

# Knowledge, attitude and practice of standard precautions of infection control by hospital workers in two tertiary hospitals in Nigeria

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## Abstract

**Background:** Standard precautions are recommended to prevent transmission of infection in hospitals. However, their implementation is dependent on the knowledge and attitudes of healthcare workers (HCW). This study describes the knowledge, attitude and practice (KAP) of standard precautions of infection control among HCW of two tertiary hospitals in Nigeria is described.

**Methods:** A cross-sectional study was undertaken in 2011/2012 among HCW in two tertiary hospitals in Nigeria. Data was collected via a structured self-administered questionnaire assessing core elements of KAP of standard precautions. Percentage KAP scores were calculated and professional differences in median percentage KAP scores were ascertained.

**Results:** A total of 290 HCW participated in the study (76% response rate), including 111 (38.3%) doctors, 147 (50.7%) nurses and 32 (11%) laboratory scientists. Overall median knowledge and attitude scores toward standard precautions were above 90%, but median practice score was 50.8%. The majority of the HCW had poor knowledge of injection safety and complained of inadequate resources to practise standard precautions. House officers, laboratory scientists and junior cadres of nurses had lower knowledge and compliance with standard precautions than more experienced doctors and nurses.

**Conclusion:** Our results suggest generally poor compliance with standard precautions of infection control among HCW in Nigeria. Policies that foster training of HCW in standard precautions and guarantee regular provision of infection control and prevention resources in health facilities are required in Nigeria.

## Keywords

Compliance, healthcare workers, infection control, injection safety, standard precautions

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## Introduction

Healthcare associated infection (HCAI) is defined as an infection occurring in a patient during the process of care in a hospital or other healthcare facility which was not present or incubating at the time of admission (World Health Organization (WHO), 2011). It has been estimated that the prevalence of HCAI in developed and developing countries is 7.6% and 10.1% respectively. (Allegranzi et al, 2011; World Health Organization, 2011).

The most effective and simple way to prevent infection in the hospital is to follow standard precautions, which are a set of recommendations designed to prevent or minimise

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exposure to infectious agents by hospital staff, patients and their visitors (WHO, 2002a,b, 2004). Standard precautions assume that the blood and body substances of all patients are potential sources of infection, regardless of the diagnosis, or presumed infectious status (WHO, 2002a,b, 2004). The components of standard precautions include hand hygiene, injection safety, use of personal protective equipment and environmental cleanliness, as well as waste management, and respiratory hygiene and cough etiquette (WHO 2002a,b, 2004).

An assessment of the knowledge, attitude and practice (KAP) of standard precautions by healthcare workers is a prerequisite for initiating and implementing a successful infection prevention and control (IPAC) strategy in any health facility. Many studies have shown that HCW display variable KAP of standard precautions according to their professional group and duration of professional experience, among other factors. Longer duration of professional experience, knowledge and training in standard precautions, and high risk perception have all been associated with improved compliance with standard precautions among health workers (Kermode et al, 2005; Luo et al, 2010). The majority of studies from around the world have reported higher compliance with standard precautions among nurses than doctors (Gershon et al, 1995; Stein et al, 2003; Sadoh et al, 2006; Adinma et al, 2009; Cutter and Jordan, 2012; Okechukwu and Modteshi, 2012), but a few others have not (Kermode et al, 2005; Kotwal and Taneja, 2010; Hosoglu et al, 2011; Shuper et al, 2013). Although there have been studies on compliance with standard precautions among health workers in Nigeria (Ofili et al, 2003; Ibeziako and Ibekwe, 2006; Izegbu et al, 2006; Sadoh et al, 2006; Adinma et al., 2009; Isara and Ofili, 2010), professional differences in KAP of standard precautions of infection control among health workers have not been well defined in the Nigerian population. We therefore aimed to examine the KAP of some components of standard precautions among doctors, nurses and laboratory staff of two tertiary hospitals in Nigeria. The results of this study may guide the development and implementation of infection prevention and control activities in the study sites as well as in other health facilities in Nigeria.

