



**COMPLIANCE WITH STANDARD PRECAUTIONS GUIDELINES AND ASSOCIATED FACTORS AMONG NURSES WORKING AT PUBLIC HOSPITALS OF JIMMA ZONE, SOUTH WEST ETHIOPIA**

**BY: NUREDIN HASSEN HUSSEIN**

**A THESIS PAPER TO BE SUBMITTED TO JIMMA UNIVERSITY, INSTITUTE OF PUBLIC HEALTH, DEPARTMENT OF HEALTH POLICY AND MANAGEMENT, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS IN HEALTH CARE AND HOSPITAL ADMINISTRATION (MHA).**

**FEBRUARY, 2021  
JIMMA, ETHIOPIA**

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(MHA).**

**ADVISORS:**

- 1. Dr. ELIAS ALI YESUF (MD, MPH, Ph.D.)**
- 2. Mr. MULUGETA HAILU (BSC, MPH)**

**FEBRUARY, 2021  
JIMMA, ETHIOPIA**

**DECLARATION**

**ASSURANCE OF PRINCIPAL INVESTIGATOR AND ADVISORS**

The undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the Institute of Health in effect at the time of grant is forwarded as the result of this application.

**Name of the student**

**Signature**

**Date**

Nuredin Hassen



April 2, 2021

**APPROVAL OF THE ADVISORS**

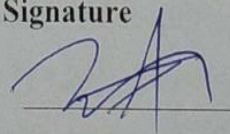
This research project has been submitted with my approval as university advisor

**Name of the first advisor**

**Signature**

**Date**

Elias Ali (MD, MPH, Ph.D.)



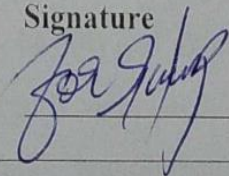
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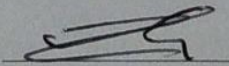
**APPROVAL OF THE INTERNAL EXAMINER**

**Name of the Internal Examiner**

**Signature**

**Date**

Mr. Muluneh Getachew (MPH, Assistant Professor)



07/04/2021

## **Abstract:**

**Background:** Exposure to blood and body fluids is a major risk factor for the transmission of infections that threaten the safety of patients and health workers. Among health workers, nurses spend the greatest time in the caregiving setting than any other member of the health team. The most effective practice of preventing blood-borne pathogen transmission is through compliance with Standard Precautions (SPs).

**This study aimed** to measure the magnitude of compliance with SPs and associated factors among nurses working in public hospitals of Jimma Zone, Southwest Ethiopia.

**Methods:** The study was conducted in six public hospitals of Jimma Zone, from March to April 2019. A cross-sectional study design was employed. All 335 nurses were invited to the study and 307 were responded to the questionnaire. Data were collected using a self-administered questionnaire. Data were entered into Epi info 7 and were exported to SPSS version 23 for analysis.

**Results:** Out of 307 respondents, less than one-fifth (21%) of the respondents were compliant with standard precautions. Infection risk perception (AOR [95% CI] 5.56 [1.30 - 23.90]), working department (AOR [95% CI] 40.05 [4.17 - 384.74]), knowledge on SPs (AOR [95% CI] 17.11[6.42 - 45.61]), risk taking personality (AOR [95% CI] 0.17 [0.06 - 0.52]), readily accessiblity of PPE (AOR [95% CI] 4.96 [1.76 - 14.00]) and management support (AOR [95% CI] 4.41 [1.303 - 14.91]) were found to be significantly associated.

**Conclusion:** Conclusion: In this study, the overall compliance level of nurses to standard precautions guidelines was very low. Working unit, perception of risk, risk-taking personality, exemplary behavior of colleagues, knowledge about SPs, management support, and ready accessibility of safety materials were factors significantly associated with compliance with SPs guidelines. Improving knowledge of nurses on SPs guidelines, the hospital management should ensure supervision and have a system of periodically assessing compliance among their staff. Also, accessibility of infection prevention materials and equipment in the hospitals should get due attention,

**Keywords:** standard precaution, nurses' compliance level, Jimma Zone hospitals

## **Acknowledgment**

I would also like to express my gratitude to Jimma University, Institute of Health, Department of Health Service Management and Policy for financial support to undertake this study

I would first like to thank my advisors Dr. Elias Ali (MD, MPH, Ph.D.) and Mr. Mulugeta Hailu (MPH) lecture at the Institute of Health, Jimma University for their advice and guidance throughout the study period.

I also wish to extend my gratitude to Jimma University Institute of health, the Ethical Review Board for granting me approval, and Jimma Zone Public Hospital management for permission to conduct this study.

I would also like to thank the nurses who were participants in this research project.

Finally, I must express my very profound gratitude to my families and friends for providing me with unfailing support and patience and for being interested in my studies.

