

Assessment of Infection Prevention Practice and Associated Factors Among Healthcare Providers in the Case of Bishoftu Referral Hospital

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Abstract: Introduction: Health care-associated infections (HCAIs) poses a real and serious threat to both the patients and health care workers. A significant number of patients acquired health care associated infections worldwide, and this has devastating effect on both the patient and the health system. It is estimated that more than 1.4 million people worldwide are suffering from infections acquired in hospitals. Even though infection prevention plays a key role in preventing and reducing the rate of healthcare associated infection, little is known about current staffing and structure of infection prevention and control programs. *Objective:* To assess Infection prevention practice and associated factors among healthcare providers in Bishoftu Referral Hospital south east Ethiopia from Dec 4, 2019 to Dec 20, 2019 G.C. *Methodology:* Institution based cross-sectional study was conducted to assess practice towards infection prevention and associated factors in Bishoftu Referral Hospital. The data was collected using structured self-administered questionnaire and supported by an observational check list. Infection prevention practice was calculated using 22 items and median was used a cut-off point to generate a binary practice outcome. The data was entered into EPI info 7 and then exported to SPSS version 20 for data management and analysis. Bivariate and Multivariable logistic regression analysis was carried to assess significance of determinants. *Results:* One hundred fifty eight (158) health care professionals were included in the study. This study showed that 60.4% of Health Care Providers had safe infection prevention Practice (95% CI (51.9%, 68.2%). Among the determinant factors, working in emergency ward [AOR=4.327, 95% CI (0.412, 45.464)], knowing the presence of infection prevention committee [AOR=7.629, 95% CI (1.580, 36.831)] and being a midwife [AOR=16.39, 95% CI (1.074, 250.171)] were significantly associated with safe infection prevention practice. *Conclusion and Recommendation:* The findings of this study show that around 40% of healthcare professional didn't adhere to safe infection prevention. Working wards, infection prevention committee and profession were factors significantly associated with infection prevention practice. The hospital should give emphasis for all working wards to increase adherence to infection prevention practice.

Keywords: Health Care-associated Infections, Infection Prevention Practice, Bishoftu Referral Hospital

1. Introduction

Health care-associated infections (HCAIs) are infections that occur during healthcare interventions in any health care setting where care is delivered. It poses a real and serious threat to both the patients and health care workers. It is the most frequent adverse event in healthcare worldwide can occur as a part of an

endemic or epidemic situation and affect the quality of care of hundreds of millions of patients every year in both developed and developing countries [1]. In their occupational environment healthcare workers (HCWs) are exposed to hazardous blood-borne pathogens such as hepatitis B virus (HBV) and hepatitis C virus (HCV) [2]. These infections are a major public health concern and a threat to patient safety, contributing to increased

morbidity, mortality, and cost [3].

Infection prevention and control is a central component of safe and high quality service delivery at the facility level. 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. 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]. Lack of knowledge, attitude and practices in infection prevention and control contribute to high rates of hospital-acquired infections. Healthcare settings with high prevalence of communicable disease and poor infection control practices can be leads to rapidly transition of disease to patients and health care workers (HCWs); immune compromised are at greatest risk for the development of infection [5].

The nature of infection prevention and control is changing. Even though infection prevention plays a key role in preventing and reducing the rate of healthcare associated infection [6], little is known about current staffing and structure of infection prevention and control programs [7].

2. Methodology

2.1. Study Area/Setting

Bishoftu Referral Hospital is found in Bishoftu town which is located Oromia Regional state, East Shoa Zone at a distance of 55 Km from the capital of Addis Ababa. According to Bishoftu Referral hospitals health management information system department report, total catchment population of the hospital is 1.5 million (720000 males and 780000 females). There were 215 health care providers who were directly working in the Referral hospital.

2.2. Study Period

The data collection was conducted starting from Dec, 4, 2019 up to Dec, 20, 2019 G.C.

2.3. Study Design

Institution based cross sectional study was conducted and also supported by an observation study to complement the practice study.

2.4. Source and Study Population

The source populations for this study were all health care providers working in Bishoftu Referral hospital. Study population are all healthcare providers which included in the study.

2.4.1. Inclusion Criteria

All health care providers working in Bishoftu Referral who were in direct care of patients and available during data collection were included.

2.4.2. Exclusion Criteria

Health care providers who were sick and not interested to participate in the study.

2.5. Sample Size Determination

For Objective 1: The sample size was determined by using single population proportion formula as:-

$$n = \frac{\left(\frac{z_{\alpha}}{2}\right)^2 P(1-P)}{d^2}$$

Where n=single population sample size

Z=confidence level (1.96)

P=prevalence of infection prevention among health care workers (0.542) from a survey done in Bahir Dar on infection prevention in Health institution

d=degree of error (0.05)

$$n = \frac{(1.96)^2 0.542(1-0.542)}{0.05^2} = 381$$

1) Since the study population is less than 10,000 correction formula was used and final sample size was founded as

$$2) nf = \frac{no}{1 + \frac{no}{N}}$$

$$3) nf = \frac{381}{1 + \frac{381}{215}}$$

$$4) nf = 137$$

Then non-response rate of 15% was added thus, 158 Health care providers were the study subjects.

For Objective 2: Calculating sample size for associated factors using E pi info version 7 by taking different proportion and odds ratio (OR) for associated factors of study done in Bahir Dar, Debre Markos referral hospital, and health care facilities West Arsi on infection prevention respectively.

Table 1. Sample size calculation for second objective.

Associated factors	Source of data	Confidence level (1- α)	Power (β)	% control exposed	Odds Ratio (OR)	Ratio	Sample		
							Cases	Control	Total
Working experience > 10 years	A study done in Bahir Dar on infection prevention (18)	95%	80%	54.2%	3.79	1:1	51	51	102
Educational level – Msc level	Debre Markos referral hospital, Northwest Ethiopia (3)	95%	80%	57.3%	3.034	1:1	71	71	142
Received training on infection prevention	WestArsi District (6)	95%	80%	36.3	5.02	1:1	32	32	64

Generally the largest sample size calculated done by the Epi info is 142. This is smaller than the sample size done with single

population proportion formula that determined as 158 total sample size. Finally, a sample size of 158 was taken.

2.6. Study Variables

2.6.1. Dependent Variable

Infection prevention practice.

2.6.2. Independent Variables

- 1) Socio-demographic characteristics:-Age, sex, work experience, educational level, profession, department working in, income.
- 2) Knowledge of health care acquired infection and proper practice.
- 3) Attitude toward Healthcare associated infections (HCAI) and patient safety, acceptability and application of their knowledge on their work activity, contribution for infection prevention toward safety practice.
- 4) Organizational Factors; Training/seminars on infection prevention, Availability of Disinfection materials, availability of universal guidelines/protocols,

Availability of water supply, Availability of PPE, Availability of IP committee, Regular supervision, Availability of IP guidelines, availability of washing materials, and hygiene poster.

