Table 1. Demographic characteristics of health care workers involved in the study

Demographic characteristics	Frequency (356)	Percentage
Sex		
Male	60	16.9
Female	284	79.8
Missing	12	3.4
Age group		
≤29	153	43
30-39	144	40.4
40+	26	7.3
Missing	33	9.3
Mean±SD	31.45±7.10	
Level of the health facility		
Regional Hospital	34	9.6
District (CHAG Hospital)	105	29.5
Health Centre	75	21.1
Clinic	36	10.1
CHPS	105	29.5
Missing	1	0.3
Marital Status		
Never married	169	47.5
Married	183	0.6
Divorced	2	0.6
Missing	2	
Taking care of children under 5		
No	104	29.2
Yes	245	68.8
Missing	7	2
Category of profession		
Community Nurse	105	29.5
Gen. Nurse	108	30.3
Doctor	21	5.9
PA	22	6.2
Midwife	98	27.5
Missing	2	0.6
Religion		
Christian	339	95.2
Islam	12	3.4
Other	2	0.6
Missing	3	0.8
Educational level		
Certificate	168	47.2
Diploma	108	30.3
Bachelor	66	18.5
Master's and above	11	3.1
Missing	3	0.8
Attended the training workshop		
No	188	52.8
Yes	100	28.1
Missing	68	19.1
District		
NJN	76	21.3
NJS	136	38.2
LMK	144	40.4

NB: Abbreviation: SD = Standard deviation; CHAG = Christian Health Association of Ghana; PA = Physician Assistant; NJN=New Juaben North; NJS=New Juaben South; LMK=Lower Manya Krobo.

Multivariate analysis showed a significant increase in knowledge among HCWs at CHAG hospital (aβ = 9.60; 95% CI = 1.40 - 17.8). HCWs who were general nurses, doctors, physician assistants (PA), and midwives had a significantly increased knowledge score compared with their counterparts who were community HCWs ($p < 0.050$). There was an increased score in knowledge assessment as the level of education increased among the HCWs. Interestingly, HCWs who attended the training workshop had decreased knowledge scores in oxygen therapy by approximately 5 points compared with those who did not, and it was statistically insignificant (β = - 4.57; 95% CI = -11.55 - 2.39). HCWs in LMK had a significantly decreased knowledge coefficient score by over 5-fold compared with HCWs in NJS (β = -9.82; 95% CI = -16.80 - -2.85) (Table 3). Factors influencing the attitude of OT involved sex differential where the attitude score of males decreased significantly by over three points compared to attitude scores of females (aβ = -3.5; 95% CI = -6.3 - -0.70). HCWs in health centres and CHPS compounds had a significant increase in attitude scores compared with those in the regional hospital (β (95% CI) = 4.51 (0.56 - 8.47) and 5.07 (1.64 - 8.51), respectively).

Doctors had approximately a 6.6-point decrease in attitude scores compared with community health nurses (aβ = -6.56; 95% CI = -12.46 - -0.67). Regarding educational level, attitude scores in relation to oxygen therapy decreased among HCWs with higher education than those with certificates (Table 3). Multivariate analysis related to oxygen therapy showed a significant decrease in practice-related scores among HCWs aged 30 - 39 years compared with those aged ≤ 29 years (β (95% CI) = -7.13 (-13.32 - -0.96)]. It was worthy of note that there was a 9.6 times increase in the practice of oxygen therapy among HCWs in the district or CHAG hospitals compared to those in regional hospitals (aβ (95% CI) = 9.60 (1.39 - 17.89)). Contrariwise, univariate analysis showed a significant decrease in scores [β (95% CI) = -10.87 (-19.05 - -2.69)]. In addition, HCWs in health centres, clinics, and CHPS compounds also had significantly decreased scores related to the practice of oxygen therapy (CHAG hospitals) compared to those in the regional hospital (aβ (95% CI) = -

Table 2. Level of practice awareness on oxygen therapy among health professionals involved in the study

Demographic characteristics	Category of response	Knowledge	Attitude	Practice
		Mean±SD	Mean±SD	Mean±SD
	Overall	45.83±23.92	41.39±9.73	32.98±18.32
Sex	Male	53.33±19.66	38.70±9.76	37.22±19.23
	Female	46.12±24.81	41.93±9.49	32.33±17.64
	P-value	0.049	0.024	0.154
Age group	≤29	49.44±23.76	41.65±9.47	34.28±18.50
	30-39	43.58±24.63	41.00±9.92	32.03±17.17
	40+	52.63±25.62	41.31±8.63	39.04±16.63
	P-value	0.115	0.865	0.304
Level of facility	Regional	66.00±17.66	38.82±8.38	37.37±13.55
	District (CHAG Hospital)	55.12±19.79	38.32±10.30	35.26±17.65
	Health center	41.53±25.75	43.33±10.47	37.56±20.72
	Clinic	42.75±23.47	40.28±7.70	30.91±19.07
	CHPS	40.53±23.85	43.89±7.72	26.09±14.47
	P-value	<0.001	<0.001	0.001
Marital status	Never married	47.07±22.69	41.57±9.23	33.41±19.15
	Currently married	48.02±25.43	41.08±9.66	31.86±16.35
	Divorced	33.33±23.57	34.28±20.20	45.45±00.00
	P-value	0.673	0.529	0.620
Taking care of under 5	No	51.02±24.47	41.49±8.88	35.31±19.00
	Yes	45.72±23.60	41.05±9.87	31.33±17.19
	P-value	0.096	0.719	0.122
Category of profession	Community Nurse	37.92±22.50	45.18±7.91	25.90±14.89
	General Nurse	53.58±23.37	38.19±9.15	34.33±17.82
	Doctor	62.50±16.99	39.68±9.64	48.25±10.08
	PA	64.58±20.06	40.86±12.02	37.37±17.86
	Midwife	43.84±23.65	41.18±9.43	34.16±19.34
	P-value	<0.001	<0.001	<0.001
Religion	Christian	47.44±24.24	40.85±9.46	32.55±17.77
	Islam	46.97±19.46	49.28±8.87	27.27±11.50
	Other	66.67±23.57	44.28±2.02	72.72±00.00
	P-value	0.53	0.009	0.059
Educational level	Certificate	38.89±22.99	44.17±8.49	28.24±15.95
	Diploma	52.92±22.78	37.85±9.46	34.55±19.94
	Bachelor	58.82±22.45	40.34±9.78	40.77±16.56
	Masters and above	50.00±17.57	38.70±11.16	41.56±7.15
	P-value	<0.001	<0.001	<0.001
Attended training workshop	No	48.29±23.51	41.38±9.54	32.86±18.99
	Yes	44.00±23.51	41.25±9.98	31.82±15.57
	P-value	0.195	0.916	0.712
district Facility is located in	New Juaben North	46.61±21.61	41.97±9.07	33.79±17.32
	New Juaben South	52.52±24.67	40.93±9.15	31.88±19.62
	Lower Manya Krobo	43.54±24.12	41.15±10.05	32.44±16.66
	P-value	0.53	0.009	0.059

