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Infection Control Knowledge, Attitudes, and Practices among Healthcare Workers in Addis Ababa, Ethiopia

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Abstract

Objective—To better understand hospital infection control practices in Ethiopia.

Design—A cross-sectional evaluation of healthcare worker (HCW) knowledge, attitudes and practices about hand hygiene and tuberculosis (TB) infection control measures.

Methods—An anonymous, 76-item questionnaire was administered to HCWs at two university hospitals in Addis Ababa, Ethiopia. Knowledge items were scored as correct/incorrect. Attitude and practice items were assessed using a Likert scale.

Results—261 surveys were completed by physicians (51%) and nurses (49%). Fifty-one percent of respondents were male; mean age was 30 years. While hand hygiene knowledge was fair, self-reported practice was suboptimal. Physicians reported performing hand hygiene 7% and 48% before and after patient contact, respectively. Barriers for performing hand hygiene included lack of hand hygiene agents (77%), sinks (30%), proper training (50%), and irritation and dryness (67%) caused by hand sanitizer made per WHO formulation. TB infection control knowledge was excellent (>90% correct). Most HCWs felt at high risk for occupational acquisition of TB (71%)

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and that proper TB infection control can prevent nosocomial transmission (92%). Only 12% of HCWs regularly wore a mask when caring for TB patients. Only 8% of HCWs reported masks were regularly available and 76% cited a lack of infrastructure to isolate suspected/known TB patients.

Conclusions—Training HCWs about the importance and proper practice of hand hygiene along with improving hand sanitizer options may improve patient safety. Additionally, enhanced infrastructure is needed to improve TB infection control practices and allay HCW concerns about acquiring TB in the hospital.

Keywords

Infection Control; Ethiopia

Introduction

Healthcare-acquired infections (HCAIs) are significant causes of morbidity and mortality among hospitalized patients worldwide. Recent literature suggests the burden of HCAIs may be disproportionally high in resource-limited settings (RLS) with rates of HCAIs estimated to be two to twenty times that of developed countries (1)(2)(3). One of the major reasons for these high rates of HCAIs is the lack of infection control programs, which have been neglected due to limited resources, competing priorities, and other barriers(3). Identifying existing infection control knowledge, attitudes, and practices (KAP) among health care workers is a key first step in developing a successful infection control program.

In an effort to raise awareness and provide guidance in combating HCAIs in RLS, the World Health Organization (WHO) launched the Global Patient Safety Challenge: *Clean Care is Safer Care* campaign(4). A cornerstone of the program is to decrease HCAIs through improving hand hygiene among healthcare workers. While the WHO campaign has outlined a framework, hand hygiene adherence continues to be problematic even though it is a simple and highly effective measure to reduce HCAIs(5)(6). While adherence with hand hygiene is poor in both developed and developing nations, barriers to implementation of a successful hand hygiene program may be different in resource-limited settings(3)(4).

Tuberculosis (TB) infection control is an essential, but often-overlooked, component of a comprehensive infection control program in resource-limited settings. In healthcare settings with high HIV prevalence and poor TB infection control practices, *Mycobacterium tuberculosis* can be rapidly transmitted to patients and HCWs; immunocompromised are at greatest risk for the development of active TB disease (7).(8)(9)(10). In many RLS, infection control procedures for suspected and active TB cases are minimal due to lack of infrastructure capacity(e.g. poor ventilation, lack of individual rooms, lack of ability to separate patients with and without TB disease, etc.), personal protective equipment (i.e., N95 respirators), and laboratory diagnostic capacity for TB. Patients with suspected or active TB are most commonly admitted to the general wards without regard to TB status leading to comingling of patients with active TB disease and highly immunocompromised persons such as those with HIV/AIDS(8)(11). Multiple studies have demonstrated higher rates of TB among HCWs than the general population in RLS(12)(13)(14). The outbreak of

extensively drug-resistant TB in South Africa demonstrated the devastating consequences of nosocomially acquired TB among HIV-infected patients(10).

A KAP survey is a representative study of a specific population that aims to collect data on baseline knowledge, beliefs, and practices in relation to a particular topic. The data from these surveys enable institutions to set program priorities, estimate resources required for implementation, and establish a baseline in which change can be assessed after interventions are implemented. In terms of infection control, KAP surveys can identify knowledge gaps, cultural beliefs, or behavioral patterns that may impede infection control efforts. With this goal in mind, we conducted the first hospital based infection control survey in Ethiopia.