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## **List of Abbreviations**

AIDS -	Acquired Immune Deficiency Syndrome
BBF -	Blood and other Body Fluids
BBI -	Blood-Borne Infections
CDC -	Centre for Disease Control and Prevention
HAI -	Hospital Acquired Infection
HAIs -	Healthcare Acquired Infections
HBV -	Hepatitis B Virus
HCV -	Hepatitis C Virus
HCWs -	Health care workers
IPC -	Infection Prevention and Control
NSSI -	Needle Sticks and Sharps Injury
PPE -	Personal Protective Equipment
SPs -	Standard Precautions
SPSS -	Statistical Package on Social Science
UPs -	Universal Precautions
US -	United States
WHO-	World Health Organization

# **1. Introduction**

## **1.1. Background**

Standard precautions are means to reduce the risk of transmission of bloodborne and other pathogens from both recognized and unrecognized sources. They are the basic level of infection control precautions which are to be used, as a minimum, in the care of nurses as well as the clients in all healthcare settings from the transmission of bloodborne and other pathogens (1). In 1987, the Centers for Disease Control and Prevention (CDC) proposed the concept of “universal precautions” originally designed to protect health care workers from exposure to blood-borne pathogens (2).

In 1996, CDC incorporates major parts of both universal precautions (UP) and body substance isolation (BSI) into a single set of guidelines that operate at two levels standard precautions and Transmission-based precautions. Standard precautions are guidelines designed for use in caring for all people-both clients and patients-attending health care facilities. They apply to blood, all body fluids, secretions and excretions (except sweat), non-intact skin, and mucous membranes. Transmission-based precautions are guidelines designed to reduce the risk of transmitting infections that are spread wholly or partly by airborne, droplet, or contact routes between hospitalized patients and health care providers (3).

Standard precautions that are advised by the World Health Organization (WHO) to help protect health care workers and clients from blood-borne infections including HIV are the following: hand hygiene, personal protective equipment (gloves, gown, goggle, head protection, foot protection, and wearing face shields), safe handling and disposing of sharps, safe handling of hospital wastes, respiratory hygiene, and cough etiquette, environmental cleaning and reprocessing of reusable patient care equipment (4).

Health care workers are increasingly at risk of becoming infected with serious blood-borne viruses such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) infections, and many other multiple drug resistance bacterial infections and clients also exposed for different infections after admission due to poor compliance of standard precaution (5). This survey was addressed the above major components of SPs.

The primary strategy for blood-borne (Nosocomial) infection control in hospitals is applying Standard precautions; it applies to all patients receiving care irrespective of their diagnosis or presumed infection status and covers blood, body fluids, secretions, excretions, non-intact skin, and mucous membrane (6).

Nosocomial infection or Health-care-associated infection (HCAI) refers to an infection that is acquired during hospitalization, the process of care, and not manifested at the time of admission to a hospital or other health-care facility (7). Transmission of Healthcare Acquired Infections (HAIs) is a global concern (8). Also of greater concern in developing countries than in developed ones (9).

The challenge of achieving significant improvement in patient care is one of the tasks facing health care providers. A large number of people continue to be successfully cared for and treated in health facilities, however, errors and other forms of harm occur (10). Compliance with Standard Precautions (proper handwashing, utilization of appropriate protective barriers such as gloves, mask, gown, and eyewear, safe handling and disposing of sharps, safe handling of hospital wastes) has been shown to reduce the risk of exposure to blood and body fluids (11).

In Ethiopia, most activities for patient care is covered by nurses assessing the compliance with standard precaution and factors influencing compliance in hospitals as early as possible can give way to manage the limited resource available in the sector and improves the quality and safety of health service for the health providers and consumers. Thus, this study will be aimed at measuring the level of compliance on standard precautions and factors influencing compliance among nurses in Jimma Zone public hospitals.

## **1.2. Statement of the problem**

Globally it is estimated that about 40% of HBV and HCV infection and 2.5% of HIV infection in health care workers are attributable to occupational exposure (12).

European survey of needle stick injury found that nurses are exposed more commonly (91%) than doctors which is (6%). An Iranian study shows that 70% of medical, 74% of dental, and 72% of nurses reported having at least one sharps injury in their working place (13). A study conducted In Turkey shows that the prevalence of Needlestick injury (NSIs) among nurses was 57% (14).

According to WHO among the 35 million health care workers worldwide, three million experience needle pricks and sharps injuries every year, with a high incidence of these injuries being reported from health care facilities that vary in terms of their level of economic development (2). Needle pricks and sharp injuries pose a considerable risk for the transmission of more than 20 kinds of blood-borne pathogens, such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) (15). Exposure due to sharps injury in the workplace accounts for 40% of infections with HBV and HCV and 2-3% of HIV infections among health care workers (2).