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Table 3. Robust and stepwise ordinary least square regression analysis showing factors associated with practice awareness of oxygen therapy among health professionals involved in the study

Variable	Knowledge		Attitude		Practice	
	Crude Point Estimate aβ[95%CI]	Adjusted Point Estimate aβ[95%CI]	Crude Point Estimate aβ[95%CI]	Adjusted Point Estimate aβ[95%CI]	Crude Point Estimate aβ[95%CI]	Adjusted Point Estimate aβ[95%CI]
Sex						
Female	ref		ref	ref	ref	
Male	7.49[-0.91-15.89]		-3.23[-6.07--0.38]*	-3.50[-6.30--0.70]*	7.21[-0.58-13.84]	
Age group						
≤29 years	ref	ref	ref		ref	ref
30-39 years	-6.27[-13.21-0.67]	-7.14[-13.32-0.96]*	-0.65[-3.03-1.74]		-5.85[-12.20-0.49]	-7.13[-13.32--0.96]*
40+ years	2.75[-10.16-15.66]		-0.34[-4.13-3.45]		3.20[-8.93-15.33]	
Level of facility						
Regional	ref	ref	ref		ref	ref
District (CHAG Hospital)	-10.80[-21.89-0.28]	9.60[1.40-17.81]*	-0.50[-4.19-3.21]		-10.87[-19.05--2.69]**	9.60[1.39-17.89]*
Health center	-26.68[-38.13--15.22]***		4.51[0.56-8.47]*		-24.47[-33.93--15.00]***	
Clinic	-22.32[-36.26--8.40]**		1.47[-2.62-5.56]		-23.25[-34-99--11.50]***	
CHPS	-26.91[-37.94--15.87]***		5.07[1.64-8.51]**		-25.46[-34.11--16.81]***	
Marital status						
Never married	ref		ref		ref	ref
Currently married	0.79[-5.52-7.11]		-0.49[-2.63-1.66]		0.95[-4.87-6.77]	
Divorced	-14.16[-50.87-22.55]		-7.29[-27.32-12.75]		-13.74[-37.40-9.92]	
Taking care of under-fives						
No	ref		ref		ref	ref
Yes	-6.65[-13.33-0.02]		-0.44[-2.74-1.86]		-5.29[-11.62-1.03]	
Category of profession						
Community Nurse	ref	ref	ref	ref	ref	ref
General Nurse	17.57[9.89-25.24]***	9.58[0.61-18.56]*	-6.99[-9.51--4.48]***		15.67[8.48-22.85]***	9.58[0.61-18.56]*
Doctor	25.09[12.99-37.18]***	17.76[8.10-27.41]***	-5.50[-10.19--0.80]*	-6.56[-12.46--0.67]*	24.58[15.70-33.46]***	17.76[8.10-27.41]**
PA	28.51[15.26-41.76]***	19.39[4.99-33.77]**	-4.32[-9.79-1.13]		26.67[15.81-37.52]***	19.39[4.99-33.77]**
Midwife	4.63[-3.21-12.46]		-4.00[-6.61--1.38]**		5.91[-1.47-13.30]	
Religion						
Christian	ref	ref	ref	ref	ref	ref
Islam	-1.20[-17.01-14.60]		8.43[3.45-13.41]***	9.00[4.45-13.55]***	-0.47[-11.95-11.01]	
Other	18.87[-17.57-55.32]	22.93[0.78-45.08]*	3.43[1.15-5.72]**	4.42[0.99-7.85]*	19.22[-4.30-42.75]	22.93[0.78-45.08]*
Educational level						
Certificate	ref	ref	ref	ref	ref	ref
Diploma	14.61[7.91-21.31]***		-6.32[-8.72--3.93]***		14.03[7.57-20.47]***	
Bachelor	21.72[13.94-29.50]***		-3.83[-6.72--0.94]**	-3.89[-6.85--0.93]**	19.93[12.55-27.32]***	
Masters and above	10.93[-4.47-26.33]	17.19[3.12-31.26]*	-5.47[-11.99-1.04]		11.11[-0.10-22.32]	-17.89[-31.26--3.11]**
Attended training workshop						
No	ref	ref	ref		ref	ref
Yes	-4.57[-11.55-2.39]		-0.14[-2.72-2.44]		-4.82[-10.82-2.25]	
Facility district						
New Juaben South	ref	ref	ref		ref	ref
New Juaben North	-6.64[-14.94-1.66]		1.03[-1.79-3.87]		-5.91[-13.29-1.45]	
Lower Manya Krobo	-9.82[-16.80--2.85]**	-5.73[-12.56-1.11]	0.23[-2.19-2.64]		-8.98[-15.63--2.33]**	-5.72[-12.56-1.11]