Methods

Study Design and Participants

From January to March 2012 we performed a cross-sectional survey of healthcare workers (HCWs) at Tikur Anbessa (Black Lion) Hospital and St. Paul's Hospital in Addis Ababa, Ethiopia. Both facilities are academic teaching hospitals affiliated with Addis Ababa University. Tikur Anbessa Specialized hospital is the major referral hospital for the whole country, with about 600beds, an average of 300,000 outpatient visits annually, total of more than 6000 surgeries per year and 14 Intensive care Unit beds(6 medical , 5 surgical and 3 pediatrics ICU beds). St Paul's General Specialized hospital has about 390 beds, more than 200,000 outpatient visits per year, total of more than 4,500 surgeries per year and , 6 ICU beds (3 surgical and 3 medical).

Both hospitals have infection control guidelines determined by separate infection control committees but adherence to these guidelines is not regularly assessed. The study received approval from the Institutional Review Boards (IRBs) of Addis Ababa University College of Health Sciences and Emory University.

An anonymous 76-item questionnaire was given to HCWs to complete. At the time of the study, there were a total of around five hundred HCWs in the two study hospitals including consultants, residents which constitute two-third and nurses the rest one-third. We planned to survey half of the HCWs and used convenient sampling to distribute questionnaires for all health care workers encountered consecutively during the day time working hours until we have distributed 300 questionnaires. The Knowledge, Attitude and Practice (KAP) survey was designed to be self-administered and was provided in both English and Amharic. HCWs provided oral consent for study participation. The survey used true and false questions to assess hand hygiene and TB infection control knowledge and five point Likert scales to assess hand hygiene and TB infection control attitudes (strongly agree, agree, no opinion, disagree, strongly disagree) and practices (never, rarely, sometimes, very often, always). The Likert scales were later collapsed into dichotomous values for data analysis.

Operational definition: Hand hygiene agent/product as used in this study is referring to the alcohol based sanitizers prepared locally according to the WHO formulation (4)(15).

Data Analysis

All data were entered into an online REDCap database and analyzed using SAS version 9.3 (SAS institute, Cary, NC).Descriptive statistics were used to report HCW demographics and survey responses. A χ^2 statistic was used to compare survey responses between physicians and nurses. A p-value <0.05 was considered statistically significant.

Results

Demographics

A total of 300 HCWs were approached and261 (87%)agreed to participate and completed the KAP survey (Table 1). The mean age of participants was 30 years and 51%were male. There were 131 (51%) physicians and 129 nurses (49%)who completed the survey. The distribution of physicians by departments is shown in Table 1. The large majority of HCWs (93%) who completed the survey reported direct patient care and 79% provided care to patients with TB. Most HCWs (73%) had been in their current position for ≤ 4 years. Eleven percent of HCWs reported that they had been treated for active TB disease while more than half (51%) knew a co-worker who had been treated for active TB.

Knowledge

Overall infection control knowledge among HCWs was good (>90% correct on 11/16 [69%] questions) with knowledge better regarding tuberculosis infection control (>90% correct on 5/6 [83%] questions) versus hand hygiene (>90% correct on 6/10 [60%] questions (Table 2). There were a few notable infection control topics with poor knowledge. Only 56% of respondents correctly believed that gloves do not provide complete protection against acquiring or transmitting infection (71% of physicians vs. 41% of nurses, $p < 0.05$). Only 59% knew that an alcohol-based hand sanitizer was as effective as soap and water when the hands were not visibly dirty (51% of physicians vs. 68% of nurses, $p < 0.05$).With regards to TB, the majority of physicians correctly agreed that people who have received BCG vaccine can still develop active TB in contrast to slightly over half of nurses (91% vs. 59%, respectively, $P < 0.05$).

Attitudes

The majority of both physicians (93%) and nurses (92%) felt they would be less likely to transmit infections to their patients if they performed hand hygiene; however, only 50% of HCW reported receiving hand hygiene training and only 30% thought their supervisors stressed the importance of hand hygiene (Table 3). The majority of HCWs felt hand hygiene agents (alcohol based sanitizer or soap and water) were not readily available (77%) and 67% of all HCWs reported that available alcohol based hand sanitizers caused irritation and dryness. Significantly more physicians than nurses reported that they often forget to perform hand hygiene (52% vs. 21%, respectively, $p < .01$). Forty-four percent of HCWs reported that gloves were not always available.