Incidents involving healthcare professionals, particularly nurses were mainly due to poor practice of the SPs, for example, unsafe disposal of needles or not wearing protective clothing such as masks during their work activities (16)

Many of the pathogens that cause HCAs can present and live on health care equipment, unwashed soiled hands, and in the healthcare setting environment in which patients and HCWs touch. These pathogens are easily transmitted from patient to patient or HCWs and vice versa that leads to serious morbidity, increase hospitalization days for patients, increased antimicrobial resistance, long-term disability, high economic costs for patients and healthcare systems, and tragic loss of life. Mainly as a result of healthcare professionals and facilities not follow Standard precautions guidelines (16).

Compliance with standard SPs is fundamental to quality of care and essential to protect HCWs, patients, and communities (17).

The Federal Ministry of Health (FMOH) of Ethiopia started initiatives in hospitals to protect patients and health workers from healthcare-associated infection by setting infection prevention

standards and guidelines. Hence to improve compliance with standard precautions (SPs) among HCWs; In Ethiopia different strategic interventions have been performing till now (17) (18).

In 2010 Ethiopia hospitals reform implementation guidelines (EHRIG) and 2014 clean and safe health (CASH) initiatives had been launched in line with the Ethiopian hospitals' alliance for quality (EHAQ) which has the same aim on SPs. So that the main aim was to make hospitals clean, comfortable, and safe environment for patients, attendants, visitors, staff and to increase patient confidence and organizational commitment to assure patient safety and good health outcomes (19) (20).

Those all constituents of standard SPs are challenged by accessibility and availability of infrastructures, understaffing, shortage of basic PPEs, workload, inadequate structural organization, and lack of awareness and on infection prevention practices and control guidelines (18).

Ethiopian Federal Ministry of Health has clearly defined policies and procedures to implement universal precautions/standard precautions, less emphasis is given at the facility level for the preventive strategies in reducing occupational injuries and increasing conformity with standard precautions (16) (21). Still, the problem is important and different studies were recommending infection control teams and researchers need to consider the reasons for non-compliance and provide a supportive environment that is conducive to the routine, long-term application of standard precautions (22) (18).

Needlestick injury prevalence in Ethiopia was 17.5% annually which is attributed to risky habits and inappropriate standard precaution compliance (10). Another Ethiopian study in six hospitals of the Tigray region also revealed that significant numbers of healthcare workers (56.3%) were exposed to Blood and Body Fluids (BBFs) and 17.2% of nurses exposed to needle stick injury (NSI) (23). Furthermore in other studies, 39.3% of NSI was reported among nurses working in Jimma zone public hospitals which put them at significant risk of Healthcare-associated infections (HAI) (22).

These statistics do show that some nurses do not comply with the standard precautions and thus may place themselves and the patient's life in danger of being infected by blood-borne infection.

As the predominant occupation in the health sector and as the health worker with the most patient interaction than any other member of the health team, nurses are at high risk of acquiring

and transmitting blood-borne pathogens. Improving nurses' compliance to the recommended SPs guidelines should assist to reduce occupational transmission of illness (24).

There were some studies on SPPs done in Ethiopia (25) (18) (26) (27). However, these studies focused on part healthcare workers in general and that studied only a few aspects of the SPs. Thus they did not provide a comprehensive picture of SPs practices among nurses. Nevertheless, 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.

Therefore, this study will be aimed at assessing the level of compliance towards standard precautions and associated factors among nurses who have direct contact with patients in public hospitals of Jimma Zone Ethiopia.

### **1.3. Significance**

The findings of the study help design effective programs that would reinforce compliance with infection prevention standard precautions and therefore reduce hospital-acquired infections among nurses and patients.

Findings from the study will be used by the hospitals' management, nurses, other stakeholders, and researchers, through the planning of actions to improve compliance to standard precautions in hospital institutions.



## 2. Literature Review

### 2.1. Compliance with Standard Precautions

In developing countries like Ethiopia where resources are very limited, compliance with standard precautions is a cost-effective strategy to prevent blood-borne and other infections (BBIs), both from patients and health care professionals in health institutions. Although health organizations worldwide recognize SPs as the best way to prevent BBIs, the compliance with these measures is still suboptimal among healthcare providers particularly nurses, who are involved in direct and repeated patient care and thereby can be more exposed to microorganisms associated with cross-infection (28).

In many studies, compliance with standard precautions among healthcare professionals was reported to be inadequate concerning eye protection, avoidance of needle recapping, glove use when required, and washing hands before and after patient contact, use of facemasks, and avoidance of a used needle that is disassembled from a syringe and in implementation of precautions for all patients (29).

A study done in Cyprus among nurses indicated that compliance was inadequate concerning hand hygiene, use of gloves when exposure to body fluids was anticipated, eye protection, mouth and nose protection, wearing a gown when required, avoidance of needle recapping after it was used for a patient, and provision of healthcare considering all patients as potentially infectious (11).