Note: ref denotes the reference category used for inference. β represents normalized coefficient estimate both crude and adjusted. CI present Confidence Interval

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9.96 (-16.15 - -3.81)). Furthermore, knowledge about pneumonia among doctors increased significantly compared to community health nurses. Also, HCWs with diplomas (aβ (95% CI) = 18.01 (11.18 - 24.84)) and bachelor's degrees (aβ (95% CI) = 18.86 (6.57 - 31.16)) had significantly increased knowledge scores in relation to pneumonia than those with certificates. HCWs in LMK had significantly increased knowledge scores in pneumonia compared to their colleagues in the NJS district (aβ (95% CI) = 6.17 (1.03 - 11.33)) (Table 5). Factors that significantly increased attitude scores in relation to pneumonia from the univariate analysis were respondents who were divorced, doctors and PAs, and those with higher educational levels ($p < 0.05$). Meanwhile, there was a significant decrease in attitude scores related to pneumonia among HCWs in LMK compared to those in NJS (aβ (95% CI) = -5.09 (-9.53 - -0.65)). The multivariate analysis showed a significant increase (nearly eight-fold) in attitude scores related to pneumonia among HCWs in health centres than those in the regional hospital (aβ (95% CI) = 7.78 (2.83 - 12.74)) (Table 5). The bivariate analysis showed a significant increase among the following factors: males, those aged 30+ years, divorced, all professions other than community health nurses, and increasing education level in practices relating to pneumonia ($p < 0.050$). From the multivariate analysis, males, HCWs aged 40+ years, doctors, and PAs had significant respective increases in their practice scores relating to pneumonia by over 7-fold, 9-fold, 12-fold, and 14-fold. In addition, as education level increased, the

Table 4: Level of practice awareness on pneumonia among health professionals involved in the study

Demographic characteristics	Demographic characteristics	Knowledge	Attitude	Practice
		Mean±SD	Mean±SD	Mean±SD
	Overall	69.12±14.17	89.18±18.07	66.03±20.53
Sex	Male	69.41±17.76	90.28±18.44	72.50±19.28
	Female	66.69±17.57	88.97±18.07	64.82±21.25
	P-value	0.278	0.631	0.013
Age group	≤29	64.90±18.79	87.32±20.76	61.88±23.16
	30-39	68.83±16.45	89.74±16.28	68.72±19.12
	40+	72.40±11.50	88.46±16.17	73.33±15.23
	P-value	0.043	0.559	0.006
Level of facility	Regional	76.99±20.29	92.97±19.30	77.24±16.67
	District (CHAG Hospital)	64.42±20.10	93.48±11.04	64.00±21.03
	Health center	66.90±14.69	88.38±18.34	66.30±21.31
	Clinic	69.77±18.61	86.03±17.61	68.00±21.25
	CHPS	65.60±14.49	85.97±21.56	63.30±20.35
	P-value	0.005	0.026	0.023
Marital status	Never married	66.59±15.78	87.42±20.42	64.41±21.11
	Currently married	67.31±19.33	90.88±15.31	67.22±20.53
	Divorced	79.41±4.15	100±0	80.00±0
	P-value	0.568	0.155	0.384
Taking care of under 5	No	66.68±19.22	89.74±16.51	65.00±19.47
	Yes	67.90±15.84	89.36±18.61	66.34±21.53
	P-value	0.54	0.866	0.6
Category of profession	Community Nurse	62.46±15.80	88.14±17.71	59.38±18.81
	General Nurse	66.12±18.14	91.41±16.15	63.67±21.17
	Doctor	77.03±24.81	97.50±7.69	83.53±16.18
	PA	86.90±6.27	94.05±10.91	85.71±14.34
	Midwife	66.56±15.17	85.87±21.71	67.78±19.36
	P-value	<0.001	0.029	<0.001
Religion	Christian	67.45±17.00	89.33±18.03	66.11±20.70
	Islam	61.76±14.64	95.00±10.54	56.00±22.71
	Other	67.65±12.47	62.50±17.68	80.00±28.28
	P-value	0.535	0.065	0.201
Educational level	Certificate	62.29±15.71	84.76±20.51	60.13±19.33
	Diploma	67.43±17.74	91.09±16.43	60.06±20.29
	Bachelor	75.85±18.05	93.55±11.92	76.67±19.54
	Master's and above	80.21±17.70	95.45±15.07	86.67±19.54
	P-value	<0.001	0.008	<0.001
Attended training workshop	No	65.77±19.49	88.37±18.41	64.12±21.42
	Yes	68.41±12.11	90.05±15.26	68.00±18.31
	P-value	0.218	0.453	0.138
Facility district	New Juaben North	67.18±16.43	89.44±16.72	65.35±20.55
	New Juaben South	67.13±20.14	91.93±16.73	69.33±19.74
	Lower Manya Krobo	66.83±15.69	86.84±19.36	63.13±21.50
	P-value	0.535	0.065	0.201

Table 5. Robust and stepwise ordinary least square regression analysis showing factors associated with practice awareness on pneumonia among health professionals involved in the study