The large majority of HCWs agreed that wearing masks (90%) and geographically separating patients with active TB disease from other patients (87%) were important interventions in preventing nosocomial transmission of TB. The majority of HCWs (59%)

did not believe that UV light was an effective TB control measure; significantly more physicians than nurses felt UV lights were effective (56% vs.26%, p<0.01). A lack of basic TB infection control measures was reported by 77% of HCWs; this included limited availability of masks or respirators and inability to isolate patients suspected or known to have pulmonary TB disease. The large majority of HCWs (71%)were concerned about acquiring TB while at work.

Practice

Among physicians, low rates of hand hygiene were reported before patient contact (7%), before caring for a wound (42%) and after patient contact (48%). Physicians were most likely to practice hand hygiene when their hands felt or looked dirty (82%), after caring for a wound (85%) and after contact with blood or bodily fluids (97%) (Table 4). Nurses reported washing their hands more frequently than physicians; 71% of nurses reported washing their hands at least 6 times per day vs. 38% of physicians (P<0.01).Responses to TB infection control practice questions indicated a lack of implementation of TB infection control policies and procedures. Very few HCWs reported wearing a mask or respirator when caring for patients with active TB disease (12%) and a low proportion of HCWs reported patients with active TB disease were separated from other patients (18%), including those infected with HIV (10%). Less than one third of physicians (27%) reported ordering a sputum examination when suspecting TB.

Discussion

In our KAP survey that was conducted at two teaching referral hospitals in Addis Ababa Ethiopia, HCWs were found to have a good understanding of the importance of hand hygiene and TB infection control principles. However, this knowledge did not translate into effective implementation of infection control practices. Potential barriers to implementing effective hand hygiene and TB infection control practices identified by the KAP survey included lack of infrastructure, training, and infection control role models as well as hand hygiene products that caused skin irritation to a large proportion of HCWs. Our results provide important baseline information about infection control practices in a resource-limited country and highlight some of the barriers to implementing effective infection control policies in Ethiopia and potentially other similar settings.

We found an overall high level of knowledge regarding the importance and principles of hand hygiene and tuberculosis infection control but some important gaps in knowledge were identified. Approximately 90% of more of the HCWs surveyed knew healthcare-associated pathogens are found on intact skin and that hand hygiene decreases the risk of pathogen transmission. In addition, the understanding of TB transmission was excellent with 90% of respondents correctly answering basic TB transmission questions. Important knowledge gaps were identified; for example, 29% of physicians and 25% of nurses felt there was no need to perform hand hygiene before doing procedures that did not involve bodily fluids and 41% of HCWs felt alcohol based hand sanitizer was less effective than soap and water. These gaps should be addressed through educational initiatives and infection control campaigns.

Despite adequate knowledge on a variety of infection control measures, further steps are urgently needed to ensure that basic infection control measures are implemented at the two teaching hospitals in Addis Ababa. This knowledge-practice discrepancy has been found in many other settings in both the resource-limited and resource rich countries(6)(16)(17)and highlights the need for more than just educational initiatives to increase infection control practices. Identifying influential physician and nurse leaders to serve as infection control champions will be important in these teaching hospitals. With only 30% of HCWs stating that clinical supervisors emphasize the importance of hand hygiene, we hope to change the culture of supervision and place a strong emphasis on infection control ownership and leadership which is key for a successful program(18)(19).

Our survey results suggested that lack (and poor tolerability) of available supplies and lack of administrative TB control measures were major barriers to both hand hygiene and TB infection control. While 77% of surveyed HCWs agreed that hand hygiene agents are not always available, 67% felt it caused irritation and dryness when it is available and used. In order to improve compliance with hand hygiene, both availability and tolerability of hand hygiene agents need to be address(20)(21). The poor tolerability of the hand hygiene product supplied at both study sites has important implications as both studied hospitals currently use the WHO recommend hand hygiene formulation (Formulation 1-ethanol 80% v/v, glycerol 1.45% v/v, hydrogen peroxide (H2O2) 0.125% v/v)(4). The formulation may provide adequate hand hygiene performance in clinical trials(22) but studies evaluating its acceptance and tolerability in daily use are mostly lacking in resource limited settings(23). Whether less caustic and more tolerable hand hygiene products would increase hand hygiene compliance has yet to be evaluated in RLS and deserves further evaluation.

