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Original Article

Health workers' knowledge, attitudes, and perceptions concerning MRSA at two hospitals in Ghana

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Abstract

Introduction: This study assessed the knowledge, attitudes, and perceptions (KAPs) regarding methicillin-resistant *Staphylococcus aureus* (MRSA) among healthcare workers at the Ho Teaching Hospital and Ho Municipal Hospital in Ghana.
Methodology: This cross-sectional study involved 157 healthcare workers whose KAPs were assessed using a standard questionnaire.
Results: The overall knowledge of the respondents about MRSA was sufficient (mean score = 0.58 ± 0.15). Medical doctors demonstrated the highest knowledge (mean score = 0.80), but their knowledge on the challenges in implementing effective preventive measures against MRSA acquisition, risk factors for transmission, and predominant mode of transmission were poor (mean scores = 0.18–0.37). The respondents' MRSA-related attitudes (mean score = 2.74 ± 0.31) and perceptions (mean score = 2.88 ± 0.29) were generally positive, with the highest scores recorded among laboratory staff (n = 10) (mean attitude score = 2.92 ± 0.25; mean perception score = 3.06 ± 0.24). The factors that influenced MRSA KAPs included age group (knowledge [$p < 0.001$]), educational level (knowledge [$p < 0.001$], and perception [$p = 0.044$]), and healthcare worker designation (knowledge [$p = 0.044$]). Nurses were six times more likely to have good knowledge about MRSA compared to pharmacy staff (*OR* = 6.05, $p = 0.045$).
Conclusions: The respondents had adequate knowledge, and positive MRSA-related attitudes and perceptions, although some knowledge deficits were identified. These knowledge deficiencies can be addressed during the design of educational programs on MRSA, and by increasing research on KAPs regarding MRSA, among key stakeholders in healthcare, particularly, in Ghana.

Key words: MRSA; knowledge; attitudes; perceptions; health workers.

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Introduction

Staphylococcus aureus (*S. aureus*) is a clinically-significant human and animal commensal bacterium that causes several infections, including, but not limited to, skin and soft tissue infections (SSTIs), meningitis, and pneumonia [1–4]. Though the pathogen is primarily harbored in the anterior nares, its ubiquity ensures that it can be harbored on the hands and other body parts as well [5–8]. The importance of infections caused by the pathogen has increased exponentially following the global emergence and spread of multidrug-resistant *S. aureus* strains [9–11]. A typical example of such strains is methicillin-resistant *S. aureus* (MRSA), which is responsible for life-threatening complications, owing to its extensive antibiotic resistance trait [7,8,12–15]. For instance, a 20–40% fatality rate has been reported in connection with MRSA neonatal septicemia [16,17]. The proportion of *S. aureus* infections attributable to MRSA have been on the rise in the past five decades [18–20].

Individuals who harbor MRSA and other *S. aureus* strains, termed carriers, can also transmit the organisms in a variety of settings, inclusive of communities [5,6]. Healthcare settings, however, usually provide optimum environments for MRSA transmission, and this is facilitated by poor infection control and prevention practices, especially, on the part of healthcare providers [21,22]. Importantly, knowledge and perceptions could impact infection control and prevention attitudes and practices [23–25]. Hence identifying MRSA knowledge and perception deficits, as well as MRSA-related attitudes, particularly, among healthcare workers, is critical to the success of public health interventions targeted at MRSA. Nonetheless, such studies are limited, and no such study appears to have been conducted in Ghana — a country in which several MRSA outbreaks have occurred and MRSA carriage prevalence of up to 34.8% have been reported in hospital settings [11,20,27,28]. This paucity of MRSA-related anthropogenic data makes it difficult to design

robustly tailored MRSA public health interventions. To help fill these vital knowledge gaps, this study assessed knowledge, attitudes, and perceptions (KAPs) regarding MRSA among healthcare workers and at the Ho Teaching Hospital and Ho Municipal Hospital in the Volta Region of Ghana.

Methodology

Study design and area

This cross-sectional study was conducted at the Ho Teaching Hospital and Ho Municipal Hospital, the two major referral health facilities in the Volta Region of Ghana. The Ho Teaching Hospital has major clinical and diagnostic departments such as medicine, child health, obstetrics and gynecology, pathology laboratories, radiology, anesthesia, surgery, polyclinic, accident center, surgical/medical emergency, and pharmacy. The hospital has an average annual outdoor patient department (OPD) attendance of 103,964 patients and annual admissions of 11,642 patients, with 4.6 days of stay per admission per patient. The top causes of admission are pregnancy and related complications, complicated malaria, anemia, hypertension, peptic ulcer, urinary tract infections, pneumonia, gastroenteritis, and sepsis.