Variable	Knowledge		Attitude		Practice	
	β[95%CI]	aβ[95%CI]	β[95%CI]	aβ[95%CI]	β[95%CI]	aβ[95%CI]
Sex						
Female	ref		ref		ref	ref
Male	2.71[-2.24-7.64]		1.30[-4.07-6.67]		7.67[1.99-13.25]**	7.25[0.62-13.89]*
Age group						
≤29	ref	ref	ref		ref	ref
30-39	3.93[-0.10-7.96]		2.42[-2.03-6.87]		6.83[1.76-11.92]**	
40+	7.50[2.20-12.79]**	5.19[0.43-9.96]*	1.14[-5.93-8.21]		11.44[4.28-18.62]**	9.50[1.75-17.25]*
Level of facility						
Regional	ref	ref	ref	ref	ref	ref
District (CHAG Hospital)	-12.56[-20.37--4.74]**	-9.98[-16.15--3.81]**	0.51[-6.52-7.54]		-13.24[-20.69--5.79]***	-9.24[-15.07--3.41]
Health center	-10.09[-17.65--2.52]**		-4.59[-12.50-3.33]	7.79[2.83-12.74]**	-10.94[-18.71--3.16]	
Clinic	-7.21[-16.31-1.88]		-6.94[-15.83-1.96]		-9.24[-18.50-0.01]	-10.14[-18.51--1.76]*
CHPS	-11.39[-18.73--4.05]**		-6.99[-14.92-0.92]		-13.94[-21.22--6.66]	
Marital status						
Never married	ref	ref	ref	ref	ref	
Currently married	0.72[-2.97-4.41]	-2.58[-6.37-1.20]	3.46[-0.51-7.43]		2.80[-1.77-7.37]	
Divorced	12.83[8.08-17.59]***		12.58[9.35-15.81]***	11.71[4.06-19.37]**	15.58[12.23-18.94]***	
Taking care of under 5						
No	ref		ref		ref	
Yes	1.21[-2.98-5.41]		-0.37[-4.49-3.74]		1.34[-3.49-6.16]	
Category of profession						
Community Nurse	ref	ref	ref		ref	ref
General Nurse	3.66[-0.93-8.24]	2.40[-2.99-7.80]	3.26[-1.55-8.07]		4.29[-1.36-9.95]	
Doctor	14.56[3.67-25.46]**	18.0111.18-24.84]***	9.35[4.49-14.27]***		24.15[15.71-32.58]***	12.00[0.55-23.45]*
PA	24.43[20.44-28.43]***	18.86[6.57-31.16]**	5.90[0.09-11.71]*		26.33[19.20-33.46]***	14.64[4.15-25.12]**
Midwife	4.11[-0.18-8.39]		-2.27[-7.97-3.42]		8.40[2.88-13.91]**	
Religion						
Christian						
Islam	-5.68[-19.26-7.89]		5.67[-0.89-12.23]	8.07[-1.69-17.82]	-10.11[-23.77-3.55]	
Other	0.20[-12.26-12.66]		-26.83[-44.41--9.25]**	-29.01[-44.03--14.00]***	13.89[-14.16-41.93]	
Educational level						
Certificate	ref	ref	ref	ref	ref	ref
Diploma	5.13[1.02-9.26]*	5.43[1.07-9.79]*	5.33[0.72-9.93]*		5.93[0.87-10.99]*	9.32[3.77-14.88]***
Bachelor	13.56[8.58-18.53]***	10.71[3.32-18.10]**	7.79[3.34-12.22]***	4.31[-1.06-9.68]	16.53[10.71-22.37]***	12.73[4.25-21.21]**
Master's and above	17.92[7.57-28.27]***		9.69[0.50-18.88]*		26.54[15.33-37.74]***	17.82[7.09-28.55]***
Attended training workshop						
No	ref		ref	ref	ref	
Yes	2.64[-1.03-6.31]		1.68[-2.48-5.84]	4.35[-0.15-8.86]	3.88[-1.02-8.79]	
Facility district						
New Juaben South	ref	ref	ref	ref	ref	
New Juaben North	0.05[-4.97-5.07]	4.80[-0.56-10.16]	-2.50[-7.39-2.39]		-3.98[-9.94-1.97]	
Lower Manya Krobo	-0.30[-4.56-3.96]	6.17[1.03-11.33]*	-5.09[-9.53--0.65]*	-4.98[-10.18-0.22]	-6.20[-11.29--1.10]*	

Note: ref denotes the reference category used for inference. β represent normalized coefficient estimate both crude and adjusted. CI present Confidence Interval

Table 6. Awareness of Amox DT by demographic characteristics and associated factors among health professionals involved in the study

Variable	Total	Awareness of Amox DT		Test	Logistic regression	
		No	Yes			
		%[95%CI]	%[95%CI]		OR[95%CI]	aOR[95%CI]
	356	68.5[63.5-73.2]	31.5[26.8-36.5]			
	n	%	%			
Sex						
Female	284	69.4	30.6		ref	
Male	60	71.7	28.3	7.26*	0.89[0.48-1.65]	
Missing	12	33.3	66.7			
Age group						
≤29	153	70.6	29.4	1.26		
30-39	144	68.8	31.3		1.09[0.66-1.79]	
40+	26	61.5	38.5		1.50[0.63-3.56]	
Missing	33	63.6	36.4			
Level of the health facility						
Regional Hospital	34	70.6	29.4	4.87	ref	ref
District (CHAG Hospital)	105	75.2	24.8		0.79[0.33-1.86]	0.63[0.33-1.20]
Health Centre	75	62.7	37.3		1.42[0.59-3.43]	
Clinic	36	61.1	38.9		1.53[0.56-4.14]	
CHPS	105	67.6	32.4		1.15[0.49-2.67]	
Missing	1	100	0.0			
Marital Status						
Never married	169	65.1	34.9	2.67	ref	ref
Married	183	72.1	27.9		0.72[0.46-1.13]	0.66[0.37-1.16]
Divorced	2	50	50.0		1.86[0.11-30.46]	
Missing	2	50	50.0			
Taking care of under 5						
No	104	67.3	32.7	0.58	ref	
Yes	245	69.4	30.6		0.91[0.56-1.49]	
Missing	7	57.1	42.9			
Category of profession						
Community Nurse	105	68.6	31.4	15.38**	ref	ref
Gen. Nurse	108	75	25.0		0.73[0.40-1.33]	
Doctor	21	81	19.0		0.51[0.16-1.65]	
PA	22	86.4	13.6		0.34[0.09-1.25]	0.33[0.07-1.47]
Midwife	98	55.1	44.9		1.78[1.00-3.15]*	1.61[0.86-2.99]
Missing	2	50	50.0			
Religion						
Christian	339	68.4	31.6	2.37	ref	
Islam	12	83.3	16.7		0.43[0.09-2.02]	
Other	2	50	50.0		2.17[0.13-35.13]	
Missing	3	33.3	66.7			
Educational level						
Certificate	168	64.9	35.1	8.88	ref	
Diploma	108	64.8	35.2		1.00[0.60-1.66]	
Bachelor	66	78.8	21.2		0.50[0.25-0.97]*	
Master's and above	11	90.9	9.1		0.18[0.02-1.48]]	
Missing	3	100	0.0			
Part of the training workshop						
No	188	72.9	27.1	10.24**	ref	
Yes	100	56	44.0		2.04[1.27-3.51]**	2.28[1.28-4.06]**
Missing	68	75	25.0			
District						
New Juaben South	136	71.3	28.7		ref	ref
New Juaben North	76	61.8	38.2	2.12	1.53[0.85-2.78]	2.08[1.10-3.92]*
Lower Manya Krobo	144	69.4	30.6		1.09[0.65-1.83]	

