

ORIGINAL ARTICLE**Infection Prevention Practices and Associated Factors among Healthcare Workers in Governmental Healthcare Facilities in Addis Ababa****Biniyam Sahiledengle¹, Azeb Gebresilassie^{2*}, Tadesse Getahun³, Desta Hiko⁴****OPEN ACCESS**

Citation: Biniyam Sahiledengle, Azeb Gebresilassie, Desta Hiko, Tadesse Getahun. Infection Prevention Practices and Associated Factors among Healthcare Workers in Governmental Healthcare Facilities in Addis Ababa, Ethiopia. *Ethiop J Sci*.2018;28(2):177. doi:<http://dx.doi.org/10.4314/ejhs.v27i5.9>

Received: October 5, 2017

Accepted: October 21, 2017

Published: March 1, 2018

Copyright: © 2018 Biniyam Sahiledengle, et al . This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: Nil

Competing Interests: The authors declare that this manuscript was approved by all authors in its form and that no competing interest exists.

Affiliation and Correspondence:

¹Department of Public Health, Madda Walabu University Goba Referral Hospital, Bale-Goba, Ethiopia

²School of Public Health, College of Health Sciences, Mekelle University, Mekelle, Ethiopia

³Community-Based Education Director, Jimma University, Jimma, Ethiopia

⁴Department of Epidemiology, Faculty of Public Health, Jimma University, Jimma, Ethiopia

*Email: azeb18@gmail.com

ABSTRACT

BACKGROUND: Failure to follow proper infection prevention practices puts healthcare workers, patients and communities at risk. Despite the increases of highly contagious infections, infection prevention practices among healthcare workers is unknown in many developing countries. The need to understand infection prevention practices is important for prevention and control of nosocomial infections. Therefore, the objective of this study was to assess infection prevention practices and associated factors among healthcare workers in governmental healthcare facilities in Addis Ababa, Ethiopia.

METHODS: A facility based cross-sectional study design was conducted from February to March 2016, in Addis Ababa among 629 healthcare workers who were selected by multistage sampling technique from 30 governmental healthcare facilities. Data were collected using pre-tested interviewer administered structured questionnaire. Data were entered into Epi -data 3.1 and exported to SPSS version 20 for analysis. Multivariable logistic regression model was used to identify factors associated with infection prevention practices.. Findings were presented using odds ratios with their 95% confidence intervals., A p-value less than 0.05 were used to declare statistical significance.

RESULTS: Six hundred five (96.2%) healthcare workers participated in the study. Four hundred (66.1%, (95%CI: 62.1%-70.1%)) health care workers had good infection prevention practices. Having good knowledge on infection prevention measures (AOR =1.53, 95%CI: 1.05-2.22), having positive attitude towards infection prevention practices (AOR=2.03, 95%CI: 1.26-3.26), having awareness on availability of standard operating procedures (AOR=1.97, 95%CI: 1.34-2.93) and presence of continuous water supply (AOR=1.68, 95%CI: 1.11-2.56) were predictors of good infection prevention practices.

CONCLUSION: Two-third of the healthcare workers had good infection prevention practices. Having good knowledge on infection prevention measures, having positive attitude towards infection

prevention practices, having awareness on availability of standard operating procedures and presence of continuous water supply were predictors of good infection prevention practices. To sustain good practices, adequate pre-service and in-service training should be in place to equip and update health care workers about infection prevention precautions. The need for continuous supervision should be implemented to strengthen adherence for infection prevention practices among workers along with sustainable and reliable water supply is crucial.
KEYWORDS: *Healthcare workers, Infection prevention, Nosocomial infection, Practice, Addis Ababa*

INTRODUCTION

Infection prevention and control is a central component of safe and high quality service delivery at the facility level (1). With an inadequate practice of infection prevention, the risk of acquiring infections through exposure to blood, body fluids or contaminated materials in healthcare facilities is substantial (2,3). In connection with that, contracting an infection while in a healthcare setting challenges the basic idea that healthcare is meant to make people well (4). Obviously, lack of compliance with infection prevention and control measures has a number of consequences (5,6).