2.7. Sampling Procedure

The total number of Health Care providers (HCP) in Bishoftu referral hospital was obtained from Bishoftu Referral Hospital medical department. After number of HCPs working in the hospital was identified, the study populations (sample) selected from each healthcare providers were proportionately allocated based on the number of HCP in the hospitals using simple random sampling methods. This was done by multiplying each available HCP with sample size and dividing to total HCP working in the hospitals finally the total sum gives 158 samples. Detail sampling procedure based on proportionality to size is depicted below in figure.

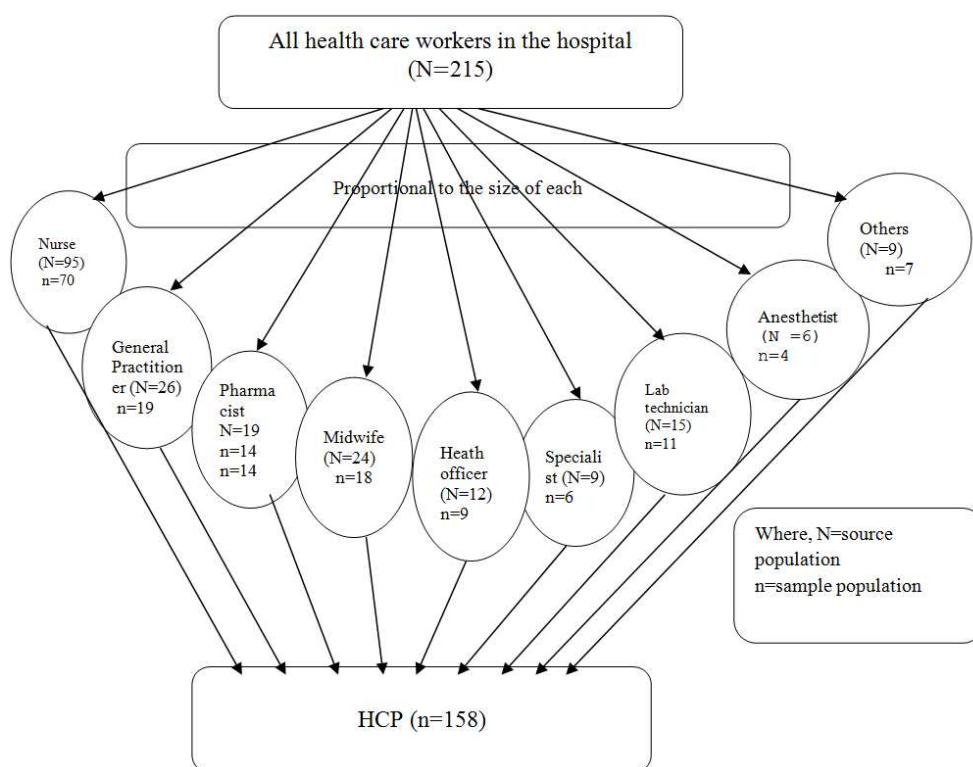


Figure 1. Schematic presentation of sampling procedure of study to select study population.

2.8. Data Collection Procedures

Data was collected by using a pretested self-administered questionnaire which was developed by reviewing different literatures and infection prevention guidelines [19]. The questionnaire was prepared in English and distributed to selected participants. Data collection was facilitated by three trained HCP that means two environmental health professionals and one nurse with principal investigator as a supervisor. To enhance instrument reliability, the instrument was pre-tested on 5% of the intended sample size drawn from outside of the study area in nearby two of Bishoftu health

center known as Babogaya Health center and Chaleleka health center that have similar characteristics to that of the study area. To improve the validity of the questions, the tool was checked by experts in the field of who participate in pre-test of infection prevention; based on their comments corrections was made before data collection and the aims of the study was explained for each respondent.

A checklist/guide for observation was developed by using a study done in Dubti Referral hospital, Bahir Dar, West Arsi and infection prevention guidelines which consists of practice on Hand hygiene, Personal Protective Equipment (PPE) use, Instrument processing practice, Linen handling practice, waste collection and disposal practice and injection

related practice. Finally for each of observation, short summaries were written about the observation.

2.9. Operational Definition

The infection prevention knowledge, attitude and practice among healthcare providers that were asked in terms of safe and unsafe practice by using 9 knowledge related, 10 attitude related and 22 practice related question which were summed together to generate a composite score for each theme.

- 1) Safe Practice: -Those respondents who scored above the median cut off points on the 22 infection prevention practice based questions.
- 2) Unsafe practice: -Those respondents who scored below than the median cut off points on the 22 infection prevention practice based questions.

2.10. Data Quality and Analysis Procedures

2.10.1. Data Quality

The data collectors were oriented on standardized data collection, especially in the proper filling of questionnaire, and data collector bias. To improve the quality of the data, data collection was facilitated by trained data collection facilitators under close supervision of Principal investigators, each completed questionnaire was also checked to determine all questions whether properly filled or not. Additionally data was entered into EPI info version 7 which is epidemiological software packages for editing, cleaning, coding, and check completeness, consistency, and accuracy of the collected data was checked by data collectors and principal investigators on daily basis. Then the data was exported to SPSS version 20 for data management.

2.10.2. Data Analysis Procedures

The data entered into SPSS version 20 was analysed using system software. Descriptive statistics of percentages and mean was carried. In addition, bivariate analysis was used to identify significant variables and then the significant variables which $p < 0.2$ was taken to multiple logistic regressions to determine association between factors and compliance to infection prevention practice by controlling for possible confounders. At the end observation data was analyzed by writing about the observation activities for selected health care facility wards and their activities related to infection prevention practices by health workers were observed related to introducing the questionnaires of observation part. Hand hygiene, injection related practice, personal protective Equipment (PPE) use practice, instrument processing practice, waste collection and disposal practice, linen and laundry handling practice was areas included focused in the observations assessment.

Odds ratio (OR) with 95% confidence intervals and significance level at $P < 0.05$ was used to see the association between factors and compliance to infection prevention practice. Adjusted odd ratio (AOR) with 95% confidence interval was calculated. The output of analysis was displayed by different statistical figures and tables.

3. Result

3.1. Socio-demographic Characteristics

A total of 154 respondents completely filled questionnaires with response rate of 97.5%. Out of which (59.1%) were female. The mean (\pm SD) age of respondents were 31.92 (± 6.98) years. Most of respondents (63%) were married. Around (43.5%) were nurses followed by general practitioner (12.3%). Majority of respondent's educational level were first degree 136 (88.3%). The mean work experience (\pm SD) was 9.20 (± 7.54). Regarding their working ward about (44.8%) were from inpatient followed by from out-patient (33.1%). About (43.5%) had monthly income of > 7500 birr.

Table 2. Sociodemographic characteristics of respondents.