Note: ref denotes the reference category used for inference. OR represent Odd Ratio estimate both crude and adjusted. CI present Confidence Interval

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likelihood of practices relating to pneumonia increased significantly, and the reverse was also true. Furthermore, there was a significant decrease in coefficient scores related to pneumonia among HCWs in clinics and those in the LMK by over 10-folds and 6-folds, respectively, than those in the regional hospital and NJS district [aβ (95% CI) = -10.14 (-18.51 - -1.76) and -6.20 (-11.29 - -1.10) respectively) (Table 5). The pooled prevalence of awareness of Amox DT among HCWs in the three districts was 31.5 (95% CI = 26.8 - 36.5). The prevalence was, however, non-significantly higher among HCWs in NJN (38.2%) than in NJS (28.7%) and LMK (30.6%).

Differences in Amox DT awareness among participants showed a significant association with sex, category of profession, and those who attended the training workshop ($p < 0.050$) (Table 6). From the bivariate inferential analysis, the odds of Amox DT awareness among midwives was 1.78 (95% CI = 1.00 - 3.15), which was significant when compared with community health nurses. Additionally, there was a 50% chance of Amox DT awareness among HCWs with bachelor's degrees compared with those with a certificate [OR (95% CI) = 0.25 - 0.97)]. There was also an increased odds of Amox DT awareness among HCWs who worked in levels of health facilities other than in the regional hospital, though this was not statistically significant. Further, the level of Amox DT awareness among HCWs who attended the workshop was more than twice that of those who did not attend the workshop [aOR (95% CI) = 2.28 (1.28 - 4.06)). In addition, HCWs in NJN were more than twice as likely to be aware of Amox DT than those in NJS (aOR (95% CI) = 2.08 (1.10 - 3.92)).

DISCUSSION

The goal of the SPRINT project is to reduce pneumonia deaths in children under five years old by scaling up oxygen therapy and Amox DT through a health system-strengthening approach. This study focused on exploring the practice awareness of oxygen therapy, pneumonia, and Amox DT among 356 HCWs in 99 implementing healthcare facilities in three districts in the Eastern region of Ghana.

Oxygen therapy practices awareness and associated risk factors among Health Care Workers

Generally, practice awareness among HCWs on oxygen therapy (OT) was low. The overall average score was less than 50% in all domains. This poor knowledge can potentially have adverse outcomes on case management of pneumonia in children aged under five years. This knowledge gap requires urgent attention and action if the objectives of the SPRINT Project are to be realised. HCWs were less knowledgeable about the basic aspects of the domains assessed. For instance, half of them did not know that oxygen is administered to treat and prevent hypoxia and acute myocardial infarction. This finding could be explained by the fact that in the context of SPRINT and IMNCI, this was not covered. Similarly, a little more than half of HCWs did not know about contraindications in oxygen therapy and the process of ventilation. This worrying finding was similar to what Zeleke and Kefale reported at the Debre Tabor General Hospital in Ethiopia [1]. However, Aloushan and colleagues reported a higher finding (i.e., more than 80%) with respect to the levels of knowledge [12]. The study participants in the latter study were all working in emergency departments (ED), while our study participants were in other clinical areas of the hospital, including the ED, which might have accounted for the variation. About two-thirds of our respondents knew the normal oxygen saturation at rest among adults (i.e., ranges from 96% - 98%). Further, HCWs were also not trained on how to manage pneumonia among adults because all of these are situated within the context of SPRINT and IMNCI. Our findings were, however, comparatively higher than Kigali study of ED nurses whose knowledge level in oxygen therapy was described as "poor" [19]. However, HCWs need to maintain adequate knowledge of contraindications to oxygenation in order to help them assess patients' eligibility for oxygen therapy [20]. These measurement variables are indicative of how much knowledge HCWs have regarding the process of ventilation to facilitate their ability to identify any unusual movement of air in and out of the lungs of a patient [21].

