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Complete List of Authors:	Angaw, Dessie ; Institute of public health,college of medicine and health science , University of Gondar,Ethiopia, Department of Epidemiology and Bio statistics Gezie, Lemma Derseh; Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia, Department of Epidemiology and Biostatistics Dachew, Berihun; Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia, Department of Epidemiology and Bio statistics
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Standard Precaution Practice and Associated Factors among Health Professionals Working in Addis Ababa Governmental Hospitals, Ethiopia: A cross-sectional questionnaire survey and Multilevel Analysis

Dessie Abebaw Angaw*[1], Lemma Dereseh Gezie[1], Berihun Assefa Dachew[1]

Address: dessieabebaw96@gmail.com, lemmagezie@gmail.com , berihunassefa21@gmail.com

Phone number: +251912480696, +251918773355, +251911542348

[1]department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia

***Corresponding author**

ABSTRACT

Objectives: Occupational exposure to blood and body fluids is a major risk to transmission of infections for health care workers in developing countries like Ethiopia. The aim of this study was to assess standard precautions practice and its associated factors among health professionals working in Addis Ababa governmental hospitals.

Methods: cross-sectional study was conducted in 2015 among 360 males and 412 females from eight Addis Ababa governmental hospitals. Multistage sampling technique was used to select the study participants. Health professionals who were directly participating in screening, diagnosis; treatment and follow up of patients were included. To take into account the hierarchical structure of data, multilevel binary logistic regressions were used. The intra-class correlation coefficient was calculated to evaluate whether the variation in the scores is primarily within or between hospitals.

Result: Among health professionals 50.65% of them had good standard precaution practice. There is a variation in health professionals practice between hospitals (ICC=5.6%). At the individual level attitude, age and educational status were found to be much more important factors with standard precaution practice. Controlling individual level factors; applying regular observation (AOR: 1.82; 95% CI: 1.2 to 2.76), providing sufficient materials (AOR: 1.53; 95% CI: 1.03 to 2.28) and week response for reported incidences (AOR: 0.47; 95% CI: 0.30 to 0.8) were also associated factors at hospital level.

Conclusion: There is low practice of standard precautions in the health care setting that put patients and health professionals at significant risk of acquiring infections. This finding warrant working on both at hospital and individual level factors has a significant role to maintain optimal practice in the hospitals

Key words: - Health professionals, multilevel analysis, standard precaution practice

ARTICLE SUMMARY

Strengths and limitations of this study

- The strength of this study was having large sample size which increases the estimation power and
- Incorporating all levels/types of hospitals like (referral, general and specialized hospitals) in the Addis Ababa city
- Applying multilevel model analysis used to avoid atomistic and ecological fallacy.
- The limitation of this study was the possibility of response bias that they were likely to over report their practice

BACKGROUND

Standard precaution is the basic minimum standard of hygiene to be applied throughout all contact with blood or body fluids from any patient or source regardless of diagnosis or infection status. Healthcare workers should apply the principles of standard precautions with each encounter with a patient and consider every person, patient or staff, as potentially infectious or susceptible to infection *(1-4)*. It is designed for use in caring for all people both clients and patients attending healthcare facilities *(5)*. Both those receiving and providing care in a hospital are at risk of acquiring and transmitting infections through exposure to blood, body fluids or contaminated materials *(6, 10)*.

Health care workers are exposed to blood and other body fluids while they perform their activities. Among the 35 million health workers worldwide, about 3 million receive percutaneous exposures to blood borne pathogens each year; two million of those to HBV, 0.9 million to HCV and 170 000 to HIV. These injuries may result in 15 000 HCV, 70 000 HBV and 500 HIV infections. More than 90% of these infections occur in developing countries*(7)*.

Hospital level factors have a significant impact of occupational exposure on health care professionals. For example, a study done SaoPaulo revealed that an institutional factor has significant association on standard precaution practice. Eighty eight percent (88%) of health professionals those who was supported and got frequent feedback on safety by the institution management had compliance on standard precaution practice with AOR 3. 49 compared to poor management support and infrequent feedback on safety practice respectively *(23)*

Although minimal data is available on the prevalence of health care acquired infection in Ethiopian hospitals, in developing countries with health systems and resources similar to Ethiopia,

studies have shown HCAI rates as high as 40% *(4)* .In Ethiopia, there is dramatic increase in the development of health facilities, but less emphasis is given for preventing occupational exposures that still the prevalence is high. For example, a study in Direa Dawa and Harari in 2010 the prevalence of splashing of blood or body fluids to the mouth or eyes was 28.8% *(10)*.

Though few researches exist in Ethiopia on standard precautions practice, still they did not address on identifying the factors at individual and hospitals level using a single analytical framework to provide reliable information. In this context, therefore, real information from both levels was required to enable Health Care Workers and to design more effective strategies for increasing compliance of standard precaution practices and to prevent transmissions of infectious diseases in the health care setting.

The aim of the current study was to assess standard precaution practice and its associated factors among health professionals working in Addis Ababa governmental hospitals, Ethiopia

METHODS

Study setting, study design, participants and sampling procedure

Institutional based cross-sectional study was conducted from March 22 to April 23, 2015 in Addis Ababa governmental hospitals. All health professionals who were working in the 8 selected Hospitals and those who were participating in screening, diagnosis, treatment and follow up of patients were included in the study. The sample size was calculated using single population formula for descriptive part and double population proportion formula for associated factors. Multistage sampling technique with design effect two was used to select 866 study participants with simple random sampling method.

Data collection tools, quality control issues and study variables

Closed ended self-administered questions were used which was adapted from different literatures and Ethiopian Hospital Reform Implementing Guideline (EHRIG) to collect information on socio demographic characteristic, knowledge, attitudes and institutional factors of standard precautions practice. Eight BSc nurse data collectors' and two supervisors (health officers) were assigned for data collection.

The questions were first prepared in English language then translated to Amharic then back translated to English to keep its consistency. Pretest was conducted on 44 respondents (5% of total sample size) before five days of data collection in governmental non selected hospitals (Gandhi and Alert hospitals) and necessary correction was taken after the pretest done on the questionnaires. There were half day training for data collectors and supervisors on how to collect data. Before the respondents respond to the questions orientation was given to fill the questions. The collected data was cheeked by the principal investigator and the supervisors for its completeness.

The study variables included were individual level variables such as socio-demographic characteristics, knowledge and attitude of the respondents and hospital level variables such as frequent observation, hospital category (general, special and referral hospital) and self-reported practice on standard precaution.

Patient and Public Involvement

Patients and the public were not involved in the design and conception of the study and there are no plans to disseminate the results to patients.

Data management and analysis

The respondents were asked 30 questions which were graded by assigning scores to likert scale responses on a Scale of 0–5 points to assess the overall standard precaution practice. The total mean score was used to measure the standard precaution practice. Those health professionals who scored less than the total score mean value were considered as having poor SPP and health professionals who scored greater than or equal to the total score mean value were considered as having good SPP. After appropriate coding, the data was entered using Epi Info version 7 software and it was exported to STATA version 12 software for analysis.

Using a two-level binary logistic regression modeling, we examined the effect of a number of individual and hospital level variables. Descriptive analyses was involved the use of numbers and percentage for variables to show the distribution of the outcome variables by the associated variables.

Three models were constructed for the analysis. The first model, an empty model without any explanatory variable. The second model control for the individual-level variables, while the third

control for both the individual- and hospital -level variables simultaneously. p -value of <0.05 was used to define statistical significance.

The Deviance Information Criterion (DIC) was used as a measure of how well our different models fitted the data. The intra-class correlation coefficient (Rho) was calculated to evaluate whether the variation in the scores is primarily within or between the hospitals.

Ethical considerations

Ethical clearance was obtained from the ethical committee of institution of public health, college of medicine and health science, and university of Gondar. Official letters was given to the ministry of health, Addis Ababa health office and the selected hospitals. The purpose and importance of this study was explained for each participant, written informed consent was taken from each study participant before they fill the questionnaire, and participants' involvement was assured on voluntary bases. Participants who were unwilling to participate and want to abstain at any step of filling the questionnaire in the study were informed to do so without any restriction. Name was not writing on the questionnaire and the confidentiality of the data has been kept at all level of the study.