## Material and methods

This cross-sectional study was undertaken in two tertiary hospitals located in south-south and north-central Nigeria. Both hospitals have a total bed capacity of 350 beds (200 and 150 beds each) and provide tertiary level of patient care covering major medical and surgical disciplines.

The study was conducted over a two month period in both sites; between March and April 2011 in the 150 bed hospital and between February and March 2012 in the 200 bed hospital. Ethical approval for the study was obtained from both hospitals' ethical review committee and all study participants gave consent for the study.

The study population of 381 health workers included all doctors ( $n=128$ ), nurses ( $n=220$ ) and laboratory scientists ( $n=33$ ) of both hospitals, excluding those on annual or study leave at the time of the study. Of the 381 health workers, 216 (56.7%) were working in the 200 bed hospital.

## Data collection

Data was collected from study participants using a standardised self-administered questionnaire distributed as hard copies by eight trained research assistants (four at each study site). The research assistants made attempts to reach all 381 healthcare workers at their duty posts, explained the purpose of the study to those who could be reached and obtained consent for the questionnaire to be filled anonymously and returned within one hour or when not possible, at the end of the day's work. The responses of study participants were treated confidentially.

The questionnaire was pre-tested on a random sample of five doctors, eight nurses and four laboratory staff from each hospital to ensure practicability and validity in questions and interpretation of responses. Following pre-testing, some questions and responses had to be revised for clarity or deleted as appropriate.

The questionnaire comprised three categories of questions: (1) demographic and occupational characteristics; (2) knowledge, attitude and practice of standard precautions, specifically hand washing, use of personal protective equipment such as gloves and face masks, and injection safety; (3) challenges preventing practice of standard precautions.

Questions were developed from review of qualitative and quantitative literature for relevant items (Ofili et al, 2003; Ibeziako and Ibekwe, 2006; Izegbu et al, 2006; Sadoh et al, 2006; Adinma et al., 2009; Isara and Ofili, 2010), including guidelines on standard precautions provided by the World Health Organization (WHO, 2002a,b, 2004)

## Scoring

Knowledge was measured by a set of 22 questions. For every correct response, 1 point was given and 0 was given for an incorrect answer. Consequently, knowledge scores ranged from 0 to 22.

Attitude was measured by a set of 14 positive and negative attitude questions using an abridged Likert's scale with responses including 'agree', 'disagree' and 'uncertain'. A score of 1 was given for two types of responses; (1) 'Agree' to a positive attitude question or 'Disagree' to a negative attitude question. A zero score was given for three types of responses; (1) 'Uncertain', (2) 'Disagree' to a positive attitude question, and (3) 'Agree' to a negative attitude question. Consequently, attitude scores ranged from 0 to 14.

Practice was measured by a set of 14 questions using a five-point Likert's scale response for practice questions

**Table 1.** Demographic and occupational characteristics of study participants.

Variables	200 bed hospital	150 bed hospital	Total population
Age (years)			
Median (IQR)	34 (29,45)	39 (33,48)	37 (30,46)
Gender (n %)			
Male	86 (51.8%)	47 (37.9%)	133 (45.9%)
Female	80 (48.2%)	77 (63.1%)	157 (54.1%)
Training in infection control			
Yes	78 (57.4%)	58 (42.6%)	136 (48.6%)
No	78 (54.2%)	66 (45.8%)	144 (51.4%)
Professional group (n %)			
House officers	23 (13.9%)	-	23 (7.9%)
Medical officers/Resident doctors	30 (18.1%)	20 (16.1%)	50 (17.2%)
Consultant doctors	27 (16.3%)	11 (8.9%)	38 (13.1%)
Staff nurse/SNO	44 (26.5%)	55 (44.4%)	99 (34.1%)
PNO/ACNO/CNO	31 (18.7%)	17 (13.7)	48 (16.6%)
Laboratory scientists	11 (6.6%)	21 (16.9)	32 (11%)
Total	166 (57.2%)	124 (42.8%)	290 (100%)

Key: IQR=interquartile range, SNO=senior nursing officer, PNO=principal nursing officer, ACNO=assistant chief nursing officer, CNO=chief nursing officer.