Our survey responses clearly show that Ethiopian HCWs understand the importance of administrative TB Infection control measures and personal protection protective equipment in preventing the transmission of and acquisition of TB in the hospital setting. However, > 75% of sampled HCWs indicated that N95 respirators were not routinely available and there was limited or no ability to isolate patients with proven or suspected TB. This inability to separate suspected (and known) TB patients from susceptible populations is a major concern for countries with high HIV and TB prevalence rates, such as Ethiopia. Implementing administrative controls has been shown to reduce the nosocomial spread of TB but is dependent on political, financial, and laboratory support for successful implementation (11)(24)(25)(26).Improving TB infection control practices in our two study hospitals and other similar institutions will require administrative support to augment screening and isolation procedures while improving the laboratory capacity to provide rapid and reliable TB diagnostic tests.

In addition to the administrative controls, we have identified areas where clinicians and nurses can make immediate positive change in TB infection control practices. Of the surveyed HCWs, only 43% open windows to increase ventilation in crowded wards. Both hospitals have large floor to ceiling windows that can be opened to facilitate natural ventilation. In one study conducted in South America, natural ventilation out performed mechanical ventilation(27) in older hospitals with large windows and congregate wards. Although natural ventilation has limitations (weather, comfort, etc), educating HCWs to

maximizing natural ventilation by opening windows is an easy, low cost intervention that may reduce patients and HCWs exposure to airborne TB. Although several studies have shown that a well-designed upper room or shielded ultraviolet germicidal irradiation (UVGI) system can disinfect mycobacteria or surrogate test organisms, its use does not replace ventilation systems; rather, they should be considered as a complementary intervention(28). Upper UVGI devices are potentially hazardous if improperly designed or installed. In well-designed systems, the principal hazard is inadvertent eye exposure by workers climbing up into the high-UV zone for tasks such as painting, cleaning and maintenance(29). As with any engineering control, a UVGI device needs proper design, installation, operation and maintenance (11).

In addition to increasing natural ventilation by opening windows, a strengthened focus on maximizing TB diagnostic services can be initiated at both hospitals. Only 27% of physicians order sputum smear microscopy for acid-fast bacilli (AFB) when TB is suspected. This low rate may, in part, be due the belief that the microbiology laboratory does not have adequate capacity to diagnosis TB (34% of physicians agree) or lack of confidence in AFB smear microscopy results (only 56% of physicians trust AFB results). Although smear microscopy is a poor, insensitive test (30% or less in HIV-infected persons with TB), especially in high HIV prevalence countries (30)(31)(32), in many African countries, including Ethiopia, it is unfortunately often the only diagnostic tool available as is the current situation at our two hospitals where the KAP study was carried out. Improved diagnostic capacity for TB is urgently needed at these hospitals to provide better patient care and enhance TB infection control measures. The implementation of the Xpert TB/RIF, which is superior to smear microscopy and has been recommended by WHO is one potential strategy to enhance diagnostic capacity(33).

Given the lack of TB infection control measures, it is not surprising that a relatively high rate of a history of TB (11%)was reported by HCWs. While we did not ask HCWs when they were treated for TB, the 11% rate is considerable and warrants further evaluation of ongoing nosocomial TB transmission among HCWs and emphasizes the importance of implementing effective TB infection control measures. Given the lack of TB infection control measures and a substantial number of HCWs who report having had TB, it is understandable that most HCWs (71%) were worried about acquiring TB at work and only 20% of HCWs thought they had a very low risk of acquiring TB from their patients. These concerns have been echoed in other KAP surveys in Africa (8) and emphasize the lack of implementation of TB infection control throughout most of sub-Saharan Africa. It is well known that HCWs in low to middle income countries are at increased risk of TB acquisition (9)(10)(34)(35)(36); however, local data such as ours are imperative in convincing hospital administration to invest in facility-level managerial activities and administrative controls to protect the welfare of HCWs (13)(14). In order to maintain a safe working environment for HCWs, changes in infection control measures must be a top priority for hospital administrators and leaders in the Ministry of Health. Education is important but alone will not fix problems that require structural changes in the hospital(11)(24)(19).

In summary, we were able to identify specific knowledge and attitude gaps to be addressed during implementation of future Infection control programs and the major practice issues

that need emphasis. HCWs have a high degree of knowledge and a realistic attitude of hand hygiene and TB infection control, but a lack of continuous training, supervision, leadership, and, most importantly, administrative and facility controls has resulted in poor infection control practices. Implementation of effective and sustainable infection control protocols to increase compliance of hand hygiene and minimize the spread of TB is challenging. An effective program requires working within the financial and structural limitations of the healthcare environment and educating local HCWs and administrators on the importance of prevention. Involving the healthcare community in the planning and subsequent implementation of infection control interventions will increase the sustainability of the intervention.