Globally, hundreds of millions of people are affected every year by avoidable infections in health care (1). In this respect, healthcare associated infections (HCAIs) affect patients, healthcare workers (HCWs), support staff, medical students and patient attendants (2). The associated burden of disease related to HCAIs is extremely high and the impact of HCAIs implies prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobials, massive additional financial burden for health systems, high costs for patients and their family, and unnecessary deaths (5,6,7). HCAIs accounted for 16 million additional hospital stay in Europe with estimated total costs of €7 billion, and this also cost the United State healthcare system to loss an estimated \$ 30-45

billion each year. The worldwide estimated indicated more than 1.4 million people are suffering from infections acquired in hospitals. Such risk is 2-20 times higher in developing countries (8-11). Despite the simplicity and clarity of precautions; understanding how poor practice could fuel up the transmission, the practice among health care worker is still low. This problem is exacerbated in resource limited settings, like Africa (12,13).

Alike other African countries, HCAI in Ethiopia is a major public health problem with the magnitude is not clearly known or not well studied. Besides, adherence to the precautions of infection prevention practices among HCWs is questionable and not addressed well (3,14). Conversely, the Federal Ministry of Health (FMOH) of Ethiopia undertook a multitude of initiatives to protect patients and HCWs by setting standards and guidelines (2,3,15). Although, in many healthcare settings, resources are constrained and control of the risk of acquiring HCAIs is a bit challenging and HCWs lack adequate knowledge and motivation to implement the recommended infection prevention practice (3).

Compliance with infection prevention measures is the only way to reduce and protect HCWs, patients and the community from the occurrence of HCAIs and unnecessary injuries (2,3). On top of this, various multifaceted factors extremely play a great role to achieve the goal of infection prevention, like adequate knowledge towards infection prevention, availability of personal protective equipments and materials, human power, training, policy and guidelines and essential environmental health conditions (1,3,6,11). Hence, it is important that HCWs must know and use the recommended infection prevention measures accordingly (2,6,11,14).

Cognizant of this, no matter what HCAIs can effectively be prevented by applying infection prevention principles, without adequately giving the due attention and assessing the current infection prevention practice of HCWs, it is impossible to enhance infection prevention practice of HCWs, improve quality of service and thereby

reduce HCAs. In addition, there are limited studies in Ethiopia which focused on infection prevention practices of HCWs. Thus, assessing infection prevention practices and identifying associated factors with infection prevention practices among HCWs is crucial to develop strategies for a successful infection prevention programs and interventions in Ethiopia.

METHOD AND MATERIALS

Study area, period and design: A facility based cross-sectional study was conducted from February 15 to March 30, 2016, in randomly selected 30 governmental healthcare facilities found in Addis Ababa (the capital city of Ethiopia). A total of 86 governmental health centers and 13 hospitals were found in Addis Ababa. In these healthcare facilities, 7,563 health professionals were working at the time of this study (16).

Sources and study population: All HCWs (general practitioners, public health officers, nurses, midwifery, laboratory technicians and technologists, dentists, anesthetists, ophthalmologists and cataract surgeons) working in all governmental healthcare facilities in Addis Ababa were considered as sources population. From all, HCWs who were found in randomly selected 30 governmental healthcare facilities were the study population. HCWs who were seriously ill, workers in study leave and those working in administrative offices during data collection period were excluded.

Sample size determination: Sample size was determined using single population proportion formula considering proportion of having good infection prevention practices among HCWs, (54.2%) (17), 5% margin of error, 95% confidence interval, design effect of 1.5 and 10% for non-response. To identify predictors of the outcome variable, two-population proportion formula for comparative cross-sectional design was also used. Large sample size (629) calculated using a single population proportion formula was used to address both objectives.

Sampling techniques: A multistage sampling technique was used. First, all governmental healthcare facilities found in Addis Ababa city

were identified and stratified by type of health care facility into hospitals and health centers. Then, to enhance representativeness, 30% of healthcare facilities from each stratum were selected randomly and included in the sample. The sample size (n=629) was allocated to each selected four hospitals and 26 health centers based on the proportional to the size of HCWs who were working during data collection period. Afterwards, the sampling frame was prepared using list of HCWs obtained from human resource department of each healthcare facilities. Health care workers who participated in the study were randomly selected using lottery method.

Data collection: Two trained BSc nurses collected data through face-face interview using a structured and pre-tested questionnaire prepared in local language (Amharic) was used. Data collectors were trained and supervised during data collection period.