A study conducted in China show that one thousand five hundred registered nurses were involved half of the nurses were fully qualified and half were not in training. The vast majority of the nurses (93.7%) worked in departments equipped with sharps disposal boxes. With a maximum possible score of 80, the quartile range of the overall score for compliance for all nurses were 48.29 (upper quartile score 76.36, lower quartile score 28.07), which was occupied by 64.7% of the participants. The lowest score was obtained for the use of protection equipment such as eye shields, protective masks, and quarantine clothes. The score was higher for hand washing and sterilization (30).

A study conducted in Vietnamese Health Care Workers shows for practice about standard precautions, only a small number of correct responses to items about hand hygiene indications (before patient contact: 29.1%, before using gloves: 14.5%, and after touching patient

surrounding: 14.3%) and about the use of a surgical mask (18.0%) and goggles (7.2%) when procedures likely to generate splashes and sprays of blood or body fluids (31).

A study done in Northern Nigeria shows that among a total of 421 HCWs, about 70.1% usually wear gloves before handling patients or patients' care products, 12.6% reported wash their hand before wearing the gloves, 10.7% washed hands after removal of gloves, and 72.4% changed gloves after each patient contact. Only 3.3% had a sharp disposal system in their various workplaces. The majority (98.6%) of the respondents reported that the major reason for noncompliance to universal precautions is the non-availability of the equipment (6).

A cross-sectional hospital-based survey conducted in Tikur Anbesa Specialized Hospital, Addis Ababa University, among staff nurses who were from adult emergency 40.1%, 26.7% from pedantic emergency, 23.9% from adult ICU, and 9.2% from pediatric ICU. This study shows that regarding the practice of hand hygiene compliance, 60(42%) of them responded that they practice handwashing between every patient. Whereas 7(4.9%) of respondents responded that they practice handwashing after touching every part of the hospital environment and 60(42%) of them said that they wash their hands after finishing their work. Regarding the use of PPE shows that 98(69.01%) of respondents said they use the glove for all people when needed and for procedures that need gloves however, the rest of them responded they use gloves only for HIV patients (32).

## **2.2. Factors that affect compliance with standard precautions**

It has been proved by numerous studies that compliance to Standard Precautions among nurses, is lower than the recommended level (11) (25).

According to the literature, several factors may interfere with the compliance of nurses to standard precautions. Studies on the influencing factors of SP compliance have been investigated, including sociodemographic, individual, and institutional factors.

Sociodemographic factors:

The sociodemographic factors reported affecting compliance to SP include being female, length of work experience, age, the higher level of education, and the department the nurse is stationed in (18).

Individual Factors:

Health belief, awareness, and risk perception have been identified as influencers of adherence to SP among individuals, with results varying by country, hospital type, and subject (33). A Brazilian study, among Intensive Care nurses, evaluated individual factors related to adherence to standard precautions and found 'risk-taking personality' as an example of individual factors associated with low adherence to SPs (15).

In South Africa, Nurses' attitudes, was identified as the main factors that impeded adherence (34). Another study was conducted in South Africa, to describe perceptions of registered nurses regarding factors influencing adherence to standard precautions in operating theatres. Findings show that insufficient knowledge and healthcare workers 'negative attitudes were cited as factors impeding compliance to standard precautions (35).

Institutional Factors:

Recently, institutional factors such as safety equipment availability and accessibility, management support for safe work practice, safety performance feedback, and workplace safety climate have received attention for their importance in SP Compliance (18).

In South Africa, contextual factors which affect compliance to standard precautions at public healthcare facilities, staff shortages, and a lack of training were identified as the main factors that impeded adherence (34).

A study of registered nurses from 25 public hospitals in China was affected by protective equipment, safety climate, and workload, whereas other studies show that workplace safety climate influences SP adherence among nurses in dialysis care and adherence to SP by nurses in psychiatric wards is correlated with organizational factors, including the availability of personal protective equipment (PPE) and the security climate (36).

A related study conducted in Nigerian public secondary health facilities found that the compliance to standard precautions among nurses was below the recommended levels, with the main reason being an inadequate supply of Infection Prevention and Control (IPC) equipment and materials (37).

A study in a Kenyan hospital documented motivating factors and barriers to compliance to standard precautions amongst nurses, found the continuous supply of IPC materials, regular education and training, and offering incentives for positive work performance to be motivating factors for compliance to standard precautions. Problems with a supply of infection prevention and control equipment were found to be barriers to compliance (38).

Shortage of time to implement the precautions (work overload), limited resources, lack of proper training, uncomfortable equipment, skin irritation, distance from the necessary facilities, and insufficient support from management in creating a facilitating work environment (39).

In this review, the findings of the included studies on factors influencing compliance to Standard precaution practice identified three main domains of determinant factors; namely socio-demographic, individual, and institutional/hospital-related factors.