The Ho Municipal Hospital is a 140-bed capacity facility, and its annual average admission is 7,343 patients. The main causes of admission at the hospital include malaria, anemia, diarrhea, convulsion, fever, pneumonia, pregnancy-related disease, hypertension, gynecological conditions, diabetes, and pneumonia [29].

Study population and sampling

The study included 157 healthcare workers of Ho Teaching Hospital and Ho Municipal Hospital. They were selected randomly via quota sampling based on staff strength. Healthcare workers who were indisposed at the time of sampling were excluded.

Data collection instrument and procedure

A close-ended self-administered questionnaire, with questions on demographics, knowledge, attitude, and perceptions, was used to solicit information from each respondent. The knowledge section comprised a set of 12 questions (adapted from previous studies) related to the respondents' knowledge and included questions with multiple choice and true/false responses [30]. The questions were used to develop scores to determine theoretical and practical understanding of MRSA among the respondents. Correct responses were given a score of 1, whilst a score of 0 was given for incorrect responses. Correct responses were based on current literature and best practice. Overall mean scores for knowledge that were less than 0.25 were categorized as "very poor", 0.25–0.50 as "poor", 0.51–0.75 as "sufficient", and scores more than 0.75 as "good". The perception and attitude sections were assessed using a five-point Likert scale on the choices of strongly agree, agree, don't know, disagree, and strongly disagree; with respective scores 4, 3, 2, 1, and 0; for questions requiring agreement. In the case of questions requiring disagreement as the appropriate response, strongly disagree, disagree, don't know, agree and strongly agree were scored 4, 3, 2, 1, and 0 respectively. Each score from the attitude and perception sections were standardized by calculating the mean score per section per respondent, and categorized as positive (mean score greater than or equal to 2.5) or negative (mean score less than 2.5).

The questionnaires were shared among the respondents and collected within a week. The researchers kept in touch with the respondents by phone calls and visits, where applicable, in case of challenges in the completion of the questionnaire.

Data analysis

Data obtained were entered into a Microsoft Excel spreadsheet and exported to Statistical Products and Services Solutions (SPSS), version 22 (IBM Corp, Armonk, NY, USA). The study variables were inspected for outliers, irregularities, and missing data, to ensure accuracy, before the analysis. Demographic characteristics of the respondents were summarized with descriptive statistics. Frequency distributions were used to describe study variables with nominal and ordinal levels of measurement, and measures of central tendency (mean) and variability were used to describe interval and ratio level measurements. Mean scores and their standard deviations and ranges of each distribution were used where necessary. Association between background information (demographic parameters) and MRSA KAPs of the respondents was determined by the Chi square test. A logistic regression analysis was used to assess the various determinants of MRSA knowledge, attitude, and perception of respondents. A p value < 0.05 was considered statistically significant for all tests of significance.

Ethical issues

The study received ethical clearance from the Committee on Human Research, Publication and Ethics, School of Medical Sciences, Kwame Nkrumah University of Science and Technology (KNUST).

Table 1. Sociodemographic features of the respondents

Features	Designation of respondents [*n* (%)]					Total [*n* (%)]
	Laboratory staff	Medical officer	Nurse	Health assistant	Pharmacy staff	
Educational level						
Diploma/certificate	1 (1.1)	0 (0)	69 (75.8)	14 (15.4)	7 (7.7)	91 (58.0)
Bachelors	9 (15.3)	8 (13.6)	40 (67.8)	0 (0.0)	2 (3.4)	59 (37.6)
Masters	0 (0.0)	0 (0)	1 (100.0)	0 (0.0)	0 (0.0)	1 (0.6)
Doctorate	0 (0.0)	6 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (3.8)
Age group (years)						
< 20	0 (0.0)	0 (0)	0 (0.0)	0 (0.0)	1 (100.0)	1(0.6)
20–29	5 (5.5)	1 (1.1)	70 (76.9)	12 (13.2)	3 (3.3)	91 (58.0)
30–39	3 (5.6)	7 (13.0)	39 (72.2)	1 (1.90)	4 (7.4)	54 (34.4)
40–49	2 (28.6)	3 (42.9)	0 (0.0)	1 (14.3)	1 (14.3)	7 (4.5)
50–59	0 (0.0)	3 (75.0)	1 (25.0)	0 (0.0)	0 (0.0)	4 (2.5)
Gender						
Female	2 (2.1)	5 (5.3)	75 (78.9)	6 (6.3)	7 (7.4)	95 (60.5)
Male	8 (12.9)	9 (14.5)	35 (56.5)	8 (8.40)	2 (3.2)	62 (39.5)
Hospital						
HMH	6 (13.6)	2 (4.5)	30 (68.2)	6 (13.6)	0 (0.0)	44 (28.0)
HTH	4 (3.5)	12 (10.6)	80 (70.8)	8 (7.1)	9 (8.0)	113 (72.0)
Total	10 (6.4)	14 (8.9)	110 (70.1)	14 (8.9)	9 (5.7)	157 (100.0)

HTH: Ho Teaching Hospital (Volta Regional Hospital); HMH: Ho Municipal Hospital.