Characteristics	Frequency (n)	Percent (%)
Age		
20-30	90	58.4
31-40	45	29.3
41-50	19	12.3
Sex		
Male	63	40.9
Female	91	59.1
Marital status		
Single	55	35.7
Married	97	63.0
Widowed/Separated	2	1.2
Profession		
General Practitioner	19	12.3
Nurse	67	43.5
Midwife	17	11
Health officer	9	5.8
Laboratory Technologist	11	7.1
Specialist	6	3.9
Anesthetist	4	2.6
Pharmacist	21	13.6
Educational status		
Diploma	8	5.2
BSC	136	88.3
Masters and Above	10	6.5
Work experience		
< 5 years	58	37.7
5-10 years	55	35.7
> 10	41	26.6
Working department/ward		
Outpatient ward	51	33.1
Inpatient ward	69	44.8
Emergency	11	7.1
Pharmacy	23	14.9
Monthly income (birr)		
≤ 4500	20	13
4501-6000	32	20.8
6001-7500	38	24.7
> 7500	64	41.6
Working hours/week		
≤ 40 hours/weeks	128	83.1
> 40 hours/weeks	26	16.9

3.2. Organizational Factors That Influence Infection Prevention Practice

According to healthcare providers response (70.8%) hospital had infection prevention materials and (29.2%) responses were not. Among healthcare providers (33.1%) of

them reported that the hospital had water supply for 24 hours and (66.9%) respondents were not. Including the source of water supply according to respondents who had water supply for 24 hours (31.8%), (7.1%), (1.3%) of them where used pipe line, ground and rain water respectively. From participants (83.8%), (89.6%), (77.3%), (69.5%), (79.9%) of them had infection prevention guidelines,

infection prevention committee, activities supervised by concerned bodies regularly, hand washing guide line availability in working ward and hand hygiene posters are displayed at their working department respectively. About half (53.2%) of health professional got any training about infection prevention, among this (47.1%) from outpatient wards.

Table 3. Organizational factors that influence infection prevention practice of healthcare providers in Bishoftu Referral hospital, Oromia, Ethiopia, Dec, 2020.

Characteristics	Response	Frequency	Percent
Perceived that facility have adequate supply of IP materials	Yes	109	70.8
	No	45	29.2
Perceived that hospitals have water supply for 24hrs	Yes	51	33.1
	No	103	66.9
Type of water supply	ground water	11	7.1
	pipe line water	49	31.8
	Rain water	2	1.3
Perceived that hospital have infection prevention guidelines	Yes	129	83.8
	No	25	16.2
Perceived that hospital have infection prevention committee	Yes	138	89.6
	No	16	10.4
Your activities supervised by concerned bodies regularly	Yes	119	77.3
	No	35	22.7
Hand washing guide line availability in your working ward/dep't	Yes	107	69.5
	No	47	30.5
Hand hygiene posters are displayed at your working department	Yes	123	79.9
	No	31	20.1
Participated in any training in infection prevention	Yes	82	53.2
	No	72	46.8
Received infection prevention Training in the last 12 months	Yes	37	45.1
	No	45	54.9

3.3. Infection Prevention Practice

3.3.1. Hand Hygiene Practice

Hand hygiene of health care provider where assessed based on a series of questions. Accordingly, among this respondents, 82 (53.2%), 113 (73.4%), 49 (31.8%), 45 (29.2%), 89 (57.8%), 70 (45.5%), 71 (46.1%) and 60 (39%) of them were wash their hands before patient contact, after patient contact, between

patient contacts, if they look dirty, after visiting the toilet, after contact with bloody and body fluid, after removing gloves and after caring for a wound respectively. Among the participants only 2 (1.3%) reported the main reasons for not washing their hands were due to unavailability of hand washing, while 152 (98.7%) due to high patient load. From respondents 129 (83.8%) were used antiseptic hands rub. More numerical description is depicted in Table 4 below.

Table 4. Hand hygiene practice healthcare providers in Bishoftu Referral hospital, Oromia, Ethiopia, 2020.

Characteristics	Response	Frequency	Percent
A). Hand hygiene practice			
Do you wash your hand	Yes	151	98.1
Do you wash your hand before patient contact	Yes	82	53.2
Do you wash your hand after patient contact	Yes	113	73.4
Do you wash your hand between patient contacts	Yes	49	31.8
Do you wash your hand if you look dirty	Yes	45	29.2
Do you wash your hand after visiting the toilet	Yes	89	57.8
Do you wash your hand after contact with bloody and body fluid	Yes	70	45.5
Do you wash your hand after removing gloves	Yes	71	46.1
Do you wash your hand after caring for a wound	Yes	60	39.0
Not washing hands due to unavailability of hand washing utensils	Yes	2	1.3
Not washing hands due to high patient load	Yes	2	1.3
Do you use antiseptic hand rub	Yes	129	83.8

3.3.2. Personal Protective Equipment Use Practice

Those using personal protective equipment for infection prevention (96.8%) were used one types personal protective equipment and only (3.2%) were not used. Among healthcare providers who used PPE, (89.0%), (87.0%),

(55.8%), (37.7%), (26%), and (5.8%) of them were used gloves, gown, mask, caps, goggle, and others like (shoes and boots,) respectively. The majority of participants (76.0%) use glove while handling of health care wastes, (70.8%) while providing patient care and (56.5%) while

handling of equipment. From the participants (36.4%), and (52.6%) those were always and sometimes wearing mask to protect nose and mouse and the remaining were (11.0%)

never wearing mask to protect nose and mouse. More numerical description of personal protective practice is shown in Table 5 below.

Table 5. Personal protective equipment practice of healthcare providers in Bishoftu Referral hospital, Oromia, Ethiopia, 2020.

Characteristics	Response	Frequency	Percent
B). Personal protective equipment			
Do you wear PPE	Yes	149	96.8
Do you use gloves	Yes	137	89.0
Do you wear gown	Yes	134	87.0
Do you wear caps	Yes	58	37.7
Do you use goggle	Yes	40	26.0
Do you use mask	Yes	86	55.8
Do you wear others (shoes, boots)	Yes	9	5.8
Reasons for not wearing Personal protective equipment	Unavailability/Shortage of PPE	3	1.9
	Due to allergic	5	3.2
	Forgetfulness	5	3.2
	Carelessness	5	3.2
	Always not necessary	2	1.3
Wears mask to protect nose and mouse is good	No	98	63.6
	Yes	56	36.4
	Always	56	36.4
How often mask is worn	Sometimes	81	52.6
	Never	17	11.0
Use glove while providing patient care	Yes	109	70.8
Use glove while handling of health care wastes	Yes	117	76.0
Use glove while handling of equipment	Yes	87	56.5
Use glove for other purposes	Yes	4	2.6

3.3.3. Safe Injection Practice

Concerning the respondents majority of them 146 (94.8%) were used decontamination for equipment in their hospitals while the remaining 8 (5.2%) were not decontaminated used equipments. Among healthcare providers who decontaminated used equipment, most of them 105 (68.2%) were used chlorine (bleach) solution, others 77 (50%), 21 (13.6%) were used alcohol and Savlon respectively. Regarding the preparation of chlorine solution by healthcare providers 119 (77.3%) knew the preparation of chlorine solution and others 35 (22.7%) were not knew how to prepared the solution. Concerning the change of chlorine solution time 119 (77.3%), 15 (9.7%), 7 (4.5%), and 13 (8.4%) were every 24 hours, were after two days, were one week, and had don't know when to change.

Concerning the time reusable medical instrument soaked in the chlorine solution 109 (70.8%) of the healthcare providers were soaked instruments for 10 minutes, 21 (13.6%) were soaked for one hours, 19 (12.3%) were soaked for 24 hours and 5 (3.2%) were soaked in an others time. Among the respondents 28 (18.2%) were used recaps for needles before disposing and 126 (81.8%) were not used recaps before disposing. From them 28 (18.2%) were used recaps always, 25 (16.2%) were used recaps sometimes and 101 (65.6%) never were used recaps before disposing needle.