RESULT

Socio demographic characteristics of the respondents

A total of 772 study participants were participated in this study with 89.2% response rate. Majority of respondents were nurses (54.4%) and more than half 397 (51.42%) of the respondents were BSc health professionals. The mean age and working experience of respondents was 29.63 years (SD=±6.95years) and 6.04 years (SD=±6.02 years) respectively (table1).

Table 1 Socio-demographic characteristics of health professionals in Addis Ababa governmental hospitals (n=772), 2015

Variable	Frequency	percentage
age cat		
20-29	400	51.81
30-39	300	38.86
40-49	42	5.44
50-59	30	3.89
Sex		
male	360	46.63
female	412	53.37
Profession		
Nurse	420	54.4
Doctors***	149	19.18
Laboratory	69	8.94
Health officer	54	6.99
midwife	39	5.05
Psychiatry	20	2.72
Anesthesiology	21	2.72
Work experience in year		
<1	18	2.33
1-5	457	59.2
6-10	215	27.85
>10	82	10.62
Marital status		
Married	287	37.18
Single	466	60.36
others**	19	2.46

* Assistance nurse** widowed, separated and divorced . *** Specialists and medical doctor

Standard precaution practice

Good standard precaution practice (SPP) among health professionals working in Addis Ababa hospitals were 50.65 %(95% CI: 46.1, 53.9).From SPP elements only safe injection management was practiced above half (fig.1).

Concerning hand washing practice after any direct contact with patients 57.6% were always practicing, 28.24% often practicing, 8.7% some times, 2.9% seldom and 2.5% respondents were never practicing. On the top of this, only 59.2% respondents were always practicing waste disposal on coded waste bin accordingly.

In the intercept model (null model) analysis the result indicated that there was considerable heterogeneity between hospitals. The intra-class correlation in the null model for standard precaution practice indicated that 5.6 % of the total variance can be attributed to differences between hospitals (table2).

Table 2: Parameter coefficients of the null model in using hospital, Addis Ababa (2015)

Random effect	Estimate	95 % conf. interval
Level 2 variance - var (cons)	0.19*	(0.055,0.66)
Rho-intra-class correlation (%)	5.6	
Deviance	1052	

*significance

In the model 3 when both individual level and hospital level variables added together ;health professionals aged 40-49 were more likely to practice standard precautions (OR=2.98; 95% CI=1.05-7.25), as compared with the youngest health professionals (aged 20-29). The odds of practicing standard precaution practice for BSc health professionals were decreased by 38 % as compared to diploma health professionals (OR =0.62; 95% CI; 0.4-0.9). The odds of developing good Standard precaution practice among health professionals who have positive attitude were 8.12 times higher as compared to health professionals who had negative attitude towards SPP (table3).

On the other hand, specialists which were significant variables at individual level become insignificant variables when added together with hospital level variables as compared with diploma (table 3)

Table 3 Multilevel multivariable Logistic Regression Modeling of Factors Associated with standard precaution practice among health professionals working in Addis Ababa governmental hospitals, 2015

Variables	**Model 1 a OR (CI 95%)**	**Model 2b** OR (CI 95%)	**Model 3c(full model** OR (CI 95%)
Age category			
20-29		1	1
30-39		2.00 (1.33-3.02)**	1.94 (1.2-2.9)**
40-49		3.43 (1.33-8.83)*	2.98 (1.05-7.25)*
50-59		5.17 (1.56-16.72)**	4.57(1.3-15.5)*
Educational level			
Diploma		1	1
Degree		0.63 (0.44-0.91)*	0.62 (0.4-0.9)*
Masters		0.46 (0.27-0.78)**	0.5(0.27-0.86)*
Specialist		0.19 (0.05-0.76)*	0.25(0.06-1.05)
Others		0.21(0.01-2.54)	0.25(0.02-3.4)
Knowledge			
Poor		1	1
Medium		1.4(0.88-2.25)	1.47 (0.9-2.3)
High		1.43(0.85-2.4)	1.52(0.9-2.6)
Attitude			
Negative		1	1
Neutral		3.25 (2.02-5.26)***	3.04 (1.9-4.96)***
Positive		8.4(4.46-15.73)***	8.12 (4.25-15.53)***

Table 3(continued)

HOSPITAL LEVEL VARIABLE			
Provide safety box and waste bin adequately			1.01(0.9-1.03)
Do not give solution for incidents which were reported			0.49(0.3-0.8)**
Allocate budget for SPP activities			1.02(0.66-1.57)
Provide materials for SPP activities			1.5(1.03-2.27)*
Management give feedback by regular observation			1.82(1.2-2.74)**
Management give feedback by giving immediate response for problems			1.45 (0.86-2.40)
Facilitate health professionals and experts to post safety symbols			0.82 (0.49-1.35)
Standard of the hospital			
General hospital			1
Specialized hospital			2.35(1.44-3.8)*
Referral hospital			1.01(0.64-1.58)
Random effect	**Model 1**	***Model 2***	***Model 3***
Hospital level variance	**0.19**(0.06,0.66)	*0.13(0.03,0.57)*	*0.14(0.03-0.6)*
Model fit statistics	**Model 1**	**Model 2**	**Model 3**
Deviance	1052	958	902
AIC	1055	1002	970

*P<0.05 ** P<0.01 *** P<0.001

- SPP=standard precaution practice, OR = odd ratio CI= confidence interval, **a** = there is no independent variable in the model, **b**= only individual level variables included in the model, **c**=all level variables included in the model

DISCUSSION

The current study found that 50.7 % of the health professionals had good standard precaution practice. This is in line with the study done in Nigeria health care workers (46.8%) *(13)*. But, it was better practiced than a study done in northern Ethiopia (42.9%).This may be due to difference in attitude of individuals towards standard precaution practice (SPP) and availability of facilities.

On the other hand, it is lower than a study done in eastern Ethiopia (80%). The possible explanation would be due to different the study participants that the eastern Ethiopia study incorporates both hospital and health center workers. The possible explanation would be due to different data collection tools used and the study participants who were included from health center and hospitals (10)

For the prevention of potential exposure to blood and other body fluids depend on the type of procedures and personal protective equipments availability *(4, 10)*. In this study 61.5% health professionals were always change gloves between patient contacts. This finding were lower than a study done in Nigeria (72.4%)*(12)*. This difference may be due to negligence of health professionals and availability of gloves in this study area.

The study found out 21.1% of the health professionals always recapped used needles. This finding was relatively similar with the previous study done in Northern Ethiopia in which 17 % of health professionals recapped used needles (14). Even if this figure was lower than previous study in Nigeria (36.7%) (13), it is risky in exposing health professional to infectious diseases like HIV and HBV.

Public concern has been growing over the disposal of wastes produced by health care facilities in the world*(20)*. The study found that 53.3 % of health professionals were never dispose of waste into an already full receptacle. This poor practice of waste segregation may be due to inadequate availability of waste bin and negligence of health professionals for their safety.

At the individual level, variables like attitude, education and age were found to be much more important associated variables to develop standard precaution practice. This finding indicated that, health professional that had positive attitude was 8.1 times more likely to develop good SPP as compared to those respondents who had negative attitude keeping other variables constant. Similar studies found that attitude has positive association for SPP *(15, 19)*.

Our study revealed that, practicing standard precaution among degree holders were decreased by 50% as compared to diploma health professionals. This indicated that the better educational status had developed lower standard precaution practice. This may due to the higher education level health professionals ignore standard precaution practice or they gave priority to their patients other than their safety. On the other hand, older health professionals had better standard precaution practice as compared to the youngest health professionals (aged 20-29). This finding was in contrast to other similar study *(23)*. The possible explanation would be the knowledge of youngest health professionals may not be supported by skill in our study setting.

The odds of developing good practice by health professional for those hospitals that did not give response for reported incidents was decreased by 51 % as compared to those hospitals gave immediate solution for reported incidents. Whereas the odds of developing standard precaution practice by health professionals working in a hospital that perform observation with feedback for activities related to SPP was increased by 82 % as compared to counterpart. This study was supported by other similar study (AOR: 3.49) (23).