(i.e. always, most of the time, sometimes, rarely, never). In nine practice questions where positive responses were expected, scores of 5, 4, 3, 2 and 1 were given for any, always, most of the time, sometimes, rarely and never responses respectively. On the other hand, in five questions where negative responses were expected, scores of 5, 4, 3, 2 and 1 were given for any, never, rarely, sometimes, most of the time and always responses respectively. Consequently, practice scores ranged from 14 to 70.

The KAP scores for each study participant were thereafter used to calculate percentage KAP scores. The validity of the KAP questionnaire was confirmed by a Cronbach's alpha internal consistency coefficient of  $\geq 0.8$ .

### Data analysis

Data were analysed using Statistical Package for Social Sciences (SPSS) version 20. Percentage KAP scores were presented as median and interquartile ranges. Differences in median percentage KAP scores between doctors, nurses and laboratory scientists were ascertained by Mann Whitney U test. Correlations between KAP percent scores were ascertained by Spearman rho correlation.  $p < 0.05$  was taken as statistically significant.

## Results

### Demographics

A total of 290 HCW (166 and 124 HCWs each from 150 bed and 200 bed hospitals respectively) participated in the study, giving an overall response rate of 76%.

The demographic and occupational characteristics of study participants are shown in Table 1. Of the 290 health workers, 111 (38.3%) were doctors, 147 (50.7%) were nurses and 32 (11%) were laboratory scientists.

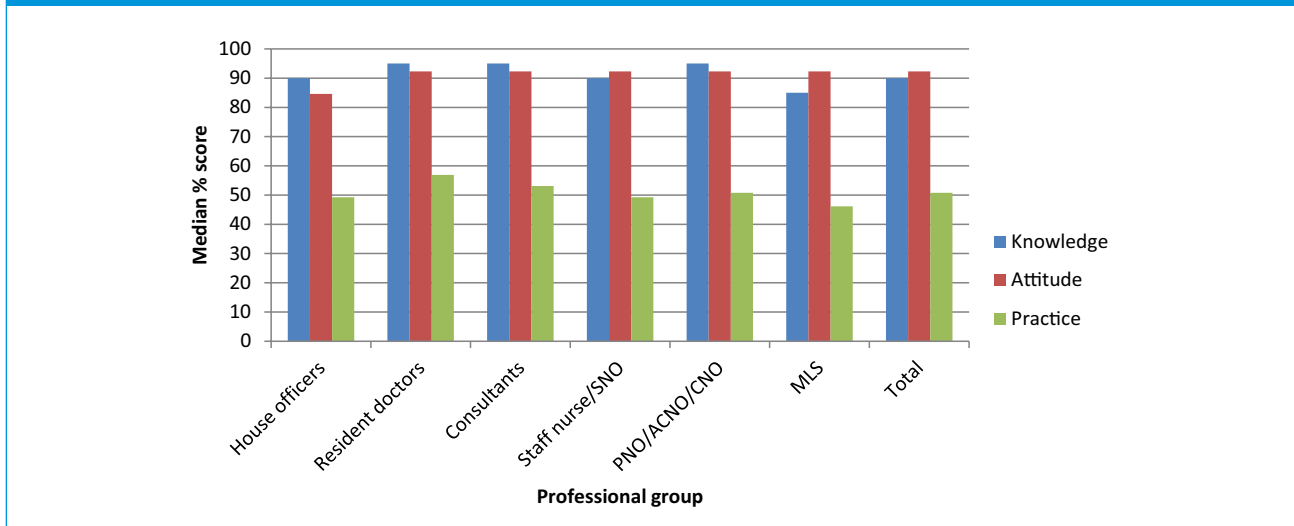
### Knowledge, attitude and practice of standard precautions of infection control

The studied participants had a median (IQR) percentage KAP score of 90 (80, 95), 92.3 (84.6, 100), and 50.8 (47.7, 56.9) respectively. The distribution of the median (IQR) percentage KAP scores across professional groups are represented in Figure 1 and described in the following section.

### Knowledge of standard precautions

The majority (91.6%) of the study participants had previously heard about standard precautions of infection control.