From the respondents 69 (44.8%) were ever Encountered needle stick injuries and 85 (55.2%) were not encountered needle stick injuries. From them 51 (33.1%), 12 (7.8%), 4 (2.6%) were encountered needle stick injuries One times, two times and more than three times respectively.

The response of HCP concerning the place used needles in a puncture-resistant container at the point of use were necessary 125 (81.2%) and others 29 (18.8%) at point of use were not necessary. The result show that 136 (88.3%) of HCP reported that they used safety boxes for needles and sharp storage after use, 10 (6.5%) were used plastic container with cover, 7 (4.6%) were used plastic container without cover and the rest 1 (0.6%) were used any available containers. From the respondents majority of them 147 (95.5%) were segregate hazardous and non hazardous waste their Hospital and only 7 (4.5%) were not segregate the wastes into its categories. In relation to this the hospitals 143 (92.9%) had color labeled three bin system and 11 (7.1%) had no color labeled three bin system. In addition to this 94 (61.0%) were decontaminated waste in their hospital before disposal and other 60 (39.0%) were not decontaminated wastes. Among the respondents 102 (66.2%) were disposed wastes of medical equipment by burning in incineration, 40 (26.0%) were disposed wastes by burial in pit and 14 (9.1%) were disposed wastes to open dumping.

Table 6. Safe injection practice of healthcare providers in Bishoftu Referral hospital, Oromia, Ethiopia, 2020.

Characteristics	Response	Frequency	Percent
C. Safe injection practice			
Frequency of Recap used for needle before disposing is necessary	Always	28	18.2
	Sometimes	25	16.2
	Never	101	65.6

Characteristics	Response	Frequency	Percent
Ever Encountered needle stick injuries	Yes	69	44.8
	Once	53	34.4
Number of times encountered injuries	Twice	12	7.8
	More than three times	4	2.6
Place used needles in a puncture-resistant container at the point of use is necessary	No	29	18.8
	Yes	125	81.2
Do you use the decontamination for equipment in your Hospital	No	8	5.2
	Yes	146	94.8
Types of disinfectant used	Bleach (chlorine solution)	105	68.2
	Alcohol	77	50.0
	Savlon	21	13.6
	Every 24 hr	119	77.3
Time chlorine solutions is change	After two days	15	9.7
	One week	7	4.5
	Don't know	13	8.4
	1hrs	21	13.6
Duration of soaking of medical instrument into chlorine solution	10 minutes	109	70.8
	24hrs	19	12.3
	Other	5	3.2
	Plastic container with cover	10	6.5
Where needles and sharps are disposed	Plastic container without cover	7	4.6
	Safety Box	136	88.3
	Any available containers	1	0.6
Segregate hazardous and non-hazardous waste in Hospital	Yes	147	95.5
Hospital has color labeled three bin systems	Yes	143	92.9
	Open dumping	102	66.2
Type of disposal of medical equipment	Burial in pit	14	9.1
	Burning in incineration	40	26.0
Decontaminate waste in the hospital before disposal	Yes	94	61.0

Practice of HCPs were assessed based on median score ≥ 21 were categorized as Safe practice and those whose median score below 21 were categorized as unsafe practice. Based on this about (60.4%) of HCP had safe practice with (95% CI (51.9%, 67.7%)) and (39.6%) of HCP had unsafe practice with (95% CI (32.3%, 48.1%)).

3.4. Bivariate Analysis on Association of Infection Prevention Practice with Sociodemographic Characteristics

Among healthcare providers in the bivariate analysis, age, working ward, Knowledge, hospital have infection prevention guidelines, presence of infection prevention committee, hand washing guide line availability in your working ward/dep't, and hand hygiene posters are displayed at your working department were factors which were significantly associated with infection prevention practice.

Table 7. Bivariate analysis on association of infection prevention practice with Sociodemographic characteristics among healthcare providers in Bishoftu referral hospital, Oromia, Ethiopia, 2020.

Characteristics	Level of practice		COR (95% CI)	P value
	Safe practice Frequency (%)	Unsafe Practice Frequency (%)		
Age category				
20-30	50 (55.6)	40 (44.4)	1	
31-40	31 (68.9)	14 (31.1)	1.771 (.832, 3.772)	0.138
41-50	12 (63.2)	7 (36.8)	0.909 (0.334, 2.474)	0.544
Sex				
Male	36 (63.2)	21 (36.8)	1.247 (0.644, 2.414)	0.513
Female	57 (58.8)	40 (41.2)	1	
Marital status				
Single	27 (47.4)	30 (52.6)	1	
Married	48 (49.5)	49 (50.5)	.831 (0.424, 1.630)	0.590
Educational status				
Diploma	4 (50)	4 (50)	1	
BSC	80 (58.8)	56 (41.2)	1.429 (.342, 5.954)	0.624
Masters and above	9 (90)	1 (10)	9 (.748, 108.310)	0.083
Profession				
General Practitioner	9 (47.4)	10 (52.6)	2.880 (.747, 11.096)	.124
Nurses	43 (64.2)	24 (35.8)	5.733 (1.868, 17.598)	.002*
Midwives	15 (88.2)	2 (11.8)	24.000 (4.028, 142.989)	.000*
Healthofficer	6 (66.7)	3 (33.3)	6.400 (1.156, 35.437)	.034*

Characteristics	Level of practice		COR (95% CI)	P value
	Safe practice	Unsafe Practice		
	Frequency (%)	Frequency (%)		
Laboratory technician	6 (54.5)	5 (45.5)	3.840 (.811, 18.176)	.090
Specialist	6 (100)	0 (0)	51.6 (000, 0)	0.99
Anesthesia	3 (75)	1 (25)	9.600 (.807, 114.173)	.073
Pharmacist	5 (23.8)	16 (76.2)	1	
work experience				
<5 years	36 (62.1)	22 (37.9)	1	
5-10 years	29 (52.7)	26 (47.3)	.682 (0.322, 1.442)	0.316
> 10 years	28 (68.3)	13 (31.7)	1.316 (.565, 3.064)	0.524
monthly income /salary				
<=4500 birr	12 (60)	8 (40)	1	
4501-6000 birr	21 (65.6)	11 (34.4)	1.273 (.401, 4.037)	.682
6001-7500 birr	22 (57.9)	16 (42.1)	.917 (.304, 2.760)	.877
>7500 birr	38 (59.4)	26 (40.6)	.974 (.350, 2.714)	.960
Working hours in a day				
<=40 hours/weeks	81 (63.3)	47 (36.7)	1.651 (0.697, 3.912)	0.108
>40 hours/weeks	12 (46.2)	14 (53.8)	1	
Another responsibility				
No	68 (63)	40 (37)	1.428 (0.710, 2.874)	0.318
Yes	25 (54.3)	21 (45.7)	1	
Working wards				
outpatient ward	28 (54.9)	23 (45.1)	3.449 (1.169, 10.176)	.025*
In patient ward	51 (73.9)	18 (26.1)	8.028 (2.741, 23.514)	.000*
Emergency ward	8 (72.7)	3 (27.3)	7.556 (1.494, 38.208)	.014*
Pharmacy ward	6 (26.1)	17 (73.9)	1	
Knowledge level				
Good knowledge	25 (44.6)	31 (55.4)	0.356 (0.180, 0.702)	0.003*
Poor Knowledge	68 (69.4)	30 (30.6)	1	
Attitude level				
High Attitude	46 (60.5)	30 (39.5)	1.011 (0.530, 1.929)	0.973
Low Attitude	47 (60.3)	31 (39.7)	1	

Table 8. Bivariate analysis on association of infection prevention practice with organizational factors among healthcare providers in Bishoftu referral hospital, Oromia, Ethiopia, 2020.