Knowledge level about OT in our study was significantly influenced by the level of the healthcare facility, category of HCW, educational level, and the district in which the facility is located. These findings are similar to studies in Saudi Arabia and Uganda [12,19]. HCWs in the regional hospital were more knowledgeable than their colleagues in other facilities, likely due to the availability of oxygen equipment and the complexity of cases at that level of the facility. In addition, general nurses, doctors, PAs, and midwives had significantly higher OT knowledge scores than their counterparts, who were community HCWs. The quality of training received by these HCWs may have influenced this finding, as demonstrated by the level of education, which significantly increased the knowledge score on oxygen therapy. Doctors, PAs, and some general nurses have a minimum qualification of a bachelor's degree, while some community healthcare workers have a minimum qualification of a certificate. HCWs practising in LMK had significantly less knowledge of OT compared with HCWs in NJS. It is interesting to note how the practice and provision of healthcare services could significantly differ by location, and this affirms the need for policymakers to ensure that inequities in health systems are adequately addressed as part of efforts to attain the goals of Quality Universal Health Coverage (UHC). Further exploration of the causes of these variations among districts could be due to the sampling strategy. However, it could also serve as the basis for future research. There could also be a consideration of instituting a system of benchmarking and learning among districts and facilities. Additionally, attitudes towards OT varied among the sexes, with male

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HCWs having a significantly lower attitude score. In addition, a little more than half of the respondents agree that oral and nasal hygiene and administration of normal saline drops in the nostrils should be routinely performed when administering continuous oxygen in critically ill adult patients. It was encouraging to find that approximately four-fifths of the participants agreed that the administration of OT to patients serves as an indication of the severity of illness, and the process could both be therapeutic and dangerous depending on usage. This practical evidence contradicts what Aloushan and co-workers found in Saudi Arabia, where about 72% of HWCs in the emergency department of a tertiary hospital had a good knowledge of the administration of oxygen, being an indication of the severity of the illness. However, approximately 33% had a positive attitude toward the dangerous aspects of oxygen therapy [12].

The cadre of health professionals and level of education generally influence attitude towards oxygen therapy, but our study revealed a contrasting view where medical doctors demonstrated a decreased attitude towards OT as compared with community health nurses. This could be explained by the fact that the training organised by the implementing districts of the SPRINT project involved more nurses and fewer doctors. Most of the doctors interviewed were junior doctors (house officers) who were yet to complete their internship to obtain permanent licenses. This also indicates that increased knowledge of an HCW in any particular skill and competency may not necessarily translate into a change in attitude or behaviour. Practice scores regarding oxygen therapy were noticed to be generally low. The average score among our participants was approximately a third (i.e., 32%). It was quite surprising that only 14% of HCWs knew that the protocol for oxygen administration ought to be followed meticulously, including special monitoring of the patient.

Also, concerning the best practice on pulse oximetry, a little more than two-fifths knew that the waveform and/or signal strength of the patient must be optimal before an accurate reading could be obtained. In addition, only 32% of the participants knew that the high percentage of oxygen 95 - 100 % (Fi02) used for short-term treatment in trauma is achieved by using a non-rebreathing oxygen mask. This finding is significantly lower than what Zeleke et al. found in Ethiopia (82%) [1]. This could be because the majority of the HCWs worked in low-level healthcare facilities that did not have pulse oximeters. Furthermore, HCWs' age was found to be associated with increasing practice scores for oxygen therapy, where the practice of oxygen therapy was nearly seven times lower in those aged 30-39 years as compared with those aged ≤ 29 years. Zeleke et al. found that HCWs who are aged 30 - 39 years were more likely to demonstrate good practice, though statistically insignificant [1]. Research conducted by Kane and colleagues suggested that knowledge about oxygen therapy is key to a patient's survival [22].

Pneumonia practices awareness and associated risk factors among Health Care Workers

Treating pneumonia by HCWs with a high level of practice awareness would aid in optimal patient care, inspired by the ability to make sound judgments and prevent bad outcomes in the recovery of mechanically ventilated patients [17]. In this study, more participants (3/4) knew the signs and symptoms of pneumonia than in a similar study in Nigeria, where only a third (27.4%) did, and 19.4% could correctly identify fever and shortness of breath as a sign and symptom of pneumonia [23]. However, knowledge about pneumonia (both the definition, signs, and symptoms) among HCWs is generally poor in Ghana [24] and elsewhere [17,25]. In our study, the knowledge about pneumonia was associated with increasing age, level of healthcare facility, level of education, and category of health professional. A probable reason could be that those in the higher healthcare facilities, such as the regional hospital (the highest referral centre in the region), have higher levels of education and are more exposed to pneumonia cases than their counterparts at the lower levels. The differences in the attitude towards the management of pneumonia among HCWs were associated with the cadre of HCWs. A higher level of education, as embodied in doctors and PAs, contributed to a good attitude towards the management of pneumonia as compared with community health nurses. However, HCWs in the LMK district had a significantly poorer attitude towards the management of pneumonia compared with those in NJS. The practice of managing pneumonia revealed that less than half of the HCWs knew the use of oxygen therapy and parenteral antibiotics as examples of treatment options in the management of pneumonia in children. It was interesting to note that approximately 3% of the HCWs indicated that herbal medicines could also be used to treat pneumonia. However, these findings are not surprising as they translate into low average knowledge about oxygen therapy among participants, as found in this study. Pneumonia management practice scores were higher among male HCWs.

Similarly, HCWs at the regional hospital had the best attitude towards the management of pneumonia. This finding could result from the higher levels of knowledge the HCWs there might have about pneumonia, which is probably translating into good practice, as reported by other authors [26]. In addition, medical doctors and PAs were more likely to have good practices in pneumonia management than other categories of staff. However, this finding is not surprising as the aforementioned professionals commonly manage pneumonia cases compared to other health professionals. WHO recommends trained community health workers to treat children aged under five years with pneumonia at the community level [27]. However, the level of practice awareness of community health workers in this study was significantly low and will need to be improved if they are expected to perform the task required of them in treating children under

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five with pneumonia at the community level. There is no doubt that Community health workers play a significant role in the follow-up and referral of sick children during home visits. Since pneumonia is a major cause of morbidity and mortality in children, it is important that practice awareness gaps of all relevant HCWs be addressed as a priority. Further, HCWs who attended the SPRINT training workshop had a good attitude towards the management of pneumonia, though statistically insignificant compared with those who did not attend. Modules for such training activities have to be reviewed to achieve the desired goal of an overall increase in practice awareness towards the management of pneumonia in children under five years.