Health professionals working in hospitals having different characteristics had different practices. The odds of developing standard precaution practice by health professionals working in specialized hospital were 2.4 times higher than health professionals working in general hospitals with the same value of random effect. The possible explanation could be the difference in availability of materials and burden of acute cases in general hospital. On the top of this, it would be the presence of shift their working place (ward) in general hospitals, which may affect following some standard precaution guide lines. The strength of this study was having large sample size which increases the estimation power and multilevel model analysis used to avoid atomistic and ecological fallacy. On the contrary, the limitation of this study was the possibility of response bias that they were likely to over report their practice. Follow up observation of all respondents would be more accurate and informative to cross check self-reported findings.

In conclusion the standard precaution practice was found to be low in the health care setting that increasing the likelihood of acquiring risk of nosocomial infections. Variables like age, educational status and attitude were factors associated with standard precaution practice at the individual level and frequent observation, the absence of immediate response for reported incidents, providing materials and hospital standards were significant factors associated with SPP at hospital level.

Competing interest

No potential conflict of interests with respect to the research, authorship and/or publication of this article.

Availability of data and material

All data generated or analyzed during this study are included in this published article. The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Authors' contribution

DA conceived the study ideas, design, analyzed data and wrote the draft manuscript; LD and BA participated in the study design, edited the manuscript and contributed to the final analysis. All authors read and approved the final manuscript.

Authors' Information

All authors are public health specialists.

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Ethics approval

Ethical committee of institution of public health, college of medicine and health science, and university of Gondar

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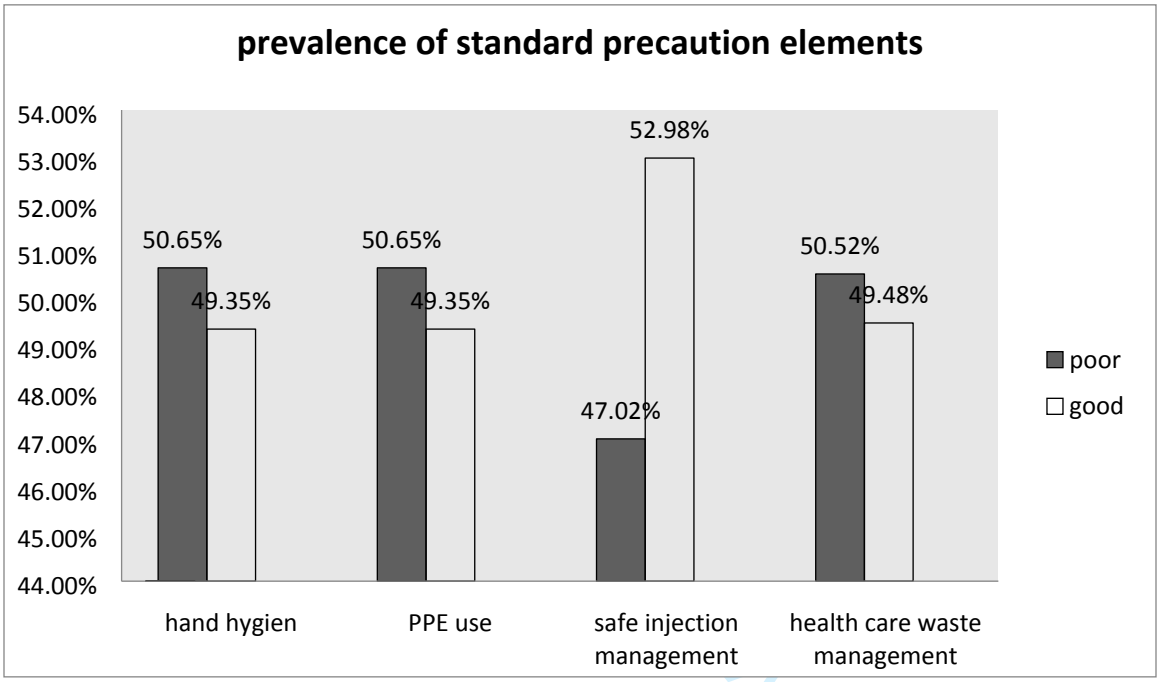
Figure

Figure 1 percentage of standard precaution practices among health professionals working Addis Ababa governmental hospitals, 2017



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Complete List of Authors:	Angaw, Dessie ; Institute of public health,college of medicine and health science , University of Gondar,Ethiopia, Department of Epidemiology and Bio statistics Gezie, Lemma Derseh; Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia, Department of Epidemiology and Biostatistics Dachew, Berihun; Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia, Department of Epidemiology and Bio statistics
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Dessie Abebaw Angaw*[1], Lemma Derseh Gezie[1], Berihun Assefa Dachew[1]

Address: dessieabebaw96@gmail.com, lemmagezie@gmail.com , berihunassefa21@gmail.com

Phone number: **+251912480696, +251918773355, +251911542348**

[1]department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia

***Corresponding author**

ABSTRACT

Objectives: Occupational exposure to blood and body fluids is a major risk to transmission of infections for health care workers in developing countries like Ethiopia. The aim of this study was to assess standard precaution practices and its associated factors among health professionals working in Addis Ababa governmental hospitals.

Methods: cross-sectional study was conducted on 772 health professionals working in eight government hospitals in Addis Ababa in 2015. Multistage sampling technique was used to select the study participants. Health professionals who were directly participating in screening, diagnosis, treatment and follow up of patients were studied. Standard precaution practices by health professionals were determined by a self-rated response on 30 items with Likert scale response. A respondent would be graded as good compliant for the assessment if he or she scored at least the mean of the total score, or would be considered as poor compliant if scored below it. So as to take into account the hierarchical structure of data, multilevel binary logistic regressions were used. The intra-class correlation coefficient was calculated to evaluate whether the variation in the scores is primarily within or between hospitals.

Result: Among health professionals, 50.65% of them had good standard precaution practices. At the individual level, attitude, age and educational status were found to be important factors for standard precaution practice. Controlling individual level factors, applying regular observation (AOR:1.82;95%CI:1.2 to2.76), providing sufficient materials (AOR:1.53;95% CI:1.03to 2.28) and weak measure for reported incidences (AOR:0.49;95% CI: 0.30 to 0.8) were also hospital level factors associated with standard precaution practices.

Conclusion: There was low practice of standard precautions in the health care setting that put patients and health professionals at significant risk of acquiring infections. This finding warrant working on both at hospital and individual level factors that would have significant role to maintain optimal practice.

Key words: - Health professionals, multilevel analysis, standard precaution practice

ARTICLE SUMMARY

Strengths and limitations of the study

- The strength of this study was having large sample size which increases the precision of estimates or estimation power.
- Incorporating factors at two levels, individual and hospital (like referral, general and specialized hospitals), in the Addis Ababa city.
- Applying multilevel model analysis used to avoid atomistic and ecological fallacy.
- The limitation of this study was the possibility of response bias that they were likely to over report their practice and
- The other limitation of this study was using unvalidated tool to measure standard precautions

BACKGROUND

Standard precaution is the basic minimum standard of hygiene to be applied throughout all contact with blood or body fluids from any patient or source regardless of diagnosis or infection status. Healthcare workers should apply the principles of standard precautions with each encounter with a patient and consider every person, patient or staff, as potentially infectious or susceptible to infection.*(1-4)* It is designed for use in caring for all people, both clients and patients, attending healthcare facilities.*(5-7)* Both those receiving and providing care in a hospital are at risk of acquiring and transmitting infections through exposure to blood, body fluids or contaminated materials.*(8-16)*

Health care workers are exposed to blood and other body fluids while they perform their activities. Among 35 million health workers worldwide, about 3 million receive percutaneous exposures to blood borne pathogens each year; two million of those to HBV, 0.9 million to HCV and 170 000 to HIV. These injuries may result in 15,000 HCV, 70,000 HBV and 500 HIV infections. More than 90% of these infections occur in developing countries.*(17)*

Hospital level factors have a significant impact of occupational exposure on health care professionals. For example, a study done in SaoPaulo revealed that an institutional factor has significant association on standard precaution practices. Eighty eight percent of health professionals those who was supported and got frequent feedback on safety by the institution management had compliance on standard precaution practice with AOR 3. 49 compared to poor management support and infrequent feedback on safety practice.*(18)*

Adherence to standard precaution practice is the best way to prevent health professionals, patients, visitors and communities at large from hospital acquired infection and needle stick injuries.(4) Although minimal data is available on the prevalence of health care acquired infection (HCAI) in Ethiopian hospitals, in developing countries with health systems and resources similar to Ethiopia, studies have shown HCAI rates as high as 40%.*(4)* In Ethiopia, there is dramatic increase in the development of health facilities, but less emphasis is given for preventing occupational exposures that still the prevalence is high. For example, a study done in Dire-dawa and Harari in 2010 showed that the prevalence of splashing of blood or body fluids to the mouth or eyes was 28.8% .*(9)*

Though there are some researches available in Ethiopia on standard precautions practice, (9,19,20) still they did not address on identifying the factors at individual and hospitals level using a single analytical framework to provide reliable information. In this context, therefore, real information from both levels was required to design more effective strategies in increasing health professionals' compliance of standard precaution practices and to prevent the transmissions of infectious diseases in the health care setting. Therefore, the aim of the study was to assess standard precaution practice and its associated factors among health professionals working in Addis Ababa governmental hospitals, Ethiopia.