Characteristics	Safe practice	Unsafe Practice	COR (95% CI)	P value
	Frequency (%)	Frequency (%)		
Perceived that your facility have adequate supply of IP materials				
No	29 (64.4)	16 (35.6)	1	
Yes	64 (58.7)	45 (41.3)	0.785 (0.382, 1.612)	0.509
Perceived that hospitals have water supply for 24hrs				
No	65 (63.1)	38 (36.9)	1	
Yes	28 (54.9)	23 (45.1)	0.712 (0.360, 1.407)	0.328
Perceived that hospital have infection prevention guidelines				
No	9 (36)	16 (64)	1	
yes	84 (65.1)	45 (34.9)	3.319 (1.358, 8.108)	0.008*
Perceived that hospital have infection prevention committee				
No	5 (31.2)	11 (68.8)	1	
yes	88 (63.8)	50 (36.2)	3.872 (1.273, 11.780)	0.017*
Your activities supervised by concerned bodies regularly				
No	21 (60)	14 (40)	121	
yes	72 (60.5)	47 (39.5)	1.021 (0.473, 2.205)	0.957
Hand washing guide line availability in your working ward/dep't				
No	21 (44.7)	26 (55.3)	1	
yes	72 (67.3)	35 (32.7)	2.547 (1.261, 5.143)	.009*
Hand hygiene posters are displayed at your working department				
No	11 (53.5)	20 (64.5)	1	
yes	82 (66.7)	41 (33.3)	3.636 (1.592, 8.304)	.002*
Participated in any training in infection prevention				
No	43 (59.7)	29 (40.3)	1	
Yes	50 (61)	32 (39)	1.054 (0.552, 2.013)	0.874
Received infection prevention Training in the last 12 months				
No	29 (64.4)	16 (35.6)	1	
Yes	22 (59.5)	15 (40.5)	0.809 (.330, 1.983)	0.643

3.5. Factors Associated with Infection Prevention Practice

This study focusing on factors associated with infection prevention practice of healthcare providers were evaluated based on both bivariate and multivariate analysis. In bivariate analysis age, education, profession, working hours, working ward, knowledge, infection prevention guidelines, infection prevention committee, hand washing guideline availability in working ward, hand hygiene posters at working department were those p value less than 0.2. Others like, sex, marital status, work experience, monthly income/salary, attitude, organizational factors were p value greater than 0.2.

The multivariate logistic regression was used to minimize the effect of confounding variable and to identify the true or exact factors contributing to infection prevention practice. For multivariate analysis the variables that P value less than 0.2 in bivariate analysis and some selected Sociodemographic factors entered into multivariate analysis and give result as significant

potential influencing factors were working ward [AOR=4.327, 95% CI (0.412, 45.464)], infection prevention committee [AOR=7.629, 95% CI (1.580, 36.831)] and profession [AOR=16.39, 95% CI (1.074, 250.171)], Others like age, sex, marital status, educational status, knowledge, infection prevention guidelines, hand washing guidelines in working wards and hand hygiene posters were not statistically significant in the multivariate analysis.

Healthcare providers who were working in emergency ward /rooms were more likely practice infection prevention [AOR= 4.327, 95% CI (0.412, 45.464)] than those working in other ward. Among healthcare providers midwives health professionals sixteen (16) times more likely Practice infection prevention than other health professionals [AOR= 16.39, 95% CI (1.074, 250.171)]. Additionally having infection prevention committee in hospital were greatest input for infection prevention practice. The details of bivariate and multivariate analysis are described in the table 9 below.

Table 9. Bivariate and multivariate analysis for associated factors with infection prevention practice among healthcare providers in Bishoftu referral hospital, Oromia, Ethiopia, 2020.

Characteristics	Level of practice		COR (95% CI)	AOR (95% CI)
	Safe practice	Unsafe Practice		
	Frequency (%)	Frequency (%)		
Age category				
20-30	50 (55.6)	40 (44.4)	1	1
31-40	31 (68.9)	14 (31.1)	1.771 (.832, 3.772)	1.178 (.432, 3.212)
41-50	12 (63.2)	7 (36.8)	0.909 (0.334, 2.474)	1.116 (.302, 4.133)
Sex				
Male	36 (63.2)	21 (36.8)	1.247 (0.644, 2.414)	.549 (.208, 1.448)
Female	57 (58.8)	40 (41.2)	1	1
Marital status				
Single	27 (47.4)	30 (52.6)	1	1
Married	48 (49.5)	49 (50.5)	.831 (0.424, 1.630)	.676 (.259, 1.764)
Educational status				
Diploma	4 (50)	4 (50)	1	1
BSC	80 (58.8)	56 (41.2)	1.429 (.342, 5.954)	2.252 (.442, 11.465)
Masters and above	9 (90)	1 (10)	9 (.748, 108.310)	9.017 (.394, 206.181)
Profession				
General Practitioner	9 (47.4)	10 (52.6)	2.880 (.747, 11.096)	1.699 (.219, 13.186)
Nurses	43 (64.2)	24 (35.8)	5.733 (1.868, 17.598)	2.763 (.393, 19.441)
Midwives	15 (88.2)	2 (11.8)	24.000 (4.028, 142.989)	16.39 (1.074, 250.171)*
Healthofficer	6 (66.7)	3 (33.3)	6.400 (1.156, 35.437)	2.880 (.213, 38.981)
Laboratory technician	6 (54.5)	5 (45.5)	3.840 (.811, 18.176)	4.426 (.368, 53.306)
Specialist	6 (100)	0 (0)	51.6 (000, 0)	1.79 (0.37, 31.63)
Anesthesia	3 (75)	1 (25)	9.600 (.807, 114.173)	3.815 (.140, 104.326)
Pharmacist	5 (23.8)	16 (76.2)	1	1
Working hours in a day				
<=40 hours/weeks	81 (63.3)	47 (36.7)	1.651 (0.697, 3.912)	1.393 (.372, 5.208)
>40 hours/weeks	12 (46.2)	14 (53.8)	1	1
Working wards				
outpatient ward	28 (54.9)	23 (45.1)	3.449 (1.169, 10.176)	1.284 (.207, 7.941)
In patient ward	51 (73.9)	18 (26.1)	8.028 (2.741, 23.514)	2.497 (.405, 15.410)
Emergency ward	8 (72.7)	3 (27.3)	7.556 (1.494, 38.208)	4.327 (.412, 45.464)*
Pharmacy ward	6 (26.1)	17 (73.9)	1	1
Knowledge Level				
Good knowledge	25 (44.6)	31 (55.4)	0.356 (0.180, 0.702)	.537 (.224, 1.285)
Poor Knowledge	68 (69.4)	30 (30.6)	1	
Hospital have infection prevention guidelines				
No	9 (36)	16 (64)	1	1
yes	84 (65.1)	45 (34.9)	3.319 (1.358, 8.108)	2.511 (.814, 7.749)