**Figure 1.** Distribution of median knowledge, attitude and practice (KAP) scores across professional groups of health workers. NB: House officers, staff nurses/senior staff nurses and medical laboratory scientists (MLS), generally had lower KAP scores than other cadres of health workers.



Ninety seven per cent knew that standard precautions should be practised on all patients and laboratory specimens irrespective of diagnosis. When asked about recommendations for handling sharps, only 47.7% knew that sharps should never be recapped. Twelve per cent did not know that it was wrong to bend or break sharps or needles. The majority of the participants (95.8%) knew that hands should be washed after touching a patient, while 96.5% knew that gloves should be worn before venipuncture. Seventy three per cent knew that hands should be washed after touching a patient's surroundings.

Among professional groups, MLS, house officers (HO) and junior cadres of nurses (staff nurse/senior staff nurse) had lower percentage median knowledge scores than the consultants and senior cadres of nurses (principal nursing officer/chief nursing officer) ( $p=0.002$ , Krukus Willis test, Figure 1). Following pair-wise comparisons using the Mann Whitney test, the median knowledge scores of MLS (85%) was significantly lower than that of the PNO/CNO (95%,  $p=0.027$ ) and the median knowledge scores of the staff nurse/SNO (90%) were also significantly lower than those of the PNO/CNO ( $p=0.049$ ). The median percentage knowledge scores were not significantly different on pair-wise comparisons of other professional groups ( $p>0.05$ , Figure 1).

#### Attitude towards standard precautions

Most (95%) of the study participants believed that standard precautions will prevent them from acquiring infection from the hospital. Seven per cent were of the view that there was no need to wash or decontaminate hands after touching patients' surroundings, while 98.9% agreed that

gloves should always be worn before venipuncture. Thirty nine per cent did not agree that sharps should never be recapped, while 13.4% felt that sharp needles can be bent or broken after use.

Among all professional groups, house officers had the lowest median percentage attitude scores of 84.6% (Figure 1). Following pair-wise comparisons, house officers had a significantly lower median percentage attitude score than residents (92.3%,  $p=0.04$ ), and PNO/ACNO ( $p=0.036$ ). The median percentage attitude scores were not significantly different when other groups of health workers were compared ( $p>0.05$ , Mann Whitney U test).

#### Practice of standard precautions

With regard to the practice of hand hygiene, 58.5%, 28.1% and 63.6% always practised hand hygiene after touching patients, after touching patients' surroundings and after removing gloves, respectively. Eighty two per cent always wear gloves before venipuncture. In relation to injection safety, 33.7% usually recap sharps with two hands, 7.9% sometimes bend or break sharps, while 63.6% had always disposed of sharps/needles in puncture proof containers in the prior six months.

The overall median percentage practice score was 50.8%. Across professional groups, the median percentage practice scores of MLS (46.2%), house officers (49.2%), and staff nurses/SNO (49.2%) were lower than those of consultants (53%), resident doctors (56.9%) and PNO/ACNO (50.7%). These differences were statistically significant ( $p<0.0001$  Krukus Willis, Figure 1).

On pair-wise comparisons, resident doctors had significantly higher median percentage practice score than MLS

**Table 2.** Differences in median percentage KAP scores among health workers in relation to prior infection control training.

Professional group	Training in infection control	% Knowledge scores		p value	% Attitude scores		p value	% Practice scores		p value
		Median	IQR		Median	IQR		Median	IQR	
Doctors	Yes	95	(90,95)	$p > 0.05$	92.3	(84.6, 100)	$p > 0.05$	53.9	(50.8, 56.9)	$p > 0.05$
	No	90	(85,95)		92.3	(84.6, 92.3)		56.9	(49.2, 61.5)	
Nurses	Yes	95	(85,97.5)	$p = 0.001$	92.3	(84.6, 100)	$p = 0.001$	50.8	(47.7, 56.9)	$p = 0.06$
	No	85	(70,95)		84.6	(84.6, 92.3)		50	(44.6, 53.9)	
MLS	Yes	80	(75,90)	$p > 0.05$	92.3	(76.9, 92.3)	$p > 0.05$	47.7	(44.6, 53.9)	$p > 0.05$
	No	85	(80,95)		84.6	(84.6, 92.3)		45.4	(42.3, 47.7)	
Total	Yes	95	(85, 95)	$p = 0.002$	92.3	(84.6, 100)	$p = 0.001$	52.3	(49.2, 56.9)	$p > 0.05$
	No	90	(75,95)		92.3	(84.6, 92.3)		50.8	(47.7, 56.9)	

MLS=medical laboratory scientists, IQR=interquartile range.