Permissions were also sought from the managements of Ho Teaching Hospital and Ho Municipal Hospital. All respondents were required to give consent for their participation.

Results

Sociodemographic features of the study participants

One hundred and fifty-seven (157) respondents participated in this study, of whom the majority (72.0%) were staff of Ho Teaching Hospital (HTH), and the remaining 28.0% were staff of Ho Municipal Hospital (HMH), which reflected the relative staff strength of the two facilities. The respondents were predominantly females (60.5%) and the educational level of the majority (58.0%) was diploma/certificate. The majority (58%) of the participants were within the age group of 20–29 years, followed by those within the age groups of 30–39 years (34.4%) and 40–49 years (4.5%). The hospital staff who were interviewed were nurses (70.1%), laboratory staff (6.4%), medical officers (8.9%), pharmacy staff (5.7%), and health assistants (8.9%). The sociodemographic features of the respondents are summarized in Table 1.

Knowledge about MRSA

The overall knowledge about MRSA among the respondents was sufficient (overall mean score = 0.58, SD = 0.15). The respondents on average scored > 0.75 (good) for four questions in the knowledge section, and obtained very poor and poor scores for five other knowledge questions. The respondents had high scores on questions about the prevention and control of MRSA, and how untreated MRSA infection could be life-threatening. Moreover, grouping of the mean knowledge scores of the respondents by their designation revealed that medical officers had a good mean score of 0.80. Laboratory staff, nurses, and health assistants had sufficient knowledge about MRSA, with mean scores of 0.62, 0.57, and 0.56, respectively. Pharmacy staff had poor knowledge about MRSA with a mean score of 0.45. The mean scores of the respondents for each question assessing MRSA-related

Table 2. Mean MRSA-related knowledge scores of the healthcare workers.

Question on MRSA-related knowledge	N	Min	Max	Mean	SD
What is MRSA?	156	0	1	0.56	0.50
All are high risk factors of contracting MRSA except	156	0	1	0.34	0.48
The most common clinical presentation of MRSA	154	0	1	0.45	0.50
Groups to be carefully evaluated for skin infection	147	0	1	0.59	0.50
MRSA infections are also now community-acquired	150	0	1	0.67	0.47
The most common method of transmission	155	0	1	0.37	0.49
Preventing and containing MRSA infections	149	0	1	0.94	0.24
Untreated MRSA is life threatening	153	0	1	0.94	0.24
Precautions with MRSA patients/items	156	0	1	0.88	0.33
Challenges to effective prevention measures	148	0	1	0.18	0.39
Most effective hand hygiene method	155	0	1	0.79	0.41
Method for receiving educational information	156	0	1	0.28	0.45
Overall	157	0	1	0.58	0.15

Mean knowledge scores per specialization: medical officers: 0.80 ± 0.06; laboratory staff: 0.62 ± 0.10; nurses: 0.57 ± 0.12; health assistants: 0.56 ± 0.14; pharmacy staff: 0.45 ± 0.17. MRSA: methicillin-resistant *Staphylococcus aureus*; SD: standard deviation.

knowledge, as well as their overall score are presented in Table 2.

Table 3 summarizes the responses to the knowledge questions. When asked what MRSA is, 89% (*n* = 139) of the respondents recognized MRSA as "*Staphylococcus* bacteria found in the nose and on the skin of healthy people". However, 37.4% (*n* = 52) of them believed the pathogen to be susceptible to beta-

Table 3. Summary of frequency of responses to knowledge questions.