Characteristics	Level of practice		COR (95% CI)	AOR (95% CI)
	Safe practice	Unsafe Practice		
	Frequency (%)	Frequency (%)		
Hand washing guide line availability in your working ward/dep't				
No	21 (44.7)	26 (55.3)	1	
yes	72 (67.3)	35 (32.7)	2.547 (1.261, 5.143)	1.498 (.609, 3.688)
Hospital have infection prevention committee				
No	5 (31.2)	11 (68.8)	1	1
yes	88 (63.8)	50 (36.2)	3.872 (1.273, 11.780)	7.629 (1.580, 36.831)*
Hand hygiene posters are displayed at your working department				
No	11 (53.5)	20 (64.5)	1	1
yes	82 (66.7)	41 (33.3)	3.636 (1.592, 8.304)	1.513 (.540, 4.243)

NB: * is $P < 0.05$.

3.6. Observed Practice

Concerning observational practice the selected facility wards were observed to check the real practice of healthcare provider's on infection prevention and to support self administered practice by using observational check list. Surgical, medical, pediatrics, maternal ward, injection and dressing rooms, instrumental processing rooms and family planning wards were observed. Generally infection prevention practice such as hand hygiene practice, personal protective equipment use practice, Instrument processing use practice, Linen and laundry handling practice, waste collection and disposal practice and injection related practice were activities considered for observation. Generally 120 healthcare providers that present during date of observation were observed.

3.6.1. Hand Hygiene Practice

Among observed practice HCP majority of them washed their hands after contact with blood, body fluids or contaminated surface 120 (77.9%) and 110 (71.4%) after contact with objects in the immediate vicinity of the patient. Only 20% of HCP were washed their hands after patient contact and immediately after removing gloves. In another ways no any HCP were washed their hands when moving from contaminated body sites to a clean –body site during patient contact. Concerning supplies necessary to adherence to hand hygiene like soap, water, paper towel, alcohol based hand rub were readily accessible to HCP in patient care areas, but alcohol based hand rub were not enough and present in some wards. In addition to this water supply were also not continuously available for 24hrs.

3.6.2. Personal Protective Equipment (PPE) Use Practice

The result of observation shows that, sufficient and appropriate PPE materials were available and readily accessible for usage. Many of them from Outpatient, inpatient, delivery and surgery wards. Among 110 HCP observed 105 (95.4%), 85 (77.3%), 40 (36.4%), 30 (27.3%), 20 (18.2%) of them were used gown, glove, mask, caps, goggle and the remain 8 (7.3%) were used like shoes and boots respectively.

3.6.3. Instrument Processing Practice

Concerning instrument processing the hospital had two autoclave which were old and new with one room which

inside surgery wards. But the new autoclave was not functional 24hrs due it need continuous water supplies. Among observed instruments all of them were sterilized and labeled with dates. Concerning the change of chlorine solution facility was change the solution with in 24hrs. But the preparation of chlorine solution was with incorrect proportion and inappropriate using for disinfection.

3.6.4. Linen and Laundry Handling Practice

The result during observation show that, hospital was prepared separated rooms for sorting clean and soiled linens. The sorted clean and soiled linens were transported by using carts. But, the facility had no enough and separated carts for linen transportation. Concerning clean linen storage, some of them were covered by plastic and placed on the table due the prepared shelves were not enough. Generally the facility had around 10 shelves for clean and soiled linen in two separated rooms having five shelves for each storage room. In addition to this the facility laundry was functional for linen and material washing.

3.6.5. Waste Collection and Disposal Practice

Among the observed hospital wards and area for waste disposal there was standardized functional incinerator and color coding waste bins. Concerning waste segregation the wastes were not fully segregated into infectious, non infectious and sharp wastes. Because during observation there were infectious waste and sharp materials like syringes were disposed into open plastic containers and puncture resistant containers. The wastes also not disposed appropriately to disposal sites as some wastes like syringes, bandages, cannula and needles which were contain infectious available at open field in disposal sites. In addition to this the facility had well constructed and standardized placental pit.

3.6.6. Injection Related Practice

Among observed sharp wastes and needles in safety boxes wastes were not disposed immediately on time due to they wait until the safety boxes filled up to 75% either it takes two or three days.

4. Discussion

The result of this study shows that, about 60.4% of health care provider had safe infection prevention practice. This

finding is consistence with study done in Wolaitta Sodo with safe practice 60.5% [20] and Debre Markos referral hospital with safe practice of 57.3% [3]. This finding was greater than study done hi-tech medical college nursing India and hospital [21], Dubti referral Hospital [8], study done in Bir hospital, Kathmandu [22] and West Arsi district [6] with safe infection prevention practice of 50%, 48.35%, 48.2% and 36.3% respectively. However our finding is lower than study done in Palestinian Hospitals with safe practice of 91.1% [23] and Dessie Referral Hospital with safe practice of 87.5% [5]. The difference might be due to study setting difference and difference in health care provider work experience.

This study shows that profession was statistically associated with infection prevention practice. Having different professional background should made difference in infection prevention practice. Finding from this study show that midwives health professional had 16 times infection prevention practice which AOR= [16.39, 95% CI, (1.074, 250.171)] than other health professional. This study finding was greater than study done in Debre Markos referral hospital [3], study done among students of medicine and health sciences in Northwest Ethiopia [24] and West Arsi [6].

Different ward in the hospital have different characteristics that make HCP infection prevention practice different. Finding from this study show that there was significant association between infection prevention practice and working wards. Compared to outpatient department/ward those working in emergency ward adhere to infection prevention practice more than 4 folds. This finding is lower than study done in Debra Berhan town [13].

One of the many important strategies needed to prevent and control health care acquired infections in health care setting is availability of infection prevention committee. An infection prevention committee provides a forum for multidisciplinary input and cooperation, and information sharing. This committee should include wide representation from relevant departments. The committee must have a reporting relationship directly to either administration or the medical staff to promote programme visibility and effectiveness [25]. These committees coordinate the overall activities needed to prevent and control nosocomial infection and make health care setting suitable for health service delivery. Finding of this study show that availability of infection prevention committee was significantly associated (AOR = 7.629; 95% CI: 1.580, 36.831) with adherence of HCP to infection prevention practice. This is greater than study done in west Arsi district [6].

Due to data was collected by using self administered questionnaire and it has potential exposure for desirability and data collectors' bias. Because the respondents answer the question in terms of their interest or what was known rather than reflecting their actual practice. So, practice of HCP were reported wrongly under or over estimation. This study also supported by observation, so it is also affected by observational bias.