Amoxicillin dispersible therapy awareness and risk factors among Health Care Workers

The United Nations Commission on Life-saving Commodities for Women and Children has selected Amox DT as one of the 13 life-saving commodities [9]. It is a broad-spectrum antibiotic that is effective against bacterial pneumonia and can be used as the first-line treatment for pneumonia in countries with high cases [9]. The Amox DT model was implemented in Ghana in 2019. However, awareness among HCWs from the three implementing districts was very low, as found in this study. Approximately two-thirds of the participants in the three implementing districts (a higher proportion among those in the New Juaben North district), including those who had received training, were not aware of Amox DT. In this study, more female HCWs, community health nurses and HCWs with certificates and diplomas were more aware of Amox DT than others. This, however, raises the question of why there was low awareness of oxygen therapy and pneumonia practice among the same group. Additionally, HCWs with higher education (bachelor's or master's level) were relatively likely to have good practice awareness related to oxygen therapy and pneumonia but were less likely to be aware of Amox DT. Also, most HCWs at the regional and CHAG hospitals were unaware of Amox DT. This finding could be explained by the fact that Amox DT intervention is targeted at the community level, where HCWs at the clinics and the CHPS compounds or zones were to be trained to administer the drug [28].

Generally, the study found a very low level of practice awareness regarding oxygen therapy and pneumonia in addition to low Amox DT awareness prevalence among the participants. This could be a result of low technical knowledge on the job among HCWs regarding OT and exposure to pneumonia cases, unavailability of guidelines, and inadequate supplies of oxygen delivery devices, as was found elsewhere [29].

Strength and limitation

The main strength of the present study is that it provides useful information and direction for upscaling training to address practice awareness gaps across the country. The study included healthcare facilities at various levels of the healthcare system and clearly demonstrated the strengths at each level. This study provides useful information for training and supervision. It also provides additional information for program planners and implementers, including the Ghana Health Service, who are designing effective and impactful training programmes for their staff members. The overlapping similarities with some of the clinical features (e.g., pneumonia and oxygen therapy) of the ongoing COVID-19 pandemic make it even more urgent to address the findings of our study. The practice awareness design of the study permits mostly quantification of gaps. The addition of a qualitative component may have allowed further exploration of the reasons behind the gaps observed and might be useful in providing further information for training purposes and improving the delivery of healthcare. The findings were based on one region of the country as a pilot study; however, the application of probability-based sampling allows generalisation to the study population from which the sample was drawn. Further, healthcare worker knowledge assessment on oxygen therapy was based on their prior knowledge in the subject area other than from the workshop.

Conclusion

The practice awareness of oxygen therapy and pneumonia, as identified in this study, is low, and the gap established in this study can serve as a baseline to re-strategise and redesign a more effective execution of the SPRINT interventions in Ghana. Similarly, practice awareness among community health nurses regarding oxygen therapy and pneumonia was low, making it necessary to reconsider the WHO's recommendation for "community health nurses to treat children under five with pneumonia". The organisation of the training workshop only influenced Amox DT's awareness. However, it did not significantly impact practice awareness regarding either oxygen therapy or pneumonia. In order to achieve the WHO recommendation (i.e., that community health nurses treat children under five with pneumonia), it will be necessary to redesign training programmes for HCWs through improved content, facilitation and skill acquisition. The supply of oxygen delivery devices to health facilities should be accompanied by the appropriate guidelines and protocols. It is pertinent to include oxygen therapy in IMNCI training programmes for the management of pneumonia.

DECLARATIONS

Ethical consideration

Approval for the use of administrative and health facility data was provided by the Family Health Division (FHD) of the Ghana Health Service (GHS), the Eastern Regional Health Directorate, and the District Health Management Teams of the selected districts. Written informed consent was obtained from health workers and managers who provided administrative and health coverage information. Confidentiality was strictly observed, and no personal health worker information was included in this study.

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No potential conflict of interest was reported by the authors.

Author contributions
YAE, OEH, TJ AI, A-ME, and D-AD conceptualised the study. JT and YAE undertook the statistical analysis and data reporting. YAE, OEH, TJ, AI, A-ME, D-AD, YP, YE, QH, and YAO drafted the initial manuscript. SNAH, UEA, VL, AE, S-MI, AJ, BP, WP, and SM read and provided intellectual content revisions and suggestions for clarity and precision on the subject matter. All authors read and approved the final manuscript submitted for publication.

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Availability of data
Data is available upon request to the corresponding author.