Knowledge Question	Response		
	N	%	Total
Which of these best describes MRSA?			
a. Staph bacteria found on the skin and in the nose of healthy persons that are sensitive to beta-lactam antibiotics.	52	33.1	
b. Bacterial infection of the membranes covering the brain and spinal cord.	0	0.0	
c. Staph bacteria found on the skin and in the nose of healthy persons that are resistant to beta-lactam antibiotics.	87	55.4	156
d. Painful inflammatory nodule that can occur anywhere on the skin surface that contains hair follicles and is subject to friction and maceration.	17	10.8	
These risk factors increase suspicion of MRSA infection except:			
a. Crowded living facilities, recurrent skin disease, and history of MRSA infection.	66	42.0	
b. Old age, male gender, history of heart disease within the past year, African-American race.	53	33.8	
c. Recent antibiotic use, high prevalence of MRSA in the institution, and close contact with someone known to be infected with MRSA.	8	5.1	156
d. Complaint of "spider or insect bite, clusters of infections among persons in groups	29	18.5	
The MOST common clinical presentation of MRSA			
a. Impetigo and cellulitis	51	33.1	
b. Folliculitis and cellulitis	0	0.0	154
c. Abscesses and cellulitis	86	55.8	
d. Abscesses and osteomyelitis	17	11.04	
Only inmates during the intake medical screening and physical examination with diabetes, immune-compromised, open wounds, recent surgery, and chronic skin conditions should be carefully evaluated for skin infections.			
a. True	61	41.5	147
b. False	86	58.5	
MRSA infections are now also common in the community and are called community-acquired MRSA			
a. True	101	67.3	150
b. False	49	32.7	
The MOST common method of transmission of MRSA			
a. Coughing or sneezing while in close contact with others	51	32.9	
b. Sexual intercourse with infected person	3	1.9	155
c. Contaminated objects or surfaces	43	27.7	
d. Direct physical contact with an infected person	58	37.4	
Hand washing before and after every patient contact, whether or not gloves are worn is the simplest and most important infection control measure for preventing and containing MRSA infections			
a. True	140	94.0	149
b. False	9	6.04	
Untreated MRSA infections do not result into life threatening infections			
a. True	9	5.9	153
b. False	144	94.1	
Which of the following precautions should be taken before contact with MRSA patients/items in their room?			
a. Hand Cleaning	2	1.3	
b. Gloving	16	10.3	156
c. All of the above	137	87.8	
d. Do not know	1	0.6	
All the following are NOT challenges to effective prevention measures in your facility except			
a. Absence of supplies (gloves, PPE, disinfectants etc.)	16	10.8	
b. Lack of testing for MRSA	55	37.2	
c. Lack of training/education	17	11.5	148
d. Lack of teamwork	20	13.5	
e. Decrease number of staff on duty	27	18.2	
f. Other	13	8.8	
Most effective hand hygiene method			
a. Plain soap and water	9	5.8	
b. Antimicrobial soap and water	122	78.7	155
c. Alcohol-based hand rub	20	12.9	
d. None of the above	4	2.5	
Preferred method for receiving educational information on MRSA			
a. In-services	83	53.2	
b. Infection control officer	44	28.2	
c. Internet based training	7	4.5	156
d. Journal articles	6	3.8	
e. Word of mouth	14	9.0	
f. Other (comment)	2	1.3	

MRSA: methicillin-resistant *Staphylococcus aureus;* PPE: personal protective equipment.

lactam antibiotics, while 62.6% (*n* = 87) believed that the pathogen was resistant to beta-lactam antibiotics. The 10.8% (*n* = 17) of the respondents who did not choose any of the two responses selected "painful inflammatory nodule that can occur anywhere on the skin surface that contains hair follicles and is subject to friction and maceration" as their response.

In response to the question on the factor that does not increase suspicion of MRSA infection, 42.0% (*n* = 66), 33.8% (*n* = 53), 18.5% (*n* = 29), and 5.1% (*n* = 8) of the respondents identified "crowded living facilities, recurrent skin disease, and history of MRSA infection", "old age, male gender, history of heart disease within the past year, African-American race", "complaint of spider or insect bite and clusters of infections among persons in groups", and "recent antibiotic use, high prevalence of MRSA in the institution, and close contact with someone known to be infected with MRSA", respectively (Table 3). The majority 55.8% (*n* = 86) of the respondents indicated that abscesses and cellulitis were the most common clinical presentations of MRSA; 33.1% (*n* = 51) and 11.04% (*n* = 17) of the respondents selected "impetigo and cellulitis" and "abscesses and osteomyelitis", respectively.

Furthermore, the majority of the respondents (58.5%, *n* = 86) disagreed, whilst 41.5% (*n* = 61) agreed, with the statement "only inmates during the medical intake for medical screening and physical examination with diabetes, immune-compromised, open wounds, recent surgery, and chronic skin conditions should be carefully evaluated for skin infections". In addition, 67.3% (*n* = 101) of the respondents agreed that MRSA infections are now common in the community, and are called community-acquired MRSA. Only 37.4% (*n* = 58) of the respondents indicated that "direct physical contact with an infected person via contaminated hands" is the most common mode of MRSA transmission; 32.9% (*n* = 51), 1.9% (*n* = 3), and 27.7% (*n* = 43) selected "coughing or sneezing while in close contact with others", "sexual intercourse by having anal, vaginal, or oral sex with someone who is infected", and "contaminated objects or surfaces", respectively. In addition, 94.0% (*n* = 140) of the respondents agreed that "hand washing before and after every patient contact, whether or not gloves are worn is the simplest and most important infection control measure for preventing and containing MRSA infections", and 94.1% (*n* = 144) disagreed that MRSA infections left untreated is not life threatening.