METHODS

Study setting, study design, participants and sampling procedure

Institutional based cross-sectional study was conducted from March 22 to April 23, 2015 in Addis Ababa governmental hospitals. There were 17 governmental hospitals in Addis Ababa. All health professionals who were working in these hospitals and participating in screening, diagnosis, treatment and follow up of patients were eligible for the study. However, those health professionals who were severely ill to fill the questionnaire were excluded from the study. The sample size was determined by using single population proportion formula with the assumptions of 95% confidence level (Z= 1.96), margin of error 5%, proportion 42.9 % ,*(19)* design effect 2 and 15% non-response rate.*(9)* With these assumptions, the final sample size was calculated to be 866 health professionals. Because the sampling technique was two stage sampling, first 8 hospitals were selected with simple random sampling technique out of 17 hospitals, and then the health professionals were selected with simple random sampling method after allocating the overall sample size proportionally to the selected hospitals.

Data collection tools, quality control issues and study variables

A structured questionnaire was adapted from different literatures and Ethiopian Hospital Reform Implementing Guideline (EHRIG) to collect data. Eight BSc nurse data collectors' and two supervisors (health officers) were assigned for data collection using self-administered method.

The questions were first prepared in English language which was translated to Amharic and then back translated to English to keep its consistency. Pretest was conducted on 44 respondents (5% of total sample size) five days before the start of the actual data collection. The pretest was conducted on unselected governmental hospitals (Gandhi and Alert hospitals), and necessary corrections were made on the questionnaire. There was half day training given to data collectors and supervisors focusing on how to collect the data. Before the participants gave their response,

orientation was given to them on how to fill the questions. The collected data were cheeked for completeness and consistency by the principal investigator and the supervisors.

The outcome variable of the study is the overall standard precaution practice by health professionals and it was measured by 30 questions which were graded by Likert scale responses on a scale of 0–5 points. The status of standard precaution practice of each participant was identified by taking the mean of the total score as a cutoff point. Accordingly, those health professionals who scored less than the mean score value were considered as having poor standard precaution practice (SPP) and others who scored greater than it was considered as having good standard precaution practice (SPP).

The independent variables considered in the study were individual level variables such as socio-demographic characteristics, knowledge and attitude of the respondents and hospital level variables such as frequent observation and hospital category (general, special and referral hospital). The reliability coefficient for knowledge, attitude, and practice items had a Cronbach's Alpha of 0.732, 0.725 and 0.797, respectively.

The respondents were asked 12 Likert's scale questions to measure the attitude of respondents. All individual answers were computed to determine total scores and to calculate mean. The mean scores were used to divide the participants into three groups as positive, neutral, and negative groups. Those participants who scored greater than the mean plus standard deviation (SD) was considered as having positive attitude, within the interval of mean plus or minus SD as neutral, and less than mean minus SD as negative attitudes.(21)

Patient and Public Involvement

Patients and the public were not involved in the design and conception of the study and there are no plans to disseminate the results to patients.

Data management and analysis

After appropriate coding, the data were entered into Epi Info version 7 software and exported to Stata version 12 software for analysis. Descriptive analyses were performed using numbers and percentages to show the distribution of the outcome variables by different factors.

Using a two-level binary logistic regression modeling, we examined the effect of a number of individual and hospital level variables. Thus, three different models were constructed for the analysis: the first model is an empty model without any explanatory variable; the second model controlled for the individual-level variables; the third model controlled for both the individual and hospital level variables simultaneously. A p -value of less than 0.05 was used to define statistical significance. The Deviance Information Criterion (DIC) was used as a measure of how well our different models fitted the data. The intra-class correlation coefficient (Rho) was calculated to evaluate whether the variation in the scores is primarily within or between the hospitals.

Ethical considerations

Ethical statement for the study was obtained from the ethical committee of institution of public health, college of medicine and health sciences, and university of Gondar. Official letters were given to the ministry of health, Addis Ababa health office and the selected hospitals. The purpose and significance of the study were explained for each participant; written informed consent was obtained from each study participant before they fill the questionnaire, and participants' involvement was only on a voluntary basis. Participants who were not willing to participate and

want to resign at any step of filling the questionnaire were informed to do so without any restriction. We never wrote the names of participants in the questionnaire, and the confidentiality of the data has been kept at all level of the study.

RESULT

Socio demographic characteristics

A total of 772 study participants were involved in the study with 89.2% response rate. Majority of respondents were nurses (54.4%) and slightly more than half 397 (51.42%) of the respondents were BSc health professionals. The mean (SD) age and work experience of respondents were 29.63 (6.95) and 6.04(6.02) years, respectively (table1).

Table 1: Socio-demographic characteristics of health professionals in Addis Ababa governmental hospitals (n=772), 2015

Variable	Frequency	Percentage
age cat		
20-29	400	51.81
30-39	300	38.86
40-49	42	5.44
50-59	30	3.89
Sex		
male	360	46.63
female	412	53.37
Profession		
Nurse	420	54.4
Doctors***	149	19.18
Laboratory	69	8.94
Health officer	54	6.99
midwife	39	5.05
Psychiatry	20	2.72
Anesthesiology	21	2.72
Work experience in year		
<1	18	2.33
1-5	457	59.2
6-10	215	27.85
>10	82	10.62
Marital status		
Married	287	37.18
Single	466	60.36
others**	19	2.46

* Assistance nurse** widowed, separated and divorced . *** Specialists and medical doctor

Standard precaution practices

Good standard precaution practice among health professionals working in Addis Ababa hospitals were 50.65 % (95% CI: 46.1, 53.9). About 61.5% (95% CI: 58.3,64.9) of the participants always change gloves between patient contacts and 21.11(95% CI:18.4,23.8) of them always recap used needles. Among standard precaution practice elements, only safe injection management was practiced above fifty percent (50%) (fig.1).

Concerning hand washing practice after any direct contact with patients, 57.6% were practicing it always, 28.24% often, 8.7% some times, 2.9% seldom, and 2.5% respondents were never practicing it. Moreover, only 59.2% of the respondents were always practicing waste disposal on coded waste bin accordingly.

In the intercept model (null model), the result indicated that there was considerable heterogeneity between hospitals. The intra-class correlation in the null model for standard precaution practice indicated that 5.6 % of the total variance can be attributed to differences between hospitals (table2).

Table 2: Parameter coefficients of the null model in using hospital, Addis Ababa (2015)

Random effect	Estimate	95 % conf. interval
Level 2 variance - var (cons)	0.19*	(0.055,0.66)
Rho-intra-class correlation (%)	5.6	
Deviance	1052	

*significance

In model 3 when both individual level and hospital level variables were added together, health professionals aged 40-49 were more likely to practice standard precautions (OR=2.98; 95% CI=1.05-7.25) when compared to the youngest health professionals, aged 20-29. The odds of practicing standard precaution practice for BSc health professionals were decreased by 38 % when

compared to diploma health professionals (OR =0.62; 95% CI; 0.4-0.9). The odds of developing good Standard precaution practice among health professionals who have positive attitude were 8.12 times higher when compared to health professionals who had negative attitude towards SPP (table3).