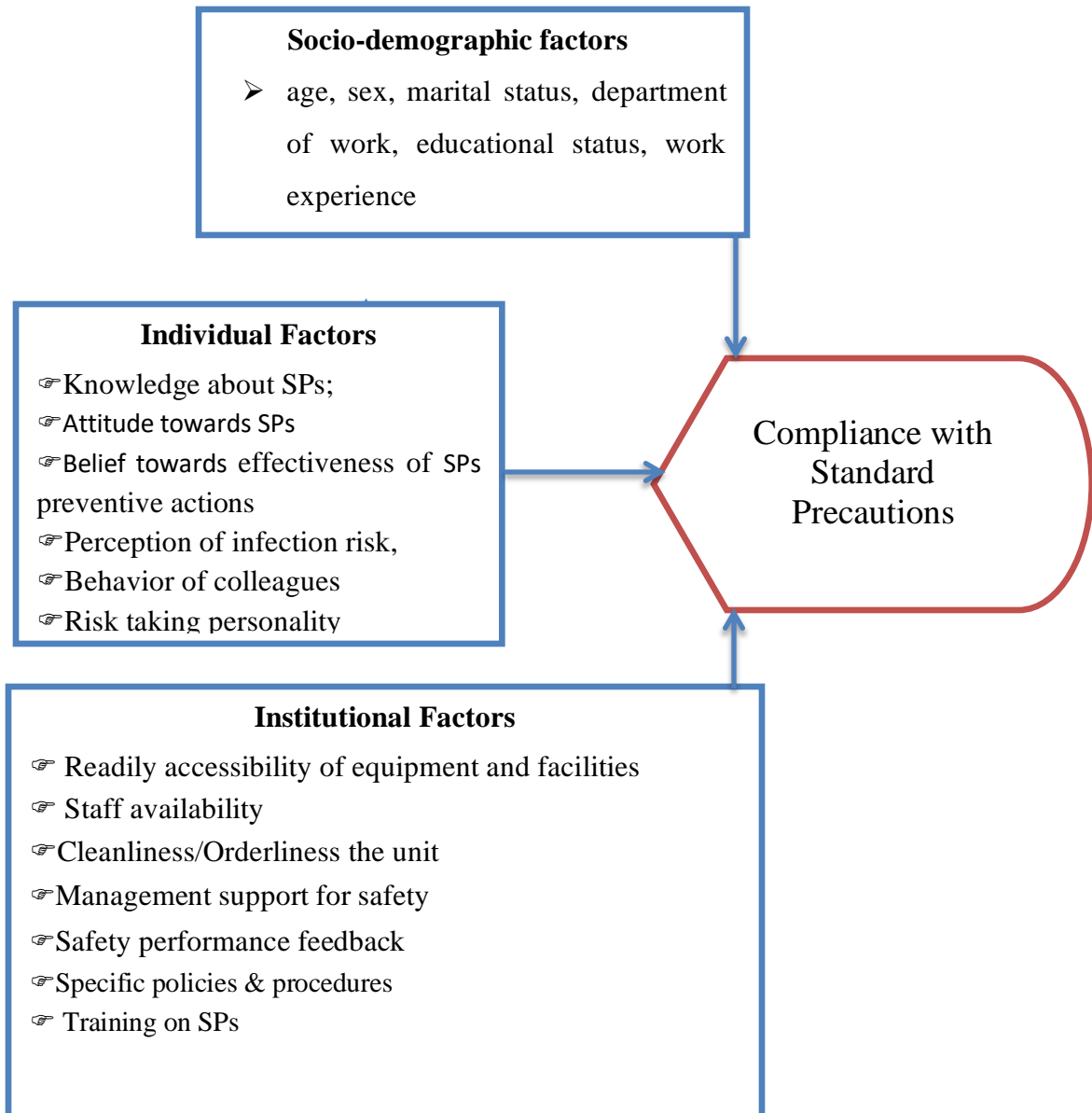
An additional Ethiopian study showed that medical staff in university hospitals were found to be affected by training on SP, accessibility of PPE, and management support. This suggests it is necessary to investigate institutional factors affecting workplace safety climates, including physical, and other circumstances, together with administrative support (18).

This study aimed to understand how sociodemographic and individual factors, such as knowledge and attitude, along with institutional factors such as safety climate and administrative support, influence the compliance of nurses to SPs in Jimma Zone public hospitals

Evaluating the effects of sociodemographic, individual, and institutional factors, will contribute to the improvement of SP compliance and the creation of a safe environment and administrative system.

### 2.3. A Conceptual Framework for nurses Compliance with standard Precautions

Existing literature identifies a variety of factors that influence nurses' compliance with standard precautions on the individual, and institutional levels. Figure (1) provides a conceptual framework that articulates the relationships among these factors. The framework is developed after a review of different kinds of literature (18) (30) (40) (41) (42) (43).