With regard to challenges to effective MRSA preventive measures, 37.2% (*n* = 55), 13.5% (*n* = 20), 11.5% (*n* = 17), 10.8% (*n* = 16), 18.2% (*n* = 27), and 8.8% (*n* = 13), identified "lack of testing for MRSA", "lack of teamwork", "lack of training/education", "absence of supplies", "decrease in number of staff on duty", and "other (comment)" respectively as challenges to effective preventive measures of MRSA infections in their facilities. When asked "which hand hygiene method is the most effective in killing MRSA", the majority (78.7%, *n* = 122) indicated "antimicrobial soap and water". Moreover, the distribution of responses to the question about the preferred method for receiving educational information on infection control practices and MRSA prevention was in-services (57.1%, *n* = 89), infection control officer (25.0%, *n* = 39), internet-based training (12.2%, *n* = 19), journal articles (3.2%, *n* = 5), word of mouth (1.3%, *n* = 2), and other (1.3%, *n* = 2).

Table 4. Summary of the responses to the attitude questions.

Attitude Question	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		*N*
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
I am confident taking preventive actions to prevent and control MRSA transmission in our facility.	38	24	107	69	11	7	0	0	0	0	156
When staff on this unit(s) do not wear gown and gloves before touching a patient with MRSA, I feel comfortable reminding them.	52	33	86	55	7	4	3	2	8	5	156
If I clean my hands and wear gowns and gloves as recommended, I will decrease my risk of getting MRSA.	113	72	40	26	0	0	3	2	0	0	156
When we are short-staffed on my unit, MRSA is spread more than when we are fully staffed.	23	15	40	26	54	35	22	14	15	10	154
When staff on this unit(s) do not clean their hands, I feel comfortable reminding them.	60	39	82	53	5	3	8	5	0	0	155
I am concerned that I will transmit MRSA to my family and/or friends at home.	51	33	68	44	17	11	16	10	3	2	155
Someone I know had MRSA and the experience influenced my attitude towards MRSA.	9	6	65	42	66	43	10	6	5	3	155
If I clean my hands and wear gowns and gloves as recommended, I will decrease my patients' risk of getting MRSA.	65	42	85	55	1	1	4	3	0	0	155
I am comfortable with educating patients and their families about MRSA.	74	48	60	39	14	9	6	4	1	1	155
The news media influenced my attitude toward MRSA.	22	14	49	32	24	16	57	37	2	1	154
MRSA is a problem in this hospital.	22	15	39	26	27	18	62	41	1	1	151
I have received meaningful education regarding MRSA.	10	6	89	58	11	7	43	28	1	1	154

MRSA: methicillin-resistant *Staphylococcus aureus.*

Respondents' attitudes and perceptions regarding MRSA

The overall mean scores for the attitude and perception statements were categorized as positive (mean score ≥ 2.5) and negative (< 2.5). The attitudes of the respondents toward MRSA were generally positive (overall mean score = 2.74 ± 0.31). The mean attitude scores decreased across laboratory staff (2.92 ± 0.25, *n* = 10), health assistants (2.84 ± 0.20, *n* = 14), nurses (2.73 ± 0.33, *n* = 109), pharmacy staff (2.72 ± 0.36, *n* = 9), and medical officers (2.67 ± 0.23, *n* = 14). Table 4 summarises the responses to the questions in the attitude section. Apart from the third and sixth questions in the table which required the respondents to disagree with the statement, the remaining items of the attitude section required agreement. The majority of the respondents "strongly agreed" and "agreed" with the positive attitude statements, while the negative attitudes statements attracted mixed responses, with a good number being "neutral" on those statements. In addition, 15% (*n* = 23) and 26% (*n* = 40) of the respondents "strongly agreed" and "agreed" to the negative attitude statement: "when we are short staffed on my unit, MRSA is spread more than when we are fully staffed"; 35% (*n* = 54) were neutral to the statement, and 14% (*n* = 22) and 10% (*n* = 10) disagreed and strongly disagreed, respectively.

As was the case with the respondents' attitude scores, the perception score was positive (overall mean score = 2.88 ± 0.29). The mean perception scores decreased across laboratory staff (3.06 ± 0.24, *n* = 10), medical officers (2.99 ± 0.2, *n* = 14), pharmacy staff (2.96 ± 0.28, *n* = 9), nurses (2.86 ± 0.31, *n* = 109), and health assistants (2.83 ± 0.17, *n* = 14).

Tables 5 and 6 summarize the responses to statements in the perception section, that required agreement and disagreement, respectively, from the respondents; as well as how they responded to each question. The majority of the respondents largely "agreed" and "strongly agreed" with nearly all the positive statements. More than a half of them (69.0%, *n* = 107) "strongly agreed" and "agreed" that they could transmit MRSA infection to their family and friends. Similarly, 67.3% (*n* = 103) of the respondents "strongly agreed" and "agreed" that they had received meaningful education regarding MRSA. Between 77.5% and 98.1%

Table 5. Summary of the responses to the positive perception statements.