On the other hand, attending a specialist level of education which was a significant variable at individual level when compared to diploma level became a non-significant variable in a model containing both individual and hospital level variables (table 3).

Table 3: Multilevel multivariable Logistic Regression Modeling of Factors Associated with standard precaution practice among health professionals working in Addis Ababa governmental hospitals, 2015

Variables	**Model 1 a OR (CI 95%)**	**Model 2b** OR (CI 95%)	**Model 3c(full model** OR (CI 95%)
Age category			
20-29		1	1
30-39		2.00 (1.33-3.02)**	1.94 (1.2-2.9)**
40-49		3.43 (1.33-8.83)*	2.98 (1.05-7.25)*
50-59		5.17 (1.56-16.72)**	4.57(1.3-15.5)*
Educational level			
Diploma		1	1
Degree		0.63 (0.44-0.91) *	0.62 (0.4-0.9) *
Masters		0.46 (0.27-0.78) **	0.5(0.27-0.86) *
Specialist		0.19 (0.05-0.76) *	0.25(0.06-1.05)
Others		0.21(0.01-2.54)	0.25(0.02-3.4)
Knowledge			
Poor		1	1
Medium		1.4(0.88-2.25)	1.47 (0.9-2.3)
High		1.43(0.85-2.4)	1.52(0.9-2.6)
Attitude			
Negative		1	1
Neutral		3.25 (2.02-5.26)***	3.04 (1.9-4.96)***
Positive		8.4(4.46-15.73)***	8.12 (4.25-15.53)***

Table 3(continued)

HOSPITAL LEVEL VARIABLE			
Provide safety box and waste bin adequately			
Yes			1.01(0.9-1.03)
No			1.0
Measures for reported incidences			
Yes			1.0
No			0.49(0.3-0.8) **
Allocate budget for SPP activities			
Yes			1.02(0.66-1.57)
No			1.0
Provide materials for SPP activities			
Yes			1.5(1.03-2.27)*
No			1.0
Management give feedback by regular observation			
Yes			1.82(1.2-2.74)**
No			1.0
Management give feedback by giving immediate response for problems			
Yes			1.45 (0.86-2.40)
No			1.0
Facilitate health professionals and experts to post safety symbols			
Yes			0.82 (0.49-1.35)
No			1.0
Standard of the hospital			
General hospital			1
Specialized hospital			2.35(1.44-3.8)*
Referral hospital			1.01(0.64-1.58)
Random effect	**Model 1**	***Model 2***	***Model 3***
Hospital level variance	**0.19**(0.06,0.66)	*0.13(0.03,0.57)*	*0.14(0.03-0.6)*
Model fit statistics	**Model 1**	**Model 2**	**Model 3**
Deviance	1052	958	902
AIC	1055	1002	970

*P<0.05 ** P<0.01 *** P<0.001

- SPP=standard precaution practice, OR = odd ratio CI= confidence interval, **a** = there is no independent variable in the model, **b**= only individual level variables included in the model, **c**=all level variables included in the model

DISCUSSION

Our study found that almost half of the health professionals had good standard precaution practice. The study also revealed that at the individual level, positive attitude, lower educational level and old age were positively associated with good standard precaution practice. Among hospital level factors, feedback and regular observation, no response to reported incidences, providing materials and hospital standards were factors significantly associated with SPP.

The prevalence of good standard precaution practice is in line with a study done in Nigeria health care workers (46.8%) .*(22)* But it is higher than a study done in northern Ethiopia (42.9%).(19) This difference might be due to variation in attitude of individuals towards standard precaution practice, regular observation, feedback, working experience and availability of facilities. On the other hand, our finding is lower than a study done in eastern Ethiopia (80%). The possible explanation might be due to the different study participants that the eastern Ethiopia study involved who were both hospital and health center workers. Another possible explanation could be due to the different data collection tools used.(9)

The prevention of potential exposure to blood and other body fluids depend on the type of procedures and personal protective equipments availability.*(4,9)* In our study, 61.5% of health professionals were always changing gloves between patient contacts, and it was lower than a study done in Nigeria (72.4%).*(23,24)* The difference between the findings in the two studies may be due to negligence of health professionals in our study setting and difference in availability of gloves.

The study found out that about 21.1% of the health professionals were recapping used needles always. This finding is relatively similar to the previous study done in Northern Ethiopia which was reported as 17 %. (19) Even if our finding was lower than the study done in Nigeria (36.7%), (22) it is still risky in exposing health professional to infectious diseases like HIV and HBV.

Public concern has been growing over the disposal of wastes produced by health care facilities in the world.(25) The study found that 53.3 % of health professionals never dispose of waste into an already full receptacle. This poor practice of waste segregation may be due to inadequate availability of waste bin and negligence of health professionals for their safety.

At the individual level, variables like attitude, education and age were found to be important variables associated with good standard precaution practice. Accordingly, health professionals who had positive attitude were slightly more than 8 times more likely to develop good SPP as compared to those respondents who had negative attitude keeping other variables constant. Other studies also reported the positive association between attitude and good SPP.*(*26-30*)*

Our study revealed that, practicing standard precaution among degree holders decreased by half as compared to diploma health professionals. This indicates that better educational attainment had a negative effect on standard precaution practice. This could be because higher educational level health professionals may ignore standard precaution practice, or they may give priority to their patients than their safety. On the other hand, older health professionals had better standard precaution practice as compared to the youngest group aged 20-29.(31-32) This finding is in contrast to other similar study *(23)*. The possible explanation may be that the knowledge of the youngest health professionals may not be supported by skill in our study setting.

For those hospitals that did not give response to reported incidents, the odds of developing good practice by health professional was decreased by 51% as compared to those hospitals which gave immediate response. The odds of developing standard precaution practice by health professionals working in a hospital who perform observation with feedback for activities related to SPP was increased by 82 % as compared to their counterpart. This finding was supported by another similar study. (18)

Health professionals working in hospitals having different characteristics had different practices. The odds of developing standard precaution practice by health professionals working in specialized hospital were 2.4 times higher than health professionals working in general hospitals with the same value of random effect. The possible explanation could be the difference in availability of materials and burden of acute cases in general hospital. Another explanation could be the presence of shift in their working place (ward) in the general hospitals which may affect the strict follow-up of some standard precaution guidelines.

The strength of the study may be the large sample size which could increase the estimation power or precision of estimates, and the use of multilevel analysis which is helpful to avoid atomistic and ecological fallacy. On the contrary, the limitation of the study was the possibility of response bias

that they were likely to over report their practice. Follow up observation of all respondents would be more accurate and informative to cross check self-reported findings.

In conclusion, the standard precaution practice was found to be low in the health care setting that may increase the likelihood of acquiring the risk of nosocomial infections. Variables like age, educational status and attitude were factors associated with standard precaution practice at the individual level, and frequent observation, the absence of measures taken for reported incidences, providing materials and hospital standards were factors significantly associated with SPP at hospital level.

Competing interest

No potential conflict of interests with respect to the research, authorship and/or publication of this article.

Availability of data and material

All data generated or analyzed during this study are included in this published article. The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Authors' contribution

DA conceived the study ideas, design, analyzed data and wrote the draft manuscript; LD and BA participated in the study design, edited the manuscript and contributed to the final analysis. All authors read and approved the final manuscript.

Authors' Information

All authors are public health specialists.