**Figure1:** Conceptual Framework for factors influencing nurse's compliance with standard precautions practice in Public hospitals of Jimma Zone, southwest Ethiopia (40) (41).

### **3. Objectives**

#### **3.1. General objective**

To measure the magnitude of compliance with standard precautions and associated factors among nurses working in public hospitals of Jimma Zone, South West Ethiopia, from March 19 to April 18, 2019.

#### **3.2. Specific objectives**

1. To determine the magnitude of nurses' compliance to standard precautions in public hospitals of Jimma Zone
2. To identify associated factors with compliance to standard precautions among nurses working in public hospitals of Jimma Zone

## **4. Method**

### **4.1. Study Area and Period**

The study was conducted among nurses working in direct patient care departments of six public hospitals of Jimma Zone during the period from March 19 to April 18, 2019. The six hospitals were: Shenen gibe General Hospital, Agaro General Hospital & Limu genet General Hospital & three primary hospitals (Seka chekorsa, Setema & Omo Nada). Jima Zone has a total of 3,452,345 populations with an area of 15,568.58 kilometers. Jimma is located at a distance of 352 km from the capital city Addis Ababa in the southwest direction (44).

### **4.2. Study design**

A hospital-based cross-sectional study was conducted.

### **4.3. Population**

#### ***4.3.1 Source population***

All categories of nurses (BSC nurse, clinical nurses, midwives, psychiatry nurses, anesthesia nurses, and scrub nurses) who are working in the six public hospitals of Jimma Zone.

#### ***4.3.2. Study population***

The study populations were nurses involved in direct patient care mainly from the following departments: Out Patient Departments (OPD), Maternal & Child Health (MCH), Inpatient wards (Medical, surgical, OB/Guy and Pediatric), Neonatal Intensive Care Units (NICU), emergency unit, wound & Injection, Operation theatre, and Delivery units. There were a total of 335 nurses were on duty during the data collection period in the public hospitals of Jimma Zone [Shenen gibe(n=70), Limu genet(n=58), Agaro(n=65), Seka chekorsa(n= 55), Setema(n= 48) and Omo Nada(n= 39)] (45).

#### 4.4. Inclusion criteria

- ☞ All nurses who were working for six months and above in the six public hospitals
- ☞ Nurses participating in direct patient care.

#### 4.5. Exclusion Criteria

- ☞ Nurses working in administrative units/have not direct contact with patients
- ☞ Nurses who came for practice.

#### 4.6. Sample size determination

The sample size was determined using a single population proportion formula.

After defining the minimum number of participants to guarantee the representativeness of the population, all nurses (335) were invited to participate in the study from the six public hospitals. As a result, 307 nurses of the hospitals had responded to the questionnaires.

#### 4.7. Sampling procedures

The nurses' list according to their shift and assigned working unit in the hospitals was obtained from department heads of each hospital during the data collection period. Then all nurses were invited to participate at their working unit of the hospitals during the study period.

#### 4.8. Study Variables

##### *4.8.1. Dependent variable*

- Overall Compliance with Standard Precautions

##### *4.8.2. Independent variables*

- **Socio-demographic variables:** age, sex, marital status, department of work, educational status, work experience
- **Individual-level variables:** Perception of the effectiveness of preventive actions, perceptions of infection risk, risk-taking personality, Attitude towards SPs, exemplary behavior of college, and Knowledge about SPs
- **Institutional level variables:** training on SPs, safety equipment accessibility, management/organizational support for safety climate, safety performance feedback, and cleanliness/orderliness of working unit



#### **4.9. Operational definition**

**Compliance:** is the extent to which nurses' practices are per the recommended Federal Ministry of Health of Ethiopia IPPS/CDC standard precautions guidelines.

**Compliant with standard precautions:** Refers to nurses who responded “always or mostly” practice the standard precautions and a score of  $\geq 80\%$  indicating better compliance (43) (33).

**Non-compliant with standard precautions:** Refers to nurses who responded “sometimes, seldom, and never” practice of standard precautions, and a score of  $< 80\%$  was taken as “non-compliant” (43) (33).

**Standard precautions:** In this study standard precautions include hand hygiene, personal protective equipment (PPE), safe handling and disposing of sharps, safe handling of hospital wastes, environmental cleaning, and reprocessing of reusable patient care equipment (1).

**Nurses:** Considered all categories of nurses (BSC nurse, clinical nurses, midwives, psychiatry nurses, anesthesia nurses, scrub nurses, NICU nurses) who were providing direct patient care routinely and regularly employed in the hospitals.

## **4.10. Data collection instrument and procedure**

### ***4.10.1. Data collection tool***

Data was collected using a self-administered questionnaire and observational checklist. English version questionnaire was used for data collection as the study participants were nurses with a diploma and above educational level.