Positive perception question	Response *N* (%)										Total (*N*)
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
MRSA infection is a serious disease that could be fatal.	67	43.2	66	42.6	20	12.9	2	1.3	0	0.0	155
MRSA infection is a global health problem.	61	39.6	76	49.4	16	10.4	1	0.6	0	0.0	154
MRSA can cause blood infection.	52	34.7	72	48.0	20	13.3	5	3.3	1	0.7	150
MRSA can cause pneumonia in lungs.	45	29.8	72	47.7	31	20.5	2	1.3	1	0.7	151
I am at high risk of catching MRSA in this hospital.	40	26.1	86	56.2	19	12.4	7	4.6	1	0.7	153
As a healthcare worker, I am afraid that I will transmit MRSA infection to my family and my friends.	34	21.9	73	47.1	9	5.8	31	2	8	5.2	155
As a healthcare worker, I adhere to core prevention strategies to protect myself.	68	43.6	84	53.8	3	1.9	1	0.6	0	0.0	156
As a healthcare worker, I adhere to core prevention strategies to protect my parents.	60	39.0	82	53.2	3	1.9	9	5.8	0	0.0	154
I am responsible for increasing the awareness of patients and their families about the importance of MRSA infection prevention strategies.	64	41.3	84	54.2	7	4.5	0	0.0	0	0.0	155
As a member of the hospital staff, I am responsible for reminding my co-workers of the importance of adhering to wearing gloves and gowns.	54	34.8	97	62.6	4	2.6	0	0.0	0	0.0	155
As a member of the hospital staff, I am responsible for reminding my co-workers of the importance of performing to hand hygiene.	65	42.2	86	55.8	2	1.3	1	0.6	0	0.0	154
I have received meaningful education regarding MRSA.	19	12.4	84	54.9	1	0.7	36	23.5	13	8.5	153

MRSA, methicillin-resistant *Staphylococcus aureus.*

Table 6. Summary of the responses to the negative perception questions.

Negative perception question	Response *N* (%)										Total (*N*)
	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
Nosocomial infectious disease is not a problem in this hospital.	9	5.9	29	19.0	8	5.2	66	43.1	41	26.8	153
I lack time required to clean my hands or put on gloves and gowns	15	9.7	14	9.0	11	7.1	70	45.2	45	29.0	155
Alcohol-rub and soap-water based hand hygiene materials are not easily available	15	9.7	26	16.9	7	4.5	77	50.0	29	18.8	154
Environmental cleanliness in this hospital and over-crowding of patients make MRSA infection uncontrolled	24	15.7	39	25.5	28	18.3	44	28.8	18	11.8	153
Previous experience with MRSA infection influenced my belief towards prevention of the infection	25	16.4	61	40.1	30	19.7	36	23.7	0	0.0	152

MRSA: methicillin-resistant *Staphylococcus aureus.*

of the respondents "strongly agreed" and "agreed" to the remaining positive perception statements (Table 5). In addition, 69.9% (n = 107), 74.2% (n = 115), and 68.8% (n = 106) of the respondents respectively either "disagreed" or "strongly disagreed" with the negative perception statements "nosocomial infectious disease is not a problem in this hospital", "I lack time required to clean my hands or put on gloves and gowns", and "alcohol-rub and soap-water based hand hygiene materials are not easily available", respectively (Table 6).

Factors influencing knowledge, attitude, and perception of MRSA among the respondents

The differences in the mean knowledge scores among the various age groups were statistically significant (p = 0.037); all the age groups recorded at least sufficient knowledge, with the 50–59 years age group recording the highest mean score of 0.8 (interpreted as good; Table 7). Significant differences were, however, not observed across the age groups with regard to the mean scores for attitude and perception. In addition, the gender and facility (hospital) of the respondents did not influence the mean scores for knowledge, attitudes, and perception.

The respondents significantly differed across the different educational levels with regard to their mean knowledge (p < 0.001) and perception (p = 0.044) scores, but not their attitude scores (p = 0.30). All the educational levels recorded at least sufficient knowledge; respondents with doctorate and masters' degrees obtained good knowledge scores (> 0.75). Similarly, respondents with doctorate degrees had the highest perception score of 3.14. Furthermore, the respondents significantly differed across their different designations with regard to their mean knowledge scores (p < 0.001), but not their perception (p = 0.10) and attitude (p = 0.35) scores.

The results of the logistic regression analysis (Table 8) showed that only healthcare workers' profession was a predictor of knowledge on MRSA. Nurses were 6 times more likely to have a good knowledge about MRSA compared to pharmacy staff (OR = 6.05, p = 0.045). However, age group, gender, education, facility, and designation (profession) of the respondents did not predict their attitudes and perceptions regarding MRSA. Respondents with positive MRSA perception were almost 10 times (OR = 9.88, p < 0.001) more likely to have a positive attitude towards MRSA, compared with those with negative perceptions.