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Ethics approval

Ethical committee of institution of public health, college of medicine and health science, and university of Gondar

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Figure

Figure 1 percentage of standard precaution practices among health professionals working Addis Ababa governmental hospitals, 2015

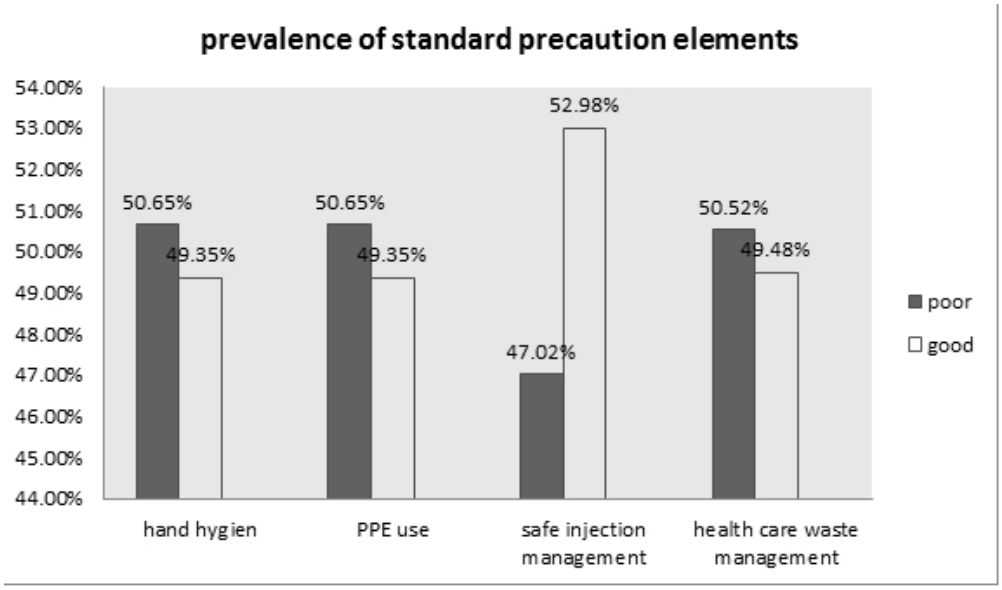

Figure 1 percentage of standard precaution practices among health professionals working Addis Ababa governmental hospitals, 2015

152x88mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2&3	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4&5	
Objectives	3	State specific objectives, including any prespecified hypotheses	5	
Methods				
Study design	4	Present key elements of study design early in the paper	6	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6&7*	
Bias	9	Describe any efforts to address potential sources of bias	6	
Study size	10	Explain how the study size was arrived at	6	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7&8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9&10
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	*9&10*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12&13
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	14 & 15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15 & 16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14 & 15
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Standard Precaution Practice and Associated Factors among Health Professionals Working in Addis Ababa Governmental Hospitals, Ethiopia: A cross-sectional study using Multilevel Analysis

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Standard Precaution Practice and Associated Factors among Health Professionals Working in Addis Ababa Governmental Hospitals, Ethiopia: A cross-sectional study using Multilevel Analysis

Dessie Abebaw Angaw*[1], Lemma Derseh Gezie[1], Berihun Assefa Dachew[1]

Address: dessieabebaw96@gmail.com, lemmagezie@gmail.com , berihunassefa21@gmail.com

Phone number: **+251912480696, +251918773355, +251911542348**

[1]department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia

***Corresponding author**

ABSTRACT

Objectives: Occupational exposure to blood and body fluids is a major risk factor for the transmission of infections to health professionals in developing countries like Ethiopia. The aim of this study was to assess standard precaution practices and its associated factors among health professionals working at Addis Ababa government hospitals.

Methods: A cross-sectional study was conducted on 772 health professionals working at eight government hospitals in Addis Ababa, 2015. The multistage sampling technique was used to select study participants. Health professionals who were directly participating in screening, diagnosis, treatment and follow ups of patients were studied. Standard precaution practices by health professionals were determined by a self-rated response to 30 item Likert scale response. A respondent would be graded as "good" compliant for the assessment if they scored at least the mean of the total score, or would be considered as poor compliant if they scored less. To take the hierarchical structure of the data into account during analysis, multilevel binary logistic regressions were used. The intra-class correlation coefficient was calculated to evaluate whether variations in score were primarily within or between hospitals.

Result: Out of the participants, 50.65% had good standard precaution practices. At the individual level, attitude, age and educational status were found to be important factors of standard precaution practices. Controlling individual level factors, applying regular observations (AOR:1.82;95%CI:1.2 to2.76), providing sufficient materials (AOR:1.53;95% CI:1.03to 2.28) and weak measures on reported incidences (AOR:0.49;95% CI: 0.30 to 0.8) were also hospital level factors associated with standard precaution practices.

Conclusion: standard precaution practices in the health care facilities were found to be so low that both patients and health professionals were at a significant risk for infections. The finding suggests the need for optimizing individual and hospital level precautionary practices.

Key words: - Health professionals, multilevel analysis, standard precaution practice

ARTICLE SUMMARY

Strengths and limitations of the study

- The strength of this study was having large sample size which increases the precision of estimates or estimation power.
- Incorporating factors at two levels, individual and hospital (like referral, general and specialized hospitals), in the Addis Ababa city.
- Applying multilevel model analysis used to avoid atomistic and ecological fallacy.
- The limitation of this study was the possibility of response bias that they were likely to over report their practice and
- The other limitation of this study was using unvalidated tool to measure standard precautions

BACKGROUND

Standard precaution is the basic minimum standard of hygiene to be applied throughout all contact with blood or body fluids from any patient or source regardless of diagnosis or infection status. Health professionals should apply the principles of standard precautions at each encounter with a patient and consider every person, patient or staff as potentially infectious or susceptible to infection.*(1-4)* The practice has been designed for use in caring for all people, both clients and patients, attending healthcare facilities.*(5-7)* Both recipients and providers of care in a hospital are at risk for acquiring and transmitting infections through exposure to blood, body fluids or contaminated materials .*(8-16)*

Health professionals are exposed to blood and other body fluids while they are performing their activities. Out of 35 million health professionals worldwide, about 3 million receive percutaneous exposures to blood borne pathogens each year; two million of them to hepatitis B virus (HBV), 0.9 million to hepatitis C virus (HCV), and 170 000 to Human Immune-deficiency Virus (HIV). These injuries may result in 15,000 HCV, 70,000 HBV and 500 HIV infections. More than 90% of these infections are known to occur in developing countries. *(17)*

Hospital level factors have a significant impact on the occupational exposure of health professionals. For example, a study done in SaoPaulo revealed that an institutional factor had significant association with standard precaution practices. Health professionals who got support and frequent feedback on safety practice by the institutional managements had more than threefold compliance with standard precaution practices when compared to those who didn't get such support and feedback .*(18)*

Adherence to standard precaution practices is the best way of preventing health professionals, patients, visitors and communities at large from hospital acquired infections and needle stick injuries.(4) Although only minimal data has been available on the prevalence of health care acquired infections (HCAI) in Ethiopian hospitals, in developing countries with health systems and resources similar to Ethiopia, studies have shown as high as 40% HCAI rates.*(4)* In Ethiopia, there has been dramatic increase in the development of health facilities, but the emphasis given to preventing occupational exposures has been inadequate despite its high prevalence. For instance, a study done in Dire Dawa and Harari in 2010 showed that the prevalence of splashing of blood or body fluids to the mouth or eyes was 28.8% .*(9)*

There were some studies on standard precaution practices done in Ethiopia; (9,19,20) however, the available studies did not address the problem of identifying factors at individual and hospital levels using a single analytical framework to provide reliable information. In this context, therefore, reliable information from both levels was required to design more effective strategies for increasing health professionals' compliance with standard precaution practices and for preventing the transmissions of infectious diseases in health care settings. Therefore, the aim of this study was to assess standard precaution practice and its associated factors among health professionals working at Addis Ababa government hospitals, Ethiopia.

METHODS

Study setting, study design, participants and sampling procedure

Institutional based cross-sectional study was conducted from March 22 to April 23, 2015 in Addis Ababa governmental hospitals. There were 17 governmental hospitals in Addis Ababa. All health professionals who were working in the hospitals and participating in screening, diagnosis, treatment and follow up of patients were eligible for the study. However, those health professionals who were severely ill to fill the questionnaire were excluded from the study.

The sample size was determined by using single population proportion formula with the assumptions of 95% confidence level (Z= 1.96), margin of error 5%, proportion 42.9 % ,*(19)* design effect 2, and 15% non-response rate; *(9)* with these assumptions, the final sample size was calculated to be 866 health professionals. Because the sample selection procedure was two-stage sampling technique, first 8 hospitals were selected with simple random sampling technique out of 17 hospitals, and then the health professionals were selected with simple random sampling method after allocating the overall sample size proportionally to the selected hospitals.

Data collection tools, quality control issues and study variables

A structured questionnaire was adapted from different literatures and Ethiopian Hospital Reform Implementing Guideline (EHRIG) to collect data. Eight BSc nurse data collectors and two supervisors (health officers) were assigned for data collection using self-administered method.