( $p < 0.0001$ ), and staff nurse/SNO ( $p < 0.0001$ ). The median percentage practice scores between other groups of health workers were not significantly different.

### Relationships between prior infection control training and KAP of standard precautions

Overall, study participants who had prior infection control training had significantly higher median knowledge and attitude percentage scores than those who did not have prior training. With regard to professional groups, nurses with infection control training had significantly higher median percentage knowledge and attitude scores than those who did not (Table 2). Although the median percentage KAP scores were generally higher among doctors and MLS who reported prior infection control training, the observed differences in relation to those without prior training were not statistically different (Table 2).

### Correlations

Among the 290 study participants, percentage knowledge scores positively correlated with attitude scores (Spearman rho  $r = 0.4$ ,  $p < 0.0001$ ) but there was no significant correlation when percentage practice scores were compared with percentage knowledge or attitude scores ( $p > 0.05$ ).

Percentage knowledge scores positively correlated with attitude scores among doctors ( $r = 0.39$ ,  $p < 0.0001$ ), nurses ( $r = 0.398$ ,  $p < 0.0001$ ) and MLS ( $r = 0.44$ ,  $p < 0.013$ ).

### Challenges preventing practice of standard precautions of infection control

The challenges that prevented the practice of standard precautions as identified by study participants are summarised

in Table 3. Out of the 290 study participants, 66.1%, identified lack of appropriate or adequate resources to practice standard precautions, 52.4% lack of regular training on infection control, 38.9% lack of an infection prevention and control committee and 34.8% excess workload as the major challenges preventing routine practice of standard precautions (Table 3). The observed differences in reported challenges among doctors, nurses and MLS were not statistically significant ( $p > 0.05$ , all analyses, Chi square).

### Discussion

Knowledge and training in standard precautions, high risk perception and longer duration of professional experience have been shown to be associated with improved compliance with standard precautions among health workers (Kermode et al., 2005; Luo et al., 2010). In our study, we found lower knowledge and attitude scores and lower compliance with standard precautions among less experienced doctors (house officers) and nurses (SN/SNO), as well as MLS, as compared to more experienced doctors and nurses. These findings may suggest that appropriate KAP of standard precautions are acquired with increasing years of professional experience, perhaps due to more frequent exposure to education or training on standard precautions. This assertion is supported by our study data which revealed higher knowledge and attitude scores among study participants who had prior infection control training. In another study among health workers in a tertiary hospital in Enugu, Nigeria, training on standard precautions was predictive of correct knowledge of standard precaution (Ibeziako and Ibekwe, 2006).

Although overall knowledge scores were generally high, especially with regard to knowledge of hand hygiene, we observed poor knowledge of injection safety, with about



**Table 3.** Challenges preventing health workers from practising standard precautions of infection control.

s/n	Reported challenges preventing health workers from practice of standard precautions	Doctors n (%)	Nurses n (%)	MLS n (%)	Total n (%)
1	Lack of knowledge of standard precautions	11 (10.6)	32 (23.4)	103 (2.3)	53 (19.5)
2	Belief that you will not acquire infection in the hospital	6 (5.7)	18 (13)	4 (12.5)	28 (10.1)
3	Lack of functional infection control committee	39 (37.5)	50 (37)	16 (51.6)	105 (38.9)
4	Absence of regular training on infection control	54 (51.9)	67 (48.9)	22 (68.8)	143 (52.4)
5	Lack of adequate facilities/resources for practice of standard precautions	68 (64.8)	89 (64.5)	24 (77.4)	181 (66.1)
6	Patients feel stigmatised when PPEs are used	17 (15.9)	35 (25.4)	5 (15.6)	57 (20.6)
7	PPE are uncomfortable	15 (14)	32 (23)	11 (34.4)	58 (20.9)
8	Time constraints	29 (27.1)	43 (31.4)	5 (16.1)	77 (28)
9	Excess workload	27 (26.2)	50 (37.9)	16 (50)	93 (34.8)

NB: there were no significant differences in each reported challenge across all professional groups ( $p > 0.05$ , Chi square).