Health care provider need to adhere to hand hygiene in every hand hygiene opportunities recommended by world

health organization and CDC. Many studies done in different time and setting show that health care provider adhere to hand hygiene practice were different because of many factors [26] [27]. According to this study, HCP adhere to hand hygiene more after patient contact 113 (73.4%), after visiting the toilet 89 (57.8%), before patient contact 82 (53.2%) and adhere less, if they look dirty 45 (29.2%), between patients contacts 49 (31.8%) and after removing gloves 71 (46.1%). This finding is lower than study done on infection prevention practice were around 75% medical students adhered to hand hygiene before patient contact [28]. The finding also lower compared to study finding in tertiary hospital in Zambia with 96.9% of the HCP had wash their hands after removing gloves, 75.5% of participants always washed hands after patient contact, which is consistent with finding of this study [26]. This difference may be due to study setting, characteristics of study participants, lack of training, and unavailability of hand washing guidelines.

To protect health care provider, patients and community in general from health care acquired infection, wearing an appropriate personal protective equipment by health care worker is needed. Finding of this study show that, majority of respondents 149 (96.8%) were used at least one type of personal protective equipment (PPE). This study finding was greater than study finding conducted in Bahirdar town that 87.6% of respondents had ever wore at least one type of PPE while providing patient care [18]. However, this finding is lower compared to study done in Dessie referral hospitals that all of respondents (100%) had used at least two types of PPE [5]. The difference might be the emphasis level given and awareness difference among health care provider at different settings.

Safe injection practice is one of standard precaution recommended by world health organization that needs emphasis at all health care institution and by health care provider. Finding of this study show that, only 18.2% of respondents was adhered to always recapping of needles before proper disposing. This study finding was lower than study done in dubti referral hospitals which show that 67.03% were always used to recap needles before disposing [8]. In other way, sharps and needles should be disposed in appropriate ways. Finding of this study show that around 88.3% of respondents use safety box for onsite disposal of needles and sharps. This study finding is better than study done in Mizan Aman hospital [29], North Wollo [30] and Jimma University Medical Center [2] were 79.2%, 73.8%, 71.7% respectively, dispose sharp materials and needle in safety box. Improper handling and management of needle can led to needle stick injury. Hence, the finding of this study shows that around 44.8% of respondent had history of needle stick injuries. This study finding is lower than study done on HCP in Tehran Teaching Hospital in Iran which show that 50.2% were encountered needle stick injuries [31] and also this study finding is lower than study done in west Arsi district were 62.4% HCP were encountered needle stick injured [6]. The difference might be due to difference in supply

concerning materials for waste collection and awareness of study participants.

In this research among the respondents (95.5%) of the participants were segregate hazardous and non hazardous waste in their hospitals and 4.5% were not segregate wastes. In relation to this (66.25%) of respondents were disposed wastes of medical equipment by burning in incineration, (26.0%) of HCP were disposed wastes of medical equipment by burial in pit and (9.1%) of HCP were disposed wastes of medical equipment in open dumping. This study finding more better than study finding from Southeast Nigeria which majority (72.2%) did not practice proper waste segregation before disposal, (92.6%) waste were collected with a common waste bin and subsequently disposed by open dumping and (1.9%) incineration was only practiced only by one facility [32].

Based on the diverse nature of factors that stresses the successful infection prevention practice, improvements require multiple strategies to address the barriers. Among strategies identified by World health organization as critical components of program aimed to improve infection prevention practice were work place reminder, training and education, evaluation & feedback play a major role [33]. However, result of this study show no significant association of infection prevention practice with these three variables in multivariate analysis. This might be due to emphasis was not given in performing this activities.

No significant statistical differences were found between median practice scores towards age, sex, marital status, work experience, Attitude, knowledge, education, and other factors. This might be due sample size, study setting; characteristics of participants and investigator not consider some variables as associated factors.

5. Conclusion and Recommendation

Totally, the findings of this study show that 40% of HCP had unsafe practice towards infection prevention. Infection prevention about unsafe practice was reported on recap not used for needles before disposing (81.8%), Only 20% of HCP were hand washing after patient contact, final waste disposal problem, needle stick injuries (44.8%), Autoclave is not functional for instrument sterilization. Working wards, infection prevention committee and profession were factors significantly associated with infection prevention practice. The hospital should give emphasis for all working wards to increase adherence to infection prevention practice.

References

- [1] World Health Organization Regional Office For Western Pacific, Manila Regional Office For Europe. Guidelines On Core Components Of Infection Prevention And Control Programmes At The National And Acute Health Care Facility Level. Place Of Publication Not Identified: World Health Organization Regional Office For Western Pacific, Manila Regional Office For Europe; 2016.
- [2] Habtemu J. Hebo, esta H. Gameda, And Kedir A. Abdusemed. Hepatitis B And C Viral Infection: Prevalence, Knowledge, Attitude, Practice, And Occupational Exposure Among Healthcare Workers Of Jimma University Medical Center, Southwest Ethiopia [Internet]. [Cited 2019 Jul 21]. Available From: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6377947/>
- [3] Melaku Desta, Ayenew T, Sitotaw N, Tegegne N, Dires M, Getie M. Knowledge, Practice And Associated Factors Of Infection Prevention Among Healthcare Workers In Debre Markos Referral Hospital, Northwest Ethiopia. BMC Health Serv Res. 2018 18; 18 (1): 465.
- [4] Sahiledengle B, Gebresilassie A, Getahun T, Hiko D. Infection Prevention Practices And Associated Factors Among Healthcare Workers In Governmental Healthcare Facilities In Addis Ababa. Ethiop J Health Sci. 2018 Mar; 28 (2): 177–86.
- [5] Alemayehu R, Ahmed K, Sada O. Assessment Of Knowledge And Practice On Infection Prevention Among Health Care Workers At Dessie Referral Hospital, Amhara Region, Southwollo Zone, North East Ethiopia. J Community Med Health Educ. 2016; 6: 487.
- [6] Geberemariam BS, Donka GM, Wordofa B. Assessment Of Knowledge And Practices Of Healthcare Workers Towards Infection Prevention And Associated Factors In Healthcare Facilities Of West Arsi District, Southeast Ethiopia: A Facility-Based Cross-Sectional Study. Arch Public Health [Internet]. 2018 Nov 12 [Cited 2019 Sep 18]; 76. Available From: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6231270/>
- [7] Stone PW, Dick A, Pogorzelska M, Horan TC, Furuya EY, Larson E. Staffing And Structure Of Infection Prevention And Control Programs. Am J Infect Control. 2009 Jun; 37 (5): 351–7.
- [8] Suoud Jemal, Mulusew Zeleke, Simachew Tezera, Suleyman Hailu, Ahmedzakir Abdosh, Et Al. Health Care Workers' Knowledge, Attitude And Practice Towards Infection Prevention In Dubti Referral Hospital, Dubti, North East Ethiopia. International Journal Of Infectious Diseases And Therapy. 2018; Vol. 3 (No. 4): 66–73.
- [9] Mbim E, Mboto C, Agbo B. A Review Of Nosocomial Infections In Sub-Saharan Africa. British Microbiology Research Journal. 2016 Jan 10; 15 (1): 1–11.
- [10] Patti G. Grotta, Phd, CNS-M-S, CIC, FAPIC,; Patti S. Grant, BSN, MS, RN, CIC, FAPIC. Environmental Infection Prevention Priorities Of Patient Safety Collaboration. Wolters Kluwer Health, Inc. 2018; 41 (1): 38–46.
- [11] Tobin KW, Ekaete, Alice SR, Asogun, Akhere D, Ikponwonsa O, Et Al. Knowledge And Practice Of Infection Control Among Health Workers In A Tertiary Hospital In Edo State, Nigeria. In 2013.
- [12] Findit@Stanford - Lane Medical Library: Knowledge, Practice, And Associated Factors Towards Prevention Of Surgical Site Infection Among Nurses Working In Amhara Regional State Referral Hospitals, Northwest Ethiopia. [Internet]. [Cited 2019 Jul 9]. Available From: <http://Sfx.Stanford.Edu/Local?Sid=Stanford:Laneweb-Search-Pubmed&Id=Pmid:26788549>
- [13] Aynalem Tesfay F, Dejenie Habtewold T. Assessment Of Prevalence And Determinants Of Occupational Exposure To HIV Infection Among Healthcare Workers In Selected Health Institutions In Debre Berhan Town, North Shoa Zone, Amhara Region, Ethiopia, 2014 [Internet]. AIDS Research And Treatment. 2014 [Cited 2019 Aug 16]. Available From: <https://www.hindawi.com/Journals/Art/2014/731848/Abs/>