The questions were first prepared in English language which was translated to Amharic and then back translated to English to keep its consistency. Pretest was conducted on 44 respondents (5% of total sample size) five days before the start of the actual data collection. The pretest was conducted on unselected governmental hospitals (Gandhi and Alert hospitals), and necessary corrections were made on the questionnaire. There was half day training given to data collectors and supervisors focusing on how to collect the data. Before the participants gave their response,

orientation was given to them on how to fill the questions. The collected data were cheeked for completeness and consistency by the principal investigator and the supervisors.

The outcome variable of the study was the overall standard precaution practice by health professionals and it was measured by 30 questions which were graded by Likert scale responses on a scale of 0–5 points. The status of standard precaution practice of each participant was identified by taking the mean of the total score as a cutoff point. Accordingly, the health professionals who scored less than the mean score value were considered as having poor standard precaution practice (SPP) and others who scored greater than the mean score value were considered as having good SPP.

The independent variables considered in the study were individual level variables such as socio-demographic characteristics, knowledge and attitude of the respondents and hospital level variables such as frequent observation and hospital category (general, special and referral hospital). The reliability coefficient for knowledge, attitude, and practice items had a Cronbach's Alpha of 0.732, 0.725 and 0.797, respectively.

The respondents were asked 12 Likert's scale questions to measure the attitude of respondents. All responses of participants were computed to determine total scores and to calculate mean. The mean score was used to divide the participants into three groups as positive, neutral, and negative groups. Those participants who scored greater than the mean plus standard deviation (SD) was considered as having positive attitude, within the interval of mean plus or minus SD as neutral, and less than mean minus SD as negative attitudes. (21)

Patient and Public Involvement

Patients and the public were not involved in the design and conception of the study and there are no plans to disseminate the results to patients.

Data management and analysis

After appropriate coding, the data were entered into Epi Info version 7 software and exported to Stata version 12 software for analysis. Descriptive analyses were performed using numbers and percentages to show the distribution of the outcome variables by different factors.

Using a two-level binary logistic regression modeling, we examined the effect of a number of individual and hospital level variables. Thus, three different models were constructed for the analysis: the first model is an empty model without any explanatory variable; the second model controlled for the individual-level variables; the third model controlled for both the individual and hospital level variables simultaneously. A p -value of less than 0.05 was used to define statistical significance. The Deviance Information Criterion (DIC) was used as a measure of how well our different models fitted the data. The intra-class correlation coefficient (Rho) was calculated to evaluate whether the variation in the scores is primarily within or between the hospitals.

Ethical considerations

Ethical statement for the study was obtained from the ethical committee of institution of public health, college of medicine and health sciences, and university of Gondar. Official letters were given to the ministry of health, Addis Ababa health office and the selected hospitals. The purpose and significance of the study were explained for each participant. Written informed consent was obtained from each study participant before they fill the questionnaire, and participants' involvement was only on a voluntary basis. Participants who were not willing to participate and want to resign at any step of filling the questionnaire were informed to do so without any restriction. We never wrote the names of participants in the questionnaire, and the confidentiality of the data has been kept at all level of the study.

RESULT

Socio demographic characteristics

A total of 772 participants were involved in the study with 89.2% response rate. The majority (54.4%) of the respondents were nurses and slightly more than half, i.e. 397 (51.42%) of the respondents were BSc health professionals. The mean (SD) age and work experience of respondents were 29.63 (6.95) and 6.04(6.02) years, respectively (Table1).

Table 1: Socio-demographic characteristics of health professionals in Addis Ababa governmental hospitals (n=772), 2015

Variable	Frequency	Percentage
age cat		
20-29	400	51.81
30-39	300	38.86
40-49	42	5.44
50-59	30	3.89
Sex		
male	360	46.63
female	412	53.37
Profession		
Nurse	420	54.4
Doctors***	149	19.18
Laboratory	69	8.94
Health officer	54	6.99
midwife	39	5.05
Psychiatry	20	2.72
Anesthesiology	21	2.72
Work experience in year		
<1	18	2.33
1-5	457	59.2
6-10	215	27.85
>10	82	10.62
Marital status		
Married	287	37.18
Single	466	60.36
others**	19	2.46

* Assistance nurse** widowed, separated and divorced . *** Specialists and medical doctor

Standard precaution practices

Good standard precaution practice among health professionals working at Addis Ababa hospitals was 50.65 % (95% CI: 46.1, 53.9). About 61.5% (95% CI: 58.3,64.9) of the participants always changed gloves between patient contacts, and 21.11(95% CI:18.4,23.8) of them always recapped used needles. Out of the standard precaution practice elements, only safe injection management was practiced above fifty percent (50%) (Fig.1).

Out of the participants, 57.6, 28.4, 8.7,2.9 and 2.5% washed their hands always, often, sometimes, seldom and never respectively, after any direct contact with patients. Moreover, only 59.2% of the respondents always disposed waste in coded bins accordingly.

In the intercept model (null model), the result indicated that there was considerable heterogeneity among hospitals. The intra-class correlation in the null model for standard precaution practices indicated that 5.6 % of the total variance could be attributed to differences among hospitals (Table2).

Table 2: Parameter coefficients of the null model in using hospital, Addis Ababa (2015)

Random effect	Estimate	95 % conf. interval
Level 2 variance - var (cons)	0.19*	(0.055, 0.66)
Rho-intra-class correlation (%)	5.6	
Deviance	1052	

*significance

In model 3, when both individual and hospital level variables were added together, health professionals aged 40-49 were more likely to practice standard precautions (OR=2.98; 95% CI: 1.05-7.25) than the younger health professionals, aged 20-29. The odds of practicing standard precaution practice for BSc health professionals were decreased by 38 % when compared with diploma health professionals (OR = 0.62; 95% CI: 0.4-0.9). The odds of developing good standard precaution practices among health professionals who had positive attitude were 8.12 times higher compared to health professionals who had negative attitude towards SPP (Table3).

On the other hand, a speciality level education which was a significant variable at individual level when compared to diploma level training became a non-significant variable in a model containing both individual and hospital level variables (Table 3).

Table 3: Multilevel multivariable logistic regression modeling of factors associated with standard precaution practice among health professionals working in Addis Ababa governmental hospitals, 2015

Variables	**Model 1 a OR (CI 95%)**	**Model 2b** OR (CI 95%)	**Model 3c(full model** OR (CI 95%)
Age category			
20-29		1	1
30-39		2.00 (1.33-3.02)**	1.94 (1.2-2.9)**
40-49		3.43 (1.33-8.83)*	2.98 (1.05-7.25)*
50-59		5.17 (1.56-16.72)**	4.57(1.3-15.5)*
Educational level			
Diploma		1	1
Degree		0.63 (0.44-0.91) *	0.62 (0.4-0.9) *
Masters		0.46 (0.27-0.78) **	0.5(0.27-0.86) *
Specialist		0.19 (0.05-0.76) *	0.25(0.06-1.05)
Others		0.21(0.01-2.54)	0.25(0.02-3.4)
Knowledge			
Poor		1	1
Medium		1.4(0.88-2.25)	1.47 (0.9-2.3)
High		1.43(0.85-2.4)	1.52(0.9-2.6)
Attitude			
Negative		1	1
Neutral		3.25 (2.02-5.26)***	3.04 (1.9-4.96)***
Positive		8.4(4.46-15.73)***	8.12 (4.25-15.53)***

Table 3(continued)

HOSPITAL LEVEL VARIABLE			
Provide safety box and waste bin adequately			
Yes			1.01(0.9-1.03)
No			1.0
Measures for reported incidences			
Yes			1.0
No			0.49(0.3-0.8) **
Allocate budget for SPP activities			
Yes			1.02(0.66-1.57)
No			1.0
Provide materials for SPP activities			
Yes			1.5(1.03-2.27)*
No			1.0
Management give feedback by regular observation			
Yes			1.82(1.2-2.74)**
No			1.0
Management give feedback by giving immediate response for problems			
Yes			1.45 (0.86-2.40)
No			1.0
Facilitate health professionals and experts to post safety symbols			
Yes			0.82 (0.49-1.35)
No			1.0
Standard of the hospital			
General hospital			1
Specialized hospital			2.35(1.44-3.8)*
Referral hospital			1.01(0.64-1.58)
Random effect	**Model 1**	***Model 2***	***Model 3***
Hospital level variance	**0.19**(0.06,0.66)	*0.13(0.03,0.57)*	*0.14(0.03-0.6)*
Model fit statistics	**Model 1**	**Model 2**	**Model 3**
Deviance	1052	958	902
AIC	1055	1002	970