50% of our study participants being ignorant of the World Health Organization's recommendation that sharps/needles should never be recapped, bent or broken. In a similar study among medical doctors in Iran, correct knowledge that needles should not be bent before disposal ranged from 27.8% among physicians to 55.6% among medical residents (Askarian et al., 2007). In other studies from Nigeria, less than 40% of health workers from Enugu (Ibeziako and Ibekwe, 2006), Abuja (Okechukwu and Modteshi, 2012) and Asaba (Isara and Ofili, 2010) had poor knowledge of the basic elements of standard precautions.

Our study finding of generally poor practice of the various elements of standard precautions of infection control, especially among less experienced health workers, is in agreement with studies from other parts of Nigeria (Ofili et al, 2003; Sadoh et al, 2006; Adinma et al, 2009; Isara and Ofili, 2010), as well as studies from other parts of the world (Stein et al, 2003; Kermodé et al, 2005; Askarian et al, 2007; Reda et al, 2010; Vaz et al, 2010; Hosoglu et al, 2011; Khapre et al, 2011). The lower practice scores among less experienced health professionals may be partly related to limited knowledge or training in infection control compared to other more experienced health workers. However, the lack of relationship between these factors and the practice of standard precautions suggest the presence of other confounding predictors of practice of standard precautions other than knowledge or training in infection control. Lack of resources and facilities for IPAC has been reported as a major factor influencing poor practice of IPAC in health facilities in Nigeria (Adinma et al, 2009; Okechukwu and Modteshi, 2012) and other countries of the world (Luo et al, 2010; Reda et al, 2010).

In agreement, our study participants reported lack of resources for practice of standard precautions, lack of IPAC committee and lack of training as the major challenges preventing routine practice of standard precautions of infection control in the hospital setting. Other limitations to compliance with standard precautions identified by our study such as excess workload and time constraints have also been reported by other studies (Adinma et al, 2009; Luo et al, 2010). Since the less experienced health workers are more actively engaged in routine clinical activities while the more experienced health workers play more of a supervisory role, it is plausible that the less experienced health workers had poorer compliance with standard precautions because they are more likely to experience excess workload, and/or time constraints, among other challenges.

One of the limitations of this study was that only a few MLS were included and it was not possible to categorise these health workers according to years of experience to reveal possible differences in KAP of standard. It may be necessary for future studies from Nigeria to enrol a larger number of MLS to elaborate on differences in KAP of standard precautions in relation to years of professional experience among MLS.

As we used questionnaires to assess past KAP, we cannot exclude possible over or under-reporting of one or more components of KAP of standard precautions among our study participants. Studies directly observing the practice of standard precautions among health workers in Nigeria are recommended for comparisons.

In conclusion, our study findings suggest that professional differences in KAP of standard precautions among

health workers are largely influenced by the duration of professional experience and not necessarily by professional group. The overall knowledge and attitude toward standard precautions of infection control among healthcare workers in the two tertiary hospitals in the south-south and north-central Nigeria was good. However, there was poor knowledge of injection safety and poor practice of standard precautions of infection control, especially among less experienced health workers such as house officers. The majority of the healthcare workers complained of inadequate resources to practise standard precautions, such as lack of regular running water supply, and the absence of a regular supply of personal protective equipment.

In order to promote good infection control practices and mitigate the risk of hospital acquired infections, it is necessary for health authorities in Nigeria to institute policies that make it mandatory to establish IPAC committees in all hospitals. Such policies should also outline strategies that ensure that IPAC resources are made routinely available and that knowledge and practice of standard precautions are improved through regular IPAC training of hospital staff, with special emphasis on newly qualified health workers such as house officers and staff nurses.

### Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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