- [14] Gamil Alrubaiee, Anisah Baharom, Hayati Kadir Shahar, Shaffe Mohd Daud And Huda Omar Basaleem. Knowledge And Practices Of Nurses Regarding Nosocomial Infection Control Measures In Private Hospitals In Sana'a City, Yemen | Safety In Health. 2017.
- [15] Tadesse Anteneh, Tariku Lambiyo, Keneni Gutema, Girmay Abraham, Asamnew Abayneh, Barana Balta, Dawit Assefa, And Tariku Gelda. Infection Control In Health Care Facilities For The Ethiopian Health Center Team. 2005; (663-A-00-00-0358-00.).
- [16] Kingston L, O'Connell NH, Dunne CP. Hand Hygiene-Related Clinical Trials Reported Since 2010: A Systematic Review. *Journal Of Hospital Infection*. 2016; 92 (4): 309–320.
- [17] Tenna A, Stenehjem E, Margoles L, Kacha E, Blumberg HM, Kempker RR. Infection Control Knowledge, Attitudes, And Practices Among Healthcare Workers In Addis Ababa, Ethiopia. *Infection Control And Hospital Epidemiology*. 2013; 34 (12): 1289–96.
- [18] Gulilat K, Tiruneh G. Assessment Of Knowledge, Attitude And Practice Of Health Care Workers On Infection Prevention In Health Institution Bahir Dar City Administration. In 2014.
- [19] Control C For D, Prevention. Guide To Infection Prevention For Outpatient Settings: Minimum Expectations For Safe Care. May 2011. National Center For Emerging And Zoonotic Infectious Diseases; 2016.
- [20] Hussen SH, Estifanos WM, Melese ES, And Moga FE. Knowledge, Attitude And Practice Of Infection Prevention Measures Among Health Care Workers In Wolaitta Sodo Otona Teaching And Referral Hospital [Internet]. [Cited 2019 Jul 31]. Available From: <https://www.omicsonline.org/open-access/knowledge-attitude-and-practice-of-infection-prevention-measures-among-health-care-workers-in-wolaitta-sodo-otona-teaching-and-ref-2167-1168-1000416.pdf>
- [21] Ashisbala Mohapatra. Assessment Of Knowledge And Practice To Control Nosocomial Infection, Among The Staff Nurses, Hi-Tech Medical College And Hospital. 2017. 2 (2).
- [22] Goma Niraula Shrestha, Bandana Thap, NAMS, Bir Hospital, Mahaboudha, Kathmandu, Nepal. Knowledge And Practice On Infection Prevention Among Nurses Of Bir Hospital, Kathmandu.
- [23] Dr. Imad Fashafsheh Mr. Ahmad Ayed Mrs. Faeda Eqtait Mrs. Lubna Harazneh. Knowledge and Practice of Nursing Staff Towards Infection Control Measures In The Palestinian Hospitals. *Journal of Education And Practice*. 2015; Vol. 6, (No. 4,).
- [24] Abdnur Abdela, Berhanu Woldu, Kassahun Haile, Biniam Mathewos And Tekalign Deressa. Assessment Of Knowledge, Attitudes And Practices Toward Prevention Of Hepatitis B Virus Infection Among Students Of Medicine And Health Sciences In Northwest Ethiopia. *BMC Research Notes*. 2016.
- [25] World Health Organization. Practical Guidelines For Infection Control In Health Care Facilities. Vol. No. 41. World Health Organization Regional Office For Western Pacific, Manila Regional Office For South-East Asia; 2004. 6 P.
- [26] Chitimwango Priscilla Chisanga. Knowledge, Attitudes And Practices Of Nurses In Infection Prevention And Control Within A Tertiary Hospital In Zambia. Stellenbosch University. 2017 Mar.
- [27] Ishwari Sharma Paudel, Vivek Ghosh, Purushottam Adhikari. Knowledge, Attitude And Practice Of Nursing Students Regarding Hand Hygiene In Western Region Of Nepal. *Journal Of College Of Medical Sciences-Nepal*. 16AD Dec; Vol-12: No 4.
- [28] Awab Ali Ibrahim Sittana Shamseldin Elshafie. Knowledge, Awareness, And Attitude Regarding Infection Prevention And Control Among Medical Students: A Call For Educational Intervention. *Advances In Medical Education And Practice*. 2016 Aug 22.
- [29] Yakob E, Lamaro T, And Henok A. Knowledge, Attitude And Practice Towards Infection Control Measures Among Mizan-Aman General Hospital Workers, South West Ethiopia. *Journal Of Community Medicine & Health Education*. 2015 Sep 30.
- [30] Mesele Damte (B.Sc.). Assessment Of The Knowledge, Attitude And Practice Of Health Care Workers On Universal Precaution In North Wollo Zone, Amhara Region, North Eastern Ethiopia, 2006. 2007 Apr.
- [31] Maryam Amini, 1, Mohammad Javad Behzadnia, Fatemeh Saboori, Mohammadkarim, Bahadori, And Ramin Ravangard. Needle-Stick Injuries Among Healthcare Workers In A Teaching Hospital. 2015 Nov 23.
- [32] Okechukwu Bonaventure Anozie, Lucky Osaheni Lawani, Justus Ndulue Eze, Emmanuel Johnbosco Mamah, Robinson Chukwudi Onoh, Et Al. Correspondence: Knowledge, Attitude And Practice Of Healthcare Managers To Medical Waste Management And Occupational Safety Practices: Findings From Southeast Nigeria.
- [33] World Health Organization: Regional Office For Europe. Guidelines On Core Components Of Infection Prevention And Control Programmes At The... National And Acute Health Care Facility Level. Place Of Publication Not Identified: World Health Organization; 2016.