Operational definition: Infection prevention practices of HCWs were assessed for main components of infection prevention measures like hand hygiene practices, utilization of personal protective equipment (PPE), and post-exposure prophylaxes (PEP), healthcare waste management practices, instrument decontamination and disinfection practice, tuberculosis infection control practice and safe injection and medication practice. There were twenty-five questions with Likert-type scale options ranging from “Always” to “Never”. The mean value was used to classify HCWs infection prevention practices as having good practice if the score was equal or above the mean .. The same procedures were applied to assess knowledge by 33 yes or no questions and 12 attitude questions with five –point Likert-type scale (17,18).

Data quality control: To assure the data quality, data collection instruments were pre-tested, and in order to minimize contamination of practices, the questioner was also arranged in PAK (Practice, Attitude and Knowledge) order. For each components, reliability test was done and the reliability coefficient for practice, attitude and knowledge items had a Cronbach’s Alpha of 0.784, 0.860 and 0.762 were found respectively. The completeness and consistency of the questionnaire

were checked by the principal investigator and the supervisors throughout data collection period.

Data processing and analysis: After data collection, each questionnaire was checked for completeness, missings and edited for other errors. Data were entered into Epi-data version 3.1 and exported to SPSS version 20 (IBM Corporation, 2012) for further analysis. Before analysis, data were cleaned and checked for outliers and missings. Univariate analysis like frequency tables, graphs, means and standard deviations were computed. Bivariate analysis like chi-squared test, binary and multivariable logistic regressions was performed to examine the presences of association between variables. Data were presented using Odds ratios(OR) and their 95% confidence intervals (CIs). Variables with P-value less than 0.2 at bivariate logistic regression model were entered into multivariable logistic regression model. Finally, multivariable logistic regression model was carried out to identify predictors infection prevention practices. Variables with P value < 0.05 were considered independent predictors of infection prevention practices.

Ethical consideration: The study was ethically approved by Jimma University Institutional Ethical Review Board (IRB), by Addis Ababa City Administration Health Bureau IRB and by St. Paul's Hospital Millennium Medical College IRB. Written informed consent was obtained from each participant after explaining the purpose of the study. The right of participants to anonymity and confidentiality was maintained. The study didn't cause any harm to the participants. In addition, participants were also informed about their right to join or to withdraw at any time from the study.

RESULTS

From 629 healthcare workers selected, 605(96.2%) participated in the study. Three hundred seventeen (52.4%) were from health centers, 246(40.7%) were from referral hospital and 42(6.9%) were from general hospital. The mean age of HCWs were 29.21 (SD=6.26) years (Table 1).

Lifetime prevalence of needle stick and blood or body fluid splash to eye, mouth or nose exposure were 242(40%) and 241(39.8%)

respectively. One year prevalence of needle stick and sharp injury was 183(30.2%) while one year prevalence of blood or body fluid splash to eye, mouth or nose exposure was 251(41.5%). Among the total HCWs, 335(55.4%) HCWs had good knowledge of infection prevention measures. Similarly, 504(83.3%) HCWs had positive attitude towards infection prevention practices respectively.

Regarding infection prevention practice, 400(66.1%) HCWs had good infection prevention practices with (95% CI:16.58-17.12).

After controlling the effect of potential confounding variables, some variables remained independent predictors of having good infection prevention practices. The result of this study showed that laboratory technician and others (like anesthesiologist, dentist and ophthalmologist) were 82% times less likely to have good infection prevention practices compared to doctors (AOR=0.18, 95%CI: 0.07-0.46). The study further identified that HCWs who had aware on availability of infection prevention related standard operating procedures (SOP) or guideline in their healthcare facility were almost two times more likely to have good infection prevention practices compared to those who had no awareness on availability of infection prevention related SOP (AOR=1.97, 95%CI: 1.34-2.93) (Table 2).

Healthcare workers working in healthcare facilities with continuous water supply in their department were 1.6 times more likely to have good infection prevention practices compared to HCWs working in healthcare facilities without continuous water supply in their department (AOR=1.68, 95%CI: 1.11-2.56). HCWs who had good knowledge regarding infection prevention measures were 1.5 times more likely to have good infection prevention practices compared to their counterpart(AOR=1.53,95%CI:1.05-2.22). HCWs who had positive attitude towards infection prevention practices were two times more likely to have good infection prevention practices compared to HCW who had negative attitude towards infection prevention practices (AOR=2.03, 95%CI: 1.26-3.26) (Table 2).