**The self-administered questionnaire was divided into 4 parts:**

**Part 1** included that measured the socio-demographic characteristics of nurses. **Part 2** contains a questionnaire that would assess nurses Compliance with SPs practices. The questionnaire was developed based on the Ethiopian infection prevention and patient safety (IPPS) guideline which was adapted from CDC SPs guidelines (46), and by adapting the content from related similar studies published (18) (47) (30). This self-report measure of compliance tool was tested for internal consistency (reliability) using Cronbach's alpha test. The resulting Cronbach's alpha value was 0.886 in this study; demonstrating an acceptable level of internal consistency.

**The 3rd part** was examining individual factors that may influence nurses' compliance including knowledge. The items were adapted from previous studies (48) (40). In this study, 4 scales were confirmed following Principal Component Analysis (PCA/CFA) with a reliability of  $\alpha=0.832$ . Nurses' knowledge of SPs was measured by 20 items, The items were adopted from the study (49),  $\alpha=0.771$ . **The 4th part** consists of the Institutional factors. The items were adapted from previous studies (48) (40). Five scales were confirmed following (PCA/CFA) with inter-item reliability of  $\alpha=0.822$ .

#### **Observational checklists:**

The observation checklist included two parts:

The first part was designed to observe the practice of nurses on the basic element of SPs recommended in the IP guidelines, which involve hand hygiene, using personal protective equipment, handling and disposal of sharp instruments and disinfection of reusable equipment, and cleaning of surfaces.

The contents of both checklists were according to the Ethiopian IPPS guideline (17) and adapted from the different studies used for nurse's observation (38).

The second part was designed to assess the hospital units for safety facilities, ready availability, and accessibility of supplies and equipment as well as cleanliness/orderliness of the unit.

This is aimed to support the quantitative findings and to provide additional information about the nurses' practice and availability of facilities.

#### ***4.10.2. Data collection procedure***

Data collection was facilitated by eight trained BSC nurses with two-degree level (health officers) supervisors' who all were working in another health facility.

The data collecting facilitators with the head of nurses were contacted the nurses at their working departments. After the verbal consent of the participants has been obtained, observational checklists were completed first without providing details of the study procedures to minimize the Hawthorne effect. The nurses were observed during their routine working hours. Two to three nurses were observed averagely.

At the same time, the assessment checklists were completed on the cleanliness and orderliness of the unit and the ready availability/accessibility of safety materials. One record was completed for each unit. Finally, the self-administered questionnaire was handed in by facilitators. One hundred and one nurses were observed. The self-administered questionnaire took an average of 25-30 minutes to completed by nurses.

The questionnaires were completed by nurses at their workplaces during their break or convenient time. All respondents given the questionnaire were followed-up for timely response to the questionnaire. The completeness of the data was checked on-site and the codes for the incomplete questionnaires were filled by revisiting the participant with respective codes. After completion, the coded questionnaires and observational checklists were kept in the sealed box and kept separately in a locked cabinet.

#### **4.11. Data quality control**

Data quality was controlled by training of data collection facilitators and supervisors for two days on the objectives of the study, the contents of the questionnaire, how to administer the questionnaire, and ethical issues. Also, training on how to conduct observation was provided to data collectors and supervisors as well a written protocol instruction.

The tools were pretested at Jimma University Medical Center on similar units, on 19(5%) of nurses that were not included in the study. Comments made by participants in the pretest study resulted in the addition of wording and the correction of numbers.

Findings were discussed among the data collection facilitator and supervisors so that, the tools were further modified for clarity and understandability of each of the items before actual data collection.

Appropriate supervision and checking filled questionnaires on daily basis for completeness and clarity of data was carried out by supervisors and principal investigator.

#### 4.12. Data processing and analysis

The filled questionnaires were coded, checked, and entered into Epi-Info version 7 and then exported into Statistical Package for the Social Sciences (SPSS window version 23) for analysis. Then, the data was cleaned and edited by exploring using descriptive and frequencies. Descriptive statistics for socio-demographic characteristics and compliance level of the respondents were reported. Categorical variables were described by frequencies and percentages and presented in a table, figure, and paragraph.

The outcome variable (self-report compliance with SPs):

The items in the questionnaire were measured how often nurse's practiced hand hygiene, utilization of PPE, safe handling and disposing of sharps, safe handling of hospital wastes, hospital environment cleaning, and reprocessing of equipment at work.

The self-reported total compliance to standard precautions practices of respondents was evaluated using a 5-point Likert scale [1=Never, 2= Seldom, 3=Sometimes, 4=Mostly, 5=Always].