Table 7. Distribution of the knowledge, attitude, and perception scores with regard to the respondents' demographic features.

Respondents' Demographics	Knowledge			Attitude			Perception		
	N	Mean	SD	*N*	Mean	SD	*N*	Mean	SD
Age Group (years)									
< 20	1	0.58		1	2.64		1	2.71	
20–29	91	0.57	0.13	91	2.74	0.31	91	2.86	0.30
30–39	54	0.57	0.14	54	2.74	0.33	54	2.91	0.28
40–49	7	0.60	0.30	7	2.80	0.22	7	2.96	0.22
50–59	4	0.80	0.06	4	2.71	0.25	4	3.02	0.25
p value*		0.037 *			0.871			0.621	
Gender									
Female	95	0.58	0.15	95	2.73	0.34	95	2.88	0.31
Male	62	0.58	0.15	62	2.77	0.27	62	2.90	0.24
p value*		0.806			0.524			0.902	
Educational level									
Bachelors	67	0.60	0.13	67	2.78	0.30	67	2.89	0.27
Diploma/Cert	83	0.54	0.14	83	2.71	0.32	83	2.86	0.30
Doctorate	6	0.81	0.05	6	2.75	0.24	6	3.14	0.11
Masters	1	0.83		1	2.42		1	2.65	
p value*		< 0.001 **			0.300			0.044 *	
Hospital									
HMH	44	0.57	0.14	44	2.74	0.36	44	2.92	0.29
HTH	113	0.58	0.15	113	2.74	0.29	113	2.87	0.29
p value*		0.971			0.133			0.545	
Designation									
Laboratory staff	10	0.62	0.12	10	2.92	0.25	10	3.06	0.24
Medical officer	14	0.80	0.06	14	2.67	0.23	14	2.99	0.20
Nurse	110	0.57	0.12	110	2.73	0.33	110	2.86	0.31
Health assistants	14	0.42	0.30	14	2.84	0.20	14	2.83	0.17
Pharmacy staff	9	0.45	0.17	9	2.72	0.36	9	2.96	0.28
p value*		< 0.001 **			0.352			0.100	

HMH: Ho Municipal Hospital; HTH: Ho Teaching Hospital; N: number of observations; SD: standard deviation. *p* value for the Mann–Whitney U or Kruskal-Wallis test; *p* value*: significant at 5%, *p value***: significant at 1%.

Table 8. Logistic regression analysis of the MRSA knowledge, attitude, and perception by demographics of the respondents.

Demographics	Odds ratio (*p* value)		
	Knowledge	Attitude	Perception
Age group (years)			
< 20	0.59 (0.99)	0	0.95 (1.00)
20–29	0.91 (0.99)	0	1.73 (1.00)
30–39	0.70 (0.99)	0	1.72 (1.00)
40–49	0.97 (0.99)	0	1.41 (1.00)
50–59	1	1	1
Gender			
Female	1.53 (0.39)	0.41 (0.17)	0.52 (0.47)
Male	1	1	1
Education			
Bachelors	0	10.50 (1.00)	0
Diploma/Cert	0	64.25 (1.00)	0
Doctorate	0	10.65 (1.00)	0
Masters	1	1	1
Hospital			
HMH	0.72 (0.43)	0.62 (0.36)	0.83 (0.77)
HTH	1	1	1
Designation			
Laboratory staff	17.53 (0.02) *	10.15 (1.00)	0.71 (0.99)
Medical officer	0.61 (0.99)	0.33 (0.45)	0.77 (0.99)
Nurse	6.05 (0.045) *	0.54 (0.59)	0
Health assistant	4.40 (0.190)	6.53 (1.00)	1.29 (0.99)
Pharmacy Staff	1	1	1

Predictors of the respondents' attitude – knowledge (OR = 1.05, $p = 0.92$); perception (OR = 9.88, $p < 0.001$). HMH: Ho Municipal Hospital; HTH: Ho Teaching Hospital; MRSA: methicillin-resistant *Staphylococcus aureus.*

Knowledge was, however, not a predictor of the respondents' attitudes towards MRSA.

Discussion

This study assessed the KAPs regarding MRSA among healthcare workers at the Ho Teaching Hospital and Ho Municipal Hospital in the Volta Region of Ghana, to fill the knowledge gaps that could be crucial to designing robustly tailored MRSA public health interventions.