Table 1: Socio-demographic characteristics of healthcare workers, Addis Ababa, Ethiopia, February to March, 2016 (N=605).

Variables		Frequency (N=605)	Percent
Age(years)	<25	181	29.9
	26-30	260	43.0
	31-35	88	14.5
	36-40	30	5.0
	>40	46	7.6
Sex	Male	222	36.7
	Female	383	63.3
Marital status	Married	238	39.3
	Single	367	60.7
Profession	Nurse/Midwife	425	70.2
	Health Officer	65	10.7
	Lab technicians	58	9.6
	Physician	47	7.8
	Other *	10	1.7
Educational status	First degree and above	361	59.7
	Diploma	244	40.3
Currently working department or unit	OPD, Emergency and Triage	155	25.6
	Maternity, Delivery Gynecology and Obstetrics unit	103	17.0
	Medical and Surgical Ward	84	13.9
	Laboratory	59	9.8
	Inpatient clinic	42	6.9
	Pediatrics ward	36	6.0
	OR and Minor-OR	29	4.8
	Other **	97	16.0
Service year in healthcare facility (years)	<3	342	56.5
	3-7	211	34.9
	>7	52	8.6
Type of healthcare facility	Health center	317	52.4
	Referral hospital	246	40.7
	General hospital	42	6.9

OPD=Outpatient department, OR= Operating theater, * Anesthesiologist, Dentist and Ophthalmologist; **EPI, FP, ANC, dental clinic, ENT unit, ophthalmology unit, ART, TB-clinic, neonatal ICU, adult ICU, Orthopedic unit, Dressing and injection room.

Table 2: Factors associated with infection prevention practices, Addis Ababa, Ethiopia, February to March, 2016 (N=605).

Variables	Infection Prevention practice status		COR (95%CI)	AOR (95% CI)
	Good n=400	Poor n= 205		
Current working department				
OPD, Emergency, Triage and inpatient				
	131(66.5)	66(33.5)	1.24(0.80-1.92)	1.12 (0.65-1.93)
Medical, Surgical and Pediatrics Ward	73(60.8)	47(39.2)	0.97(0.59-1.58)	0.63 (0.35-1.14)
Gynecology, Obstetric, Delivery, OR and Minor-OR	100(75.8)	32(24.2)	1.95(1.17-3.26)*	1.46 (0.82-2.63)
Laboratory and other dep't	96(61.5)	60(38.5)	1	
Profession				
Doctor	36(76.6)	11(23.4)	1	
Nurse/Midwife	288(67.8)	137(32.2)	0.64(0.31-1.30)	0.49(0.24-1.05)
Health officer	41(63.1)	24(36.9)	0.52(0.22-1.21)	0.48(0.19-1.19)
Laboratory technicians and others	27(46.6)	31(53.4)	0.32(0.14-0.74) *	0.18(0.07-0.46)**
Screen for Hepatitis B Surface Antigen				
Yes	275(67.9)	130(32.1)	1.27 (0.89-1.81)	1.31(0.88-1.94)
No	125(62.5)	75(37.5)	1	1
Awareness on SOP/IP guideline availability				
Yes	223(71.7)	88(28.3)	1.68 (1.19-2.35)*	1.97(1.34-2.93)**
No	177(60.2)	117(39.8)	1	
Awareness on infection prevention (IP) components				
Yes	327(69.0)	147(31.0)	1.77 (1.19-2.63)*	1.29 (0.83-2.01)
No	73(55.7)	58(44.3)	1	
Presence of hand washing facility				
Yes	367(68.2)	171(31.8)	2.21 (1.33-3.69)*	1.15 (0.58-2.27)
No	33(49.3)	34(50.7)	1	
Presence of continuous water supply				
Yes	317(68.9)	143(31.1)	1.66 (1.13-2.43)*	1.68(1.11-2.56)**
No	83(57.2)	62(42.8)	1	
Availability of PPE				
Yes	229(70.5)	96(29.5)	1.52 (1.08-2.13)*	1.37 (0.94-1.99)
No	171(61.1)	109(38.9)	1	
Ever had needle stick or sharp injury				
Yes	150(62.0)	92(38.0)	1	
No	250(68.9)	113(31.1)	1.36 (0.96-1.91)	1.37 (0.95-1.97)
Awareness on availability PEP available daily/weekly				
Yes	347(68.8)	157(31.2)	2.00 (1.29-3.09)*	1.27 (0.77-2.01)
No	53(52.5)	48(47.5)	1	
Knowledge of HCWs on infection prevention measures				
Good	245(73.1)	90(26.9)	2.02 (1.44-2.84)*	1.53(1.05-2.22)**
Poor	155(57.4)	115(42.6)	1	
Attitude of HCWs toward infection prevention practices				
Positive attitude	351(69.6)	153(30.4)	2.44 (1.58-3.76)*	2.03(1.26-3.26)**
Negative attitude	49(48.5)	52(51.5)	1	