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Table 1

Demographics and Healthcare Characteristics of Survey Participants (N=261)

Characteristic	Total n=261 (%)
Mean Age, (IQR)	30 (25–32)
Female	128 (49)
Reported BCG Vaccine	167 (63)
History of TB Treatment	30 (11)
Know a Co-worker treated for TB	134 (51)
Job Title Physician	132 (51)
Nurse	129 (49)
Physician Specialties (n=131)	
Internal medicine Surgery Obstetrics/Gynecology Other Departments	55 (42) 42 (32)) 28 (21) 6 (5)
Provide Direct Patient Care	240 (93)
Care for ICU Patients	121 (47)
Care for Patients with TB	209 (79)
Mean number of patients interacted with during a shift <5 5–10 11–15 16–20 >20	16 (6) 68 (26) 55 (21) 44 (17) 81 (31)
Duration of average shift < 8 hours 8–11 hours 12–16 hours 17–24 hours	59 (23) 136 (54) 37 (15) 21 (8)
Duration in Current Position < 1 year 1–4 Years 5–10 Years > 10 Years	88 (34) 103 (39) 42 (16) 29 (11)

Table 2

Hand Hygiene and Tuberculosis Knowledge Responses (n=261)

Knowledge Element (correct response choice)	Correct Response, N (%)			
	Total N=261	Doctor N=132	Nurse N=129	P
Hand Hygiene				
1. Gloves provide complete protection against acquiring/transmitting infection (false)	146 (56)	93 (71)	53 (41)	<.01
2. Healthcare-associated pathogens can be found on normal, intact patient skin (true)	241 (92)	126 (96)	115 (89)	0.06
3. Washing your hands with soap or an alcohol based antiseptic decreases the risk of transmission of hospital acquired pathogens (true)	253 (97)	129 (98)	124 (96)	0.45
4. If my hands are not visibly dirty, there is no need to wash my hands prior to patient contact (false)	236 (90)	131 (99)	105 (81)	<0.01
5. Use of an alcohol based antiseptic for hand hygiene is as effective as soap and water if hands are not visibly dirty (true)	154 (59)	67 (51)	87 (68)	<0.01
6. Gloves should be worn if blood or body fluid exposure is anticipated (true)	247 (95)	122 (92)	125 (97)	0.11
7. When using alcohol based antiseptics, I should keep rubbing my hands until dry (true)	134 (51)	43 (33)	91 (71)	<0.01
8. There is no need to wash hands before doing procedures that do not involve bodily fluids (false)	190 (73)	93 (71)	97 (75)	0.39
9. Hand hygiene should be performed before and after direct patient contact (true)	250 (96)	125 (95)	125 (97)	0.38
10. I can wear the same pair of gloves for multiple patients as long as there is no visible contamination on the gloves (false)	247 (95)	128 (97)	119 (92)	0.09
Tuberculosis				
11. TB is carried in airborne particles that are generated from patients with active pulmonary TB (true)	255 (98)	130 (99)	125 (97)	0.39
12. Patients with pulmonary TB are infectious and may transmit TB to other patients or HCWs (true)	254 (98)	129 (98)	125 (97)	0.68
13. Patients with TB usually become noninfectious soon after initiating appropriate treatment (true)	234 (90)	117 (89)	117 (91)	0.58
14. HIV is a major risk factor for developing active TB (true)	254 (98)	130 (99)	124 (96)	0.24
15. People that have received BCG vaccination do not develop active TB (false)	196 (76)	120 (91)	76 (59)	<.01
16. TB organisms are most commonly transmitted person-to-person through airborne particles (true)	255 (99)	132 (99)	129 (97)	0.39