Overall, the knowledge of the respondents about MRSA was sufficient, with a mean score of 0.58. As an example, 82.8% of the respondents knew MRSA to be a global health problem, 70.1% knew MRSA could cause blood infections, and 71.4% knew that it could cause pneumonia. In line with the perceived risks concerning MRSA, 87.9% of the respondents confidently took preventive actions, 86.6% felt comfortable reminding other staff about wearing personal protective equipment (PPE) before attending to patients, and 97.5% followed the recommended preventive practices. Similar to these observations, a study by Paudyal *et al.* [31] in North Dakota noted that 99% of the healthcare workers followed proper hand washing protocols, 92% were familiar with the methods of transmission, and 97% wore gloves, masks, and aprons to reduce cross contamination. The highlighted findings of the current study align with those of other studies across the globe which have reported that between 47% and 92.7% of healthcare staff felt at risk when in contact with, or caring for, MRSA-infected patients [32–34].

It was noted, however, that the respondents' knowledge on the challenges to effective MRSA prevention measures, risk factors for transmission, and predominant mode of transmission were poor, with mean scores ranging between 0.18 and 0.37. Moreover, a good proportion of the respondents (33.1%) demonstrated with their responses that they were unaware that MRSA was resistant to beta-lactam antibiotics. Although this may indicate their incognizance with current MRSA treatment guidelines, it may also reflect their possible non-familiarity with the various antibiotic classes. Another worrying finding among the respondents was that a high proportion (42%) of them did not know that living in crowded areas or having a history of recurrent skin disease or MRSA infection could predispose to MRSA infection. Another point of concern was the respondents' ignorance that MRSA infections could be life-threatening if left untreated. These identified knowledge deficits could be given priority in MRSA educational interventions, primarily at the healthcare facilities from which the study respondents were pooled. These interventions could be further refined with the aid of insights yielded by subsequent MRSA knowledge surveys to make them more generalizable to the larger population of healthcare workers in the country and beyond.

The attitudes of the respondents toward MRSA prevention were generally positive, with an overall mean score of 2.74, decreasing across laboratory staff, health assistants, nurses, pharmacy staff, and medical officers. Similarly, the overall mean perception score of the respondents was positive (2.88), decreasing across laboratory staff, medical officers, pharmacy staff, nurses, and health assistants. Although the attitudes and perceptions of the respondents were positive, they could further be strengthened to improve upon their MRSA infection control practices. This is especially important, as it is generally known that the attitudes and perceptions of individuals could influence their behaviors [23–25].

Factors that influenced MRSA KAPs among the respondents included age group (knowledge), educational level (knowledge and perception), and healthcare worker designation (knowledge). Those in the 50–59 years age group recorded the highest mean knowledge score of 0.8 (interpreted as good); as did those with doctorate degrees (> 0.75), who additionally had the highest perception score of 3.14. In contrast, some other studies have reported, age and education to have no influence on MRSA knowledge [31,35,36]. The findings that doctors had the highest knowledge score, and nurses were six times more likely to have a good knowledge about MRSA compared to pharmacy staff are consistent with what have been reported elsewhere. For example, Jennings-Sanders and Jury have demonstrated that healthcare worker designation influences knowledge on MRSA [37]. In line with that, Lugg and Ahmed, in their study, reported that nurses who cared for children had significantly lower median MRSA knowledge scores than did those cared for adults (10.1 vs. 12, $p = 0.001$) [38]. Similarly, Brady *et al*. [39] and Easton *et al*. [40] noted varied disparities in MRSA-related knowledge between nurses and physicians. To illustrate, Brady *et al.* reported significantly higher mean scores on MRSA-related knowledge among nurses compared to doctors (8.69 vs. 6.6, $p < 0.001$) [39]. On the contrary, Easton *et al*. reported that a significantly higher proportion of doctors accurately identified *S. aureus* as being Gram-positive (95% vs. 70%, $p < 0.001$), identified blood and wound/skin as the two predominant MRSA infection sites (34% vs. 17%, $p = 0.009$), and identified MRSA infections be more fatal than infections with other *S. aureus* strains (56% vs. 32%, $p < 0.001$) [40].

Overall, this study demonstrated at least sufficient knowledge, and positive attitudes and perceptions regarding MRSA among the study respondents. More importantly, it has identified critical knowledge deficits that need to be factored in the design of educational programs on MRSA. However, inferences drawn from the study need to take into account that the study was limited to two hospitals; therefore, the findings are not necessarily generalizable to other healthcare facilities in the country. Additional research, both local and global, may provide more insights on improving MRSA prevention and control strategies.

Conclusions

The respondents generally had adequate knowledge, and positive attitude and perception about MRSA. However, some knowledge deficits, such as challenges to effective MRSA prevention measures, modes, and predisposing factors to MRSA transmission, were identified. These knowledge deficiencies may be addressed during the design of educational programs on MRSA and display of informational posters. At the same time, increasing research on knowledge, attitudes, and perceptions regarding MRSA among key stakeholders in healthcare, particularly, in Ghana, is recommended.

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Conflict of interests

No conflict of interests is declared.

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