CI= Confidence Interval, COR=Crude Odds Ratio, AOR= Adjusted Odds Ratio, *Significant association ($P<0.05$) crude, ** Significant association ($p<0.05$) adjusted

DISCUSSION

Infection prevention practice is fundamental to quality of care and essential to protect HCWs, patients and communities from tremendous risks. This study attempted to assess infection prevention practice of HCWs in Addis Ababa city.

In this study, two-third (66.1%) of HCWs had good infection prevention practices. This result is higher than the studies conducted in Northwest of Ethiopia (54.2%) (17), North Ethiopia (42.9%) (13) and West Arsi Zone, Ethiopia (36.3%) (18). Difference in practice could be attributable to the difference in study settings, composite scoring, sampling technique and HCWs experiences. Since HCWs in the capital cities had better work experience and get the opportunities for various infection prevention trainings, the likelihood of having better prevention practice will be higher than HCWs residing in the country-side. This findings is also higher than Edo State, Nigeria (46.8%) (19) Iran Hospital (42%) (20). The possible explanations for the difference were difference in sample size, study time, study area and type of healthcare facilities from which HCWs were selected to participate in the study.

This study identified 46.8% of the HCWs always wore goggle or eye protection during patient care procedures, likely to generate splashes of body fluid into the eye and the mouth. This finding is much higher than the study finding from Northern Ethiopia (10.4%) (21). This discrepancy could be due to dissimilarity in level of awareness on infection prevention practices and PPE supply and utilization difference of the study populations. In this study, 57.9% of the HCWs wore mask on every occasion while approaching TB suspected and confirmed patients. This finding is higher than the study finding previously conducted in Addis Ababa city (50.2%) (22) and better than the study from North West Ethiopia (21.1%) (23).

Safe injection practice like use of sterile syringes and needles, injection verification before administering, method of sharp waste disposal and HCWs needle recapping practice were used as a key criteria for safe injection practices.

Above 90% of HCWs performed safe injection practices. This finding is better than the study finding from Northwest Ethiopia (57%) [17]. The study also reported that 98.3% of HCWs disposed sharps or needles immediately after use in safety box. This finding is encouraging and in accordance with Federal Ministry of Health (FMOH) recommendations (2,3) and higher than to the study finding in Northern Ethiopia (79.5%) (21).

This study also assessed the overall knowledge about infection prevention measures. Almost half (55.4%) of HCWs had good knowledge on infection prevention measures. This finding is consistent with the finding from West Arsi Zone of Ethiopia (53.7%) (18) but much lower than the finding of a study conducted in Northwest Ethiopia (84.2%) (17) and a study reported from Egyptian Cancer Hospital (63.6%) (24). The variation might be attributable to differences in sample size, study setting and nature of the population involved. ..

More than 80% of HCWs had positive attitude towards infection prevention practices. This finding is much higher than study finding in North West Ethiopia (55.6%) (17), Eastern Ethiopia (53.1%) (25) and finding from Iran (33%) (20). These differences might be due to differences in the experience of HCWs and training exposure. The result of the study indicated that one year prevalence rate of needle stick injury was (30.2%) among HCW. This result is much higher than the study conducted in Eastern Ethiopia (17.5%) (25), North Ethiopia (22.2%) (21) and Northwest Ethiopia (19.5%) (17). One year exposure of blood or body fluid on their mucus membrane (i.e. eye, nose or mouth) was 41.5% among HCW. This finding is lower than the study in North Ethiopia (60.2%) (21) and Tigray Region of Ethiopia (56.3%) (26).