REFERENCES

1. Zeleke S, Kefale D (2021) Nurses' Supplemental Oxygen Therapy Knowledge and Practice in Debre Tabor General Hospital: A Cross-Sectional Study. Open Access Emergency Medicine Volume 13:51–56. S299139
2. Weekley MS, Bland LE (2021) Oxygen Administration. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 [cited 2021 Jul 5]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK551617/
3. WHO (2020) Medical use of Oxygen [Internet]. Geneva: World Health Organization; 2020 p. 33–47. Available from: https://www.who.int/teams/health-product-and-policy-standards/access-to-assistive-technology-medical-devices/medical-devices/oxygen
4. WHO (2016) Oxygen therapy for children. 20 Avenue Appia, 1211 Geneva 27, Switzerland: World Health Organization; 2016.
5. UNICEF (2021) Pneumonia in Children Statistics [Internet]. 2021 [cited 2021 Jul 5]. Available from: https://data.unicef.org/topic/child-health/pneumonia/
6. UNICEF, WHO (2021) Ending Preventable Child Deaths from Pneumoniaand Diarrhoea by 2025: The integrated Global Action Planfor Pneumonia and Diarrhoea (GAPPD) [Internet]. 20 Avenue Appia, 1211 Geneva 27, switzerland: World Health Organization/The United Nations Children's Fund (UNICEF); 2013 [cited 2021 May 7]. Available from: https://apps.who.int/iris/bitstream/handle/10665/79207/WHO_FWC_MCA_13_01_eng.pdf?sequence=1
7. Kiron SS, Shirwaikar A, Saritha M, Rajagopal PL, Sreejith KR (2013) Influence of storage condition on the shelf life of amoxicillin tablets. Elixir Pharm.64:19146–19150
8. Kuti, B. P., Adegoke, S. A., Ebruke, B. E., Howie, S., Oyelami, O. A., & Ota, M. (2013). Determinants of Oxygen Therapy in Childhood Pneumonia in a Resource-Constrained Region. ISRN Pediatrics, 2013, 435976
9. UNICEF. Amoxicillin Dispersible Tablets: Market and Supply Update [Internet]. New York: United Nations; 2018 [cited 2021 Jul 2]. Available from: https://www.unicef.org/supply/media/511/file/amoxicillin-dispersible-tablets-market-and-supply-update.pdf
10. UNICEF. Amoxicillin Dispersible Tablets (DT): Product Profile, Availability and Guidance [Internet]. 2013 Jul [cited 2021 Jul 23]. Available from: https://www.unicef.org/supply/media/5021/file/amoxicillin-dt-supply-note-2013.pdf
11. Adipa FE, Aziato L, Zakariah AN (2015) Qualitative exploration of nurses' perspectives on clinical oxygen administration in Ghana. Int J Afr Nurs Sci 2:42–46.
12. Aloushan AF, Almoaiqel FA, Alghamdi RN, Alnahari FI, Aldosari AF, Masud N, Aljerian NA (2019) Assessment of knowledge, attitude, and practice regarding oxygen therapy at emergency departments in Riyadh in 2017: A cross-sectional study. World J Emerg Med 10:88.
13. Beasley R, Chien J, Douglas J, Eastlake L, Farah C, King G, Moore R, Pilcher J, Richards M, Smith S, Walters H (2015) Thoracic Society of Australia and New Zealand oxygen guidelines for acute oxygen use in adults: "Swimming between the flags". Respirology 20:1182–91.
14. Lemma G (2015). Assessment of nurses' knowledge, attitude and practice about oxygen therapy at emergency departments of one federal and three regional hospitals in Addis Ababa, Ethiopia [PhD Thesis]. Addis Ababa University.
15. Nippers I, Sutton A (2015) Oxygen therapy: professional compliance with national guidelines. Br J Nurs 23:382–6.
16. Singh V, Gupta P, Khatana S, Bhagol A (2011) Supplemental oxygen therapy: Important considerations in oral and maxillofacial surgery. Natl J Maxillofac Surg 2:10-14
17. Korhan EA, Yönt GH, Kılıç SP, Uzelli D (2014) Knowledge levels of intensive care nurses on prevention of ventilator-associated pneumonia. Nurs Crit Care 19:26–33.
18. Sullivan L (2014) Power and Sample Size Determination. https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_power/bs704_power_print.html
19. Uwineza DV (2017) Knowledge, attitudes and practice among nurses toward oxygen administration to the critically ill patients at UTHK [Internet] [Thesis]. University of Rwanda; 2017 [cited 2021 Jul 2]. Available from: http://dr.ur.ac.rw/handle/123456789/421
20. Galvagno SM (2012) "A" is for airway. Understanding ventilation vs. oxygenation in airway management. JEMS 37:52–54
21. Mackle D, Bellomo MNR, Bailey M, Beasley R, Deane A, Eastwood G, Finfer S, Freebairn R, King V, Linke N, Litton E, McArthur C, McGuinness S, Panwar R, Young P (2020) Conservative Oxygen Therapy during Mechanical

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Ventilation in the ICU. New England Journal of Medicine 382:989–998

22. Kane B, Decalmer S, Ronan O'Driscoll B (2013) Emergency oxygen therapy: from guideline to implementation. Breathe 9:246–253.

23. Yahaya AK, Ekpenyong BN, Obegu P (2018) Caregivers' knowledge of pneumonia and uptake of vaccination in under-five children in Kaduna State, Nigeria. J Med Biomed Sci 1:40–8.

24. Kegel, M. (2016, October 1). Knowledge of Pneumonia Is Poor in Ghana, Researchers Find. https://pneumonia researchnews.com/2016/09/01/knowledge-pneumonia-poor-in-ghana-researchers-find/

25. Jordan A, Badovinac A, Špalj S, Par M, Šlaj M, Plančak D (2014) Factors influencing intensive care nurses' knowledge and attitudes regarding ventilator-associated pneumonia and oral care practice in intubated patients in Croatia. Am J Infect Control 42:1115–1117.

26. Ul Haq N, Hassali MA, Shafie AA, Saleem F, Farooqui M, Aljadhey H (2012) A cross-sectional assessment of knowledge, attitude, and practice towards Hepatitis B among healthy population of Quetta, Pakistan. BMC Public Health 12:692.

27. WHO. World Health Organization, Caring for Newborns and Children in the Community: A Training Course for Community Health Workers [Internet]. Geneva: World Health Organization; 2011 [cited 2021 Jul 2]. Available from: http://apps.who.int/iris/bitstream/handle/10665/44398/9789241548045_Manual_ eng.pdf;jsessionid=6CC8B8A2FC133264F8CCD41CACC2F8BC?sequence=1

28. UNICEF. The Scaling Pneumonia Response INnovaTions (SPRINT) Project (SPRINT) [Internet]. 2020 [cited 2021 Jul 2]. Available from: https://www.unicef.org/innovation/productinnovation/SPRINT

29. Lema G, Tsadik AW, Beza L (2017) Knowledge, Attitude and Practice Study of Oxygen Therapy among Emergency Department Nurses in Addis Ababa, Ethiopia. Prehosp Disaster Med 32:S149.