*P<0.05 ** P<0.01 *** P<0.001

- SPP=standard precaution practice, OR = odd ratio CI= confidence interval, **a** = there is no independent variable in the model, **b**= only individual level variables included in the model, **c**=all level variables included in the model

DISCUSSION

Our study found that almost half of the health professionals had good standard precaution practice. The study also revealed that positive attitude, low educational level and old age were positively associated with good standard precaution practices at the individual level. Among hospital level factors, feedback and regular observations, no response to reported incidences, provision of materials and hospital standards were significantly associated with standard precaution practices

The prevalence of good standard precaution practice noted in this work is in line with that of a study done among Nigerian health professionals (46.8%).*(22)* But it is higher than the result of a study done in northern Ethiopia (42.9%).(19) The difference might be due to variations in the attitude of individuals towards standard precaution practices, regular observations, feedback, work experience and availability of facilities. On the other hand, our finding is lower than that of a study done in eastern Ethiopia (80%). The possible explanation might be due to the different study participants in that the eastern Ethiopia study involved who were both hospital and health center workers. Another possible explanation could be differences in the data collection tools used .(9)

The prevention of potential exposure to blood and other body fluids depends on the type of procedures and personal protective equipment available.*(4,9)* In our study, 61.5% of the health professionals always changed gloves between patient contacts, but that was lower than a study done in Nigeria (72.4%).*(23,24)* The variations between the findings of the two studies may be due to the negligence of health professionals in our study setting and differences in the availability of gloves.

This study found out that about 21.1% of the health professionals always recapped used needles. This finding is relatively similar to that of a previous study done in northern Ethiopia and reported 17 %. (19) Although our finding was lower than that of Nigeria (36.7%), (22) it was still capable of exposing health professional to infectious diseases like HIV and HBV.

Public concern has been growing over the disposal of wastes produced by health care facilities in the world. (25) The study found that 53.3 % of health professionals never disposed of waste into the already full receptacles. This poor practice of waste segregation may be due to inadequate availability of waste bins and the negligence of health professionals for their safety.

At the individual level, attitude, education and age were found to be important variables associated with good standard precaution practices. Thus, health professionals who had positive attitude were slightly more than 8 times more likely to develop good standard precaution practices compared to respondents who had negative attitude keeping other variables constant. Other studies also reported the positive association between attitude and good standard precaution practice. *(*26-30*)*

Our study revealed that practicing standard precaution among degree holders decreased by half compared to diploma health professionals. This indicates that better educational attainment had a negative effect on standard precaution practice. This could be because more educated health professionals may ignore standard precaution practices, or they may give priority to their patients than their safety. On the other hand, older health professionals had better standard precaution practice compared to the younger groups, aged 20-29 years .(31-32) This finding is dissimilar to that of another similar study.*(23)* The possible explanation may be that the knowledge of the younger health professionals in our study setting might not be supported by adequate skills.

For hospitals which did not respond to reported incidents, the odds of developing good practice by health professionals decreased by 51% compared to hospitals which acted immediately. The odds of developing standard precaution practices for health professionals working at hospitals and performing observations with feedback on activities relating to such practices increased by 82% compared to their counterparts. This finding was of course supported by another similar study. (18)

Health professionals working at hospitals with their different characteristics had different practices. The odds of developing standard precaution practices for health professionals working at specialized hospitals were 2.4 times higher than for health professionals working at general hospitals with the same value of random effect. The possible explanation could be differences in the availability of materials and the burden of acute cases at such hospitals. Another explanation

could be work in shifts at the general hospitals which may affect the strict follow-up of some standard precaution guidelines.

The strength of the study may be the large sample size which could have increased estimation power or the precision of estimates. Our use of a multilevel analysis which helps to avoid atomistic and ecological fallacies is another strength; the measurement of the effect of factors from both individual and hospital levels on SPP is also an attempt to address the gap we identified. (9, 19, 20) To the contrary, the limitation of the study was the possibility of response bias as participants were likely to over report their practices. Follow up observations of all respondents would help to cross-check self- reported data.

In conclusion, standard precaution practices are so low that there is an obvious likelihood of acquiring the risk for nosocomial infections. Variables like age, educational status and attitude were factors associated with standard precaution practices at the individual level, while lack of frequent observations, the absence of measures to cope with reported incidents, poor provision of materials and hospital standards were factors significantly associated with standard precaution practice at hospital levels.

Competing interest

No potential conflict of interests with respect to the research, authorship and/or publication of this article.

Availability of data and material

All data generated or analyzed during this study are included in this published article. The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Authors' contribution

DA conceived the study ideas, design, analyzed data and wrote the draft manuscript; LD and BA participated in the study design, edited the manuscript and contributed to the final analysis. All authors read and approved the final manuscript.

Authors' Information

All authors are public health specialists.

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Ethics approval

Ethical committee of institution of public health, college of medicine and health science, and university of Gondar

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Figure

Figure 1 percentage of standard precaution practices among health professionals working Addis Ababa governmental hospitals, 2015

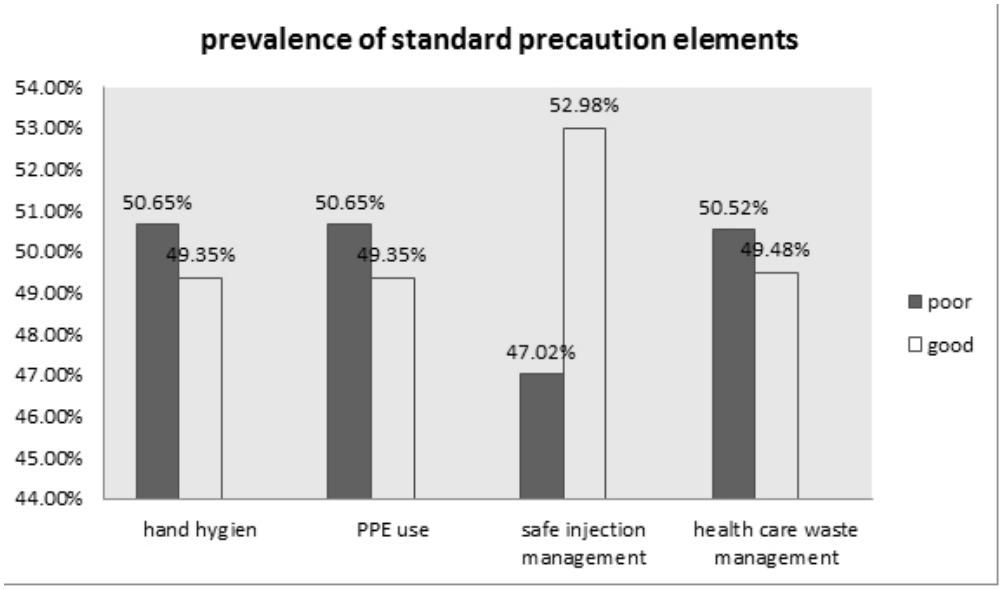

Figure 1 percentage of standard precaution practices among health professionals working Addis Ababa governmental hospitals, 2015

152x88mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2&3	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4&5	
Objectives	3	State specific objectives, including any prespecified hypotheses	5	
Methods				
Study design	4	Present key elements of study design early in the paper	6	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	NA NA 6	
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	NA NA	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6&7*	
Bias	9	Describe any efforts to address potential sources of bias	6	
Study size	10	Explain how the study size was arrived at	6	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7&8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	NA
		(*c*) Explain how missing data were addressed	NA
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	NA
		Case-control study—If applicable, explain how matching of cases and controls was addressed	NA
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9&10
		(b) Indicate number of participants with missing data for each variable of interest	NA
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	NA
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*NA*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	*NA*
		Cross-sectional study—Report numbers of outcome events or summary measures	*9&10*
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12&13
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA

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Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	14 & 15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15 & 16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14 & 15
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.