This study revealed that HCWs who were aware on availability of infection prevention standard operating procedures (SOP) were two times more likely to have good practices than their counterparts. This finding is consistent with study conducted in West Arsi (Ethiopia) and North Ethiopia (18,21). HCWs working in department with continuous running water supply

were 1.7 times more likely to have good infection prevention practices as compared with HCWs working in department without continuous running water. This finding is inconsistent with the finding from West Arsi, Ethiopia. But, as a matter of fact, having access to water and other infrastructures may directly impact the practice (18).

The study showed that HCWs who had good knowledge regarding infection prevention measures were 1.5 times more likely to have good infection prevention practices. This finding is supported studies from China (27) and other similar studies (19,20). In addition, this study indicated that positive attitude towards infection prevention practices is the core to achieve good infection prevention practices in healthcare facilities.

In conclusion, the results of the study revealed that two-third of HCWs had good infection prevention practices. Having good knowledge, having positive attitude, being aware on availability of standard operating procedures (SOP) and working in department with continuous water supply were predictors of good infection prevention practices. As a result, to sustain and improve good infection prevention practices, adequate pre-service as well as on job trainings for HCWs should be in place. The need for continuous follow up of HCWs to adhere with infection prevention recommendations, along with other supporting infrastructures like sustainable and reliable water supply are crucial.

The findings of the study should be taken in consideration of the following limitations. The study didn't use multilevel analysis which is the ideal alternative to address nested data since there might be dependency between health facility factors and the practice of HCWs at individual level. Since the study was conducted in governmental healthcare facilities, generalization of the study findings is limited to these governmental healthcare facilities.

ACKNOWLEDGEMENT

The authors would like to thank all HCWs from hospitals and health centers for their participation in the study. We also extend our thanks to administrative bodies of hospitals and health centers for allowing us to collect data from HCWs.

REFERENCES

1. WHO, UNICEF, SHARE. Water, sanitation and hygiene in health care facilities: Global strategy, burden of disease, and evidence and action priorities, workshop report. London, United Kingdom: WHO; Available at: http://www.who.int/water_sanitation_health/healthcare_waste/module16.pdf.
2. Federal Ministry of Health of Ethiopia. National Infection Prevention Guidelines for Healthcare Facilities in Ethiopia. 1sted. Addis Ababa, Ethiopia: Disease Prevention and Control Department; 2005.
3. Federal Ministry of Health of Ethiopia. Infection prevention and patient safety-reference manual for service providers and managers in healthcare facilities of Ethiopia. 2nd ed. Addis Ababa, Ethiopia: Federal Ministry of Health; 2012.
4. Alice WG, Simon MK, Elijah N, Z.Ngalo OA. Health Care Workers Adherence to Infection Prevention Practices and Control Measures: A Case of a Level Four District Hospital in Kenya. *American Journal of Nursing Science*. 2015; 4 (2): 39-44. doi: 10.11648/j.ajns.20150402.13.
5. Canadian Union of Public Employees (CUPE). Healthcare acquired infections: A backgrounder. 2009. Accessed January 13, 2016. Available at: <https://cupe.ca/sites/cupe/files/healthcare-associated-infections-cupe-backgrounder.pdf>
6. Adams J, Bartram J, Chartier Y. Essential Environmental Health Standards in Health Care. Geneva, Switzerland: WHO; 2008.
7. Mongolia: Fifth Health Sector Development Project. Subsector Analysis (Summary): Hospital Hygiene and Infection Prevention