TB, tuberculosis; HCWs, healthcare workers; BCG, Bacille Calmette-Guerin

Table 3

Hand Hygiene and Tuberculosis Infection Control Attitudes

Attitudes	Responses in Agreement			
	Total N=261	Doctors N=132	Nurses N=129	P*
Hand Hygiene				
17. Hand Hygiene agents are not always available	201 (77)	112 (85)	89 (69)	<.01
18. Clean towels to dry my hands after washing are not always available	231 (89)	127 (96)	104 (81)	<.01
19. Gloves are always available when needed	146 (56)	64 (49)	82 (64)	0.01
20. Sinks are inconveniently located	124 (48)	87 (66)	37 (29)	<.01
21. Sinks are not available	79 (30)	49 (37)	30 (23)	0.02
22. Hand hygiene agents cause irritation and dryness	176 (67)	89 (67)	87 (67)	0.99
23. Hand hygiene interferes with HCW-patient interactions	62 (24)	30 (23)	32 (25)	0.69
24. I often forget to perform hand hygiene	95 (37)	68 (52)	27 (21)	<.01
25. I have a very low risk of acquiring infections from my patients	41 (16)	14 (11)	27 (21)	0.02
26. If I perform hand hygiene, I am less likely to transmit infections to my patients	242 (93)	123 (93)	119 (92)	0.77
27. Prevention of HAIs is a valuable part of HCWs role	244 (94)	128 (97)	116 (90)	0.02
28. I have received training about the importance of hand hygiene	131 (50)	61 (46)	70 (54)	0.19
29. The importance of hand hygiene is emphasized by my clinical supervisors	79 (30)	43 (33)	36 (28)	0.41
30. I would feel uncomfortable reminding a HCW to perform hand hygiene	70 (27)	44 (33)	26 (20)	0.02
Tuberculosis Infection Control				
31. The laboratory does not have adequate capacity to diagnosis active TB	69 (26)	45 (34)	24 (19)	<.01
32. I trust the results the laboratory provides me on AFB sputum cultures	160 (61)	74 (56)	86 (67)	0.08
33. There is limited availability of masks for HCWs caring for active TB patients	200 (77)	108 (82)	92 (71)	0.04
34. Using masks to protect HCWs from TB is important	236 (90)	120 (91)	116 (90)	0.79
35. UV light is an effective TB infection control measure	107 (41)	74 (56)	33 (26)	<.01
36. UV lights can harm HCWs	131 (50)	56 (42)	75 (58)	0.01
37. Separating active TB patients from other patients is an effective strategy for preventing transmission of TB	227 (87)	117 (89)	110 (85)	0.42
38. There is limited availability to isolate patients with proven/suspected active TB	197 (76)	112 (85)	85 (66)	<.01
39. There is limited availability of anti-TB medicines for active TB patients	43 (16)	14 (11)	29 (23)	<.01
40. I think TB infection control is important to protect patients	244 (94)	125 (95)	119 (92)	0.42
41. I have a very low risk of acquiring TB from my patients	52 (20)	16 (12)	36 (28)	<.01
42. I worry about acquiring active TB disease while at work	185 (71)	105 (80)	80 (62)	<.01
43. Patient to patient transmission of TB is occurring at my hospital	96 (37)	54 (41)	42 (33)	0.16
44. Implementation of effective TB IC measures can prevent transmission of TB in hospitals	239 (92)	123 (93)	116 (90)	0.34

Table 4

Hand Hygiene and Tuberculosis Infection Control Practices

Practice	Always/Often Responses			
	Total* N=261	Physicians N=132	Nurses* N=129	P**
How often is Hand Hygiene performed				
45. Before Patient Contact	-	9 (7)	-	-
46. After Patient Contact	-	63 (48)	-	-
47. If they look or feel dirty	-	108 (82)	-	-
48. After going to the toilet	-	116 (88)	-	-
49. After contact with blood or bodily fluids	-	128 (97)	-	-
49. Before caring for a wound	-	56 (42)	-	-
50. After caring for a wound	-	112 (85)	-	-
51. After removing gloves	-	73 (55)	-	-
Tuberculosis Infection Control			-	-
52. I open windows when possible to increase natural ventilation	111 (43)	59 (45)	52 (40)	0.47
53. I wear a mask when caring for patients with active or suspected pulmonary TB	32 (12)	13 (10)	19 (15)	0.23
54. How frequently are masks available to you	20 (8)	4 (3)	16 (12)	<.01
55. I receive on-going education about TB IC policies	25 (10)	13 (10)	12 (9)	0.88
56. I order sputum specimens when I suspect active TB	80 (31)	36 (27)	44 (34)	0.23
57. Patients with suspected TB are isolated from other patients	48 (18)	21 (16)	27 (21)	0.30
58. Patients with known TB are separated from HIV patients	27 (10)	19 (14)	8 (6)	0.03

*Data from nurses regarding hand hygiene practice was not obtained. TB, tuberculosis; IC, infection control