- and Control. 2012. Accessed October 25, 2015. Available at <https://www.adb.org/sites/default/files/linked..../45009-002-mon-oth-03.pdf>.
8. Allegranzi.B, Bagheri Nejab.S, Combescure. C, Graafmans.W, Attar.H et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. *Lancet*. 2011; 377(9761):228-41.doi:[http://dx.doi.org/10.1016/S01406736\(10\)61458-4](http://dx.doi.org/10.1016/S01406736(10)61458-4).
 9. Shanelle Nelson, Patricia W. Stone, Sarah Jordan, Monika Pogorzelska, Helen Halpin, Megan Vanneman, et al. Patient Safety Climate: Variation in Perceptions by Infection Preventionists and Quality Directors. *Interdisciplinary Perspectives on Infectious Diseases*. 2011; Article id 357121. p7. doi:10.1155/2011/357121.
 10. World health organization (WHO). Infection prevention and control in health care: time for collaborative action. Regional Committee for the Eastern Mediterranean, EM/RC57/6. WHO. 2010. Available at: http://www.emro.who.int/Em_RC57_4_en.pdf.
 11. Tietjen L, Bossemeyer D, McIntosh N. Infection Prevention Guideline for Healthcare Facilities with Limited Resources. Baltimore, USA: JHPIEGO Corporation; 2003.
 12. Gammon J, Morgan-Samuel H, Gould D. A review of the evidence for suboptimal compliance of healthcare practitioners to standard/universal infection control precautions. *Journal of Clinical Nursing*. 2008; 17:157-167.
 13. Hu TA, Anh NQ, Chau NQ, Hung NV. Knowledge, Attitude and Practices Regarding Standard and Isolation Precautions Among Vietnamese Health Care Workers: A Multicenter Cross-Sectional Survey. *Intern Med*. 2012; 2:115. doi:10.4172/2165-8048.1000115.
 14. Haileamlak A, Editorial: Preventing healthcare associated infections. *Ethiopian Journal of Health Sciences*. 2011; 21(1):7-8.
 15. Federal Ministry of Health of Ethiopia. Health care waste Management National Guideline. Addis Ababa, Ethiopia: FMOH; 2008.
 16. Addis Ababa Health Bureau. Annual Report: health professional and supportive staff in Addis Ababa health facilities. Addis Ababa, Ethiopia: Addis Ababa Health Bureau Human Resources department; 2015.
 17. Gulilat K, Tiruneh G. Assessment of Knowledge, attitude and practices of health care workers on infection prevention in health institution Bahir Dar city administration. *Sciences Journal of Public Health*. 2014; 2(5): 384-393. doi:10.11648/j.sjph.20140205.13.
 18. Morka G. Assessment of the knowledge and practices towards infection prevention and associated factors among healthcare providers of public health facilities in West Arsi, Oromia regional state, Ethiopia. 2015. Addis Ababa University: Msc Thesis; 2015.
 19. Alice ET, Akhere DA, Ikponwonsa O, Grace E. Knowledge and practice of infection control among health workers in a tertiary hospital in Edo state, Nigeria. *Direct Research Journal of Health and Pharmacology*. 2013; 1 (2):20-27.
 20. Sarani H, Balouchi A, Masinaeinezhad N, Ebrahimitabs E. Knowledge, Attitude and Practice of Nurses about Standard Precautions for Hospital-Acquired Infection in Teaching Hospitals Affiliated to Zabol University of Medical Sciences. *Global Journal of Health Science*. 2014; 8(3): 193-198. URL: <http://dx.doi.org/10.5539/gjhs.v8n3p193>.
 21. Gebresilassie A, Kumei A, Yemane D. Standard Precautions Practice among Health Care Workers in Public Health Facilities of Mekelle Special Zone, Northern Ethiopia. *J Community Med Health Educ*.2014; 4:286. doi:10.4172/2161-0711.1000286.
 22. Gizaw GD, Alemu AZ, Tilahun K. Assessment of knowledge and practices of health workers toward tuberculosis infection control and associated factors in public health facilities of Addis Ababa, Ethiopia: A cross-sectional study. *Archives of public health*.

- 2015; 73:15. DOI 10.1186/s13690-015-0062-3.
23. Chanie T, Meaza D. Knowledge and practices of tuberculosis infection control among health professionals in Northwest Ethiopia; *BMC health ser res.* 2011; 14:593. doi:10.1186/s12913-014-0593-2.
24. Hany Girgis Eskander, Warda Youssef Mohammed Morsy, Hanaa Ali Ahmed Elfeky. Intensive Care Nurses' Knowledge & Practices regarding Infection Control Standard Precautions at a Selected Egyptian Cancer Hospital. *Journal of Education and Practice.* 2013; 4(19):161-174.
25. Reda AA, Fisseha S, Mengistie B, Vandeweerd J-M. Standard Precautions: Occupational Exposure and Behavior of Health Care Workers in Ethiopia. *PLoS ONE.* 2010; 5(12).
26. Gessesew A, Kahsu A. Occupational exposure of health workers to blood and body fluids in six hospitals of Tigray region: magnitude and management. *Ethiop Med J.* 2009; 47:213-219.
27. Luo Y, He GP, Zhou JW, Luo Y. Factors impacting compliance with standard precautions in nursing, China. *International Journal of Infectious Diseases.* 2010; 14: e1106–e1114