Then, total compliance was categorized as compliant and non-compliant. The study participants who reported that they *always* or *mostly* practice the standard precautions (received 1 point) and scored  $\geq 80\%$  on all compliance questions were considered as "compliant". And those who reported that they *sometimes*, *seldom*, and *never* practices the SPs (received 0 points) and scored  $< 80\%$  to all compliance questions were considered as "non-compliant". Besides, the compliance level for each item was calculated in percentage.

The total percentage score was the range from 20 to 100. A higher score was taken for this study as it indicated more frequent practices and better compliance. The cut of values and definitions to determine compliant and non-compliant levels were taken from previously published studies and methodology found in the literature (43) (33). This is because nurses are expected to maximally comply with local SPs guidelines and due to the absence of a threshold for compliance; even moderate compliance can result in the blood-borne transmission of disease (50).

Explanatory variables measures:

Individual-level and institutional-level variables were measured on 5 points Likert scale [1=Strongly Disagree, 2= Disagree, 3=Neutral, 4=Agree, 5= Strongly Agree]. For this study, the 5-point Likert response scale was treated as ordinal and reduced to a dichotomous variable for analysis consistent with outcome measures. A response of *strongly agree/agree* indicated the presence of the variable and a response of *neutral/disagree/strongly disagree* indicated the absence of the variable (33). The case definition for each explanatory variable was annexed (Annex VI).

Knowledge about SPs practices was measured with 20 items. The correct answer was given a value of 1 and for those incorrect answers, a value of 0 was given. Total knowledge scores for each participant were summed up and calculated from 100%. Individuals' scored > 80% were considered as knowledgeable on SPs otherwise not.

Binary logistic regression was carried out to evaluate the associations of selected independent variables with dependent ones (Compliance with SPs). Independent variables found with a P-value of <0.2 in the bivariate were entered into multivariable logistic regressions to control the effect of confounder's and to determine the independent predictors of compliance with SPs.

The Hosmer and Lemeshow test was used for overall goodness of fit to check the correctness of the final model. Adjusted odds ratios with 95% confidence interval were computed to assess the strength of associations and variables with a *p*-value less than 0.05 were considered statistically significant.

### **Observational checklist**

This is aimed to supplement the self-reported findings. The indications for the elements of SPs as practiced by nurses were recorded. Each indication was scored as either "Yes" for complied or "No" "not complied. Overall compliance and non-compliance were calculated by adding up all percentages for each indication of the elements of SPs then divided by the total number of SPs indicated.

Measures of the availability of personal protective equipment were made at point-of-use meaning in the patient room, score (one) was given for the ready availability of safety materials in the unit as well as cleanliness and orderliness of the working area. And score (zero) if not.

#### **4.13. Ethical considerations**

Ethical clearance and approval to conduct the research were obtained from Jimma University Institutional Review Board. Permission was obtained from Oromiya Regional Health Bureau, Jimma zone health office, and respective hospital managements.

Before administering the questionnaires, the aims and objectives of the study were explained to the participants and a written explanation was attached to each questionnaire (Annex IB).

Participants were also informed that participation was voluntary. Anyone not willing to participate in the study would have the full right not to participate. The data collection questioner was used code numbers rather than names of the participant as well name of the hospital that was not registered to increase confidentiality. Questionnaires were kept in sealed boxes that were only accessed by research teams to ensure confidentiality and anonymity.

#### **4.14. Dissemination plan**

The final result will be submitted as partial fulfillment of the degree of Master of healthcare and Hospital Administration to Jimma University, institute of health, department of health policy and management. A copy of the results will be submitted to the studied hospitals. Finally, efforts will be made to publish the report in domestic and international journals.

## **5. Result**

### **5.1. Socio-demographic characteristics of the study participants**

A total of 335 nurses were invited to the study and 307 nurses were responded to the study with a 91.6% response rate. The majority 183 (59.6%) of the respondents were from general hospitals. Among the nurses 167 (54.4%) were females. The most proportion 138 (45%) were between the age range of 26-30 years. Regarding educational status, 149 (48.5%) and 158 (51.5%) had a diploma and first degrees respectively. The majority 184 (59.9%) had less than 5 years of working experience. Among the respondents in this study, above one-fourth 83 (27%) identified outpatient department(OPD) as their working unit (Table 1).



Table1: Socio-demographic characteristics of nurses in Jimma zone public hospitals, (N=307)

Variable	Category	Frequency	%
Sex	Male	140	45.6
	Female	167	54.4
Age	20-25	89	29.0
	26-30	138	45.0
	31-35	69	22.5
	>36	11	3.6
Marital status	Single	146	47.6
	Married	153	49.8
	Divorced	5	1.6
	Widowed	3	1.0
Nurse type	General nurse	202	65.8
	Midwifery nurse	75	24.4
	Anesthetic nurse	7	2.3
	Psychiatry nurse	7	2.3
	Scrub nurse	5	1.6
	Optometry nurse	4	1.3
	Other _____*	7	2.3
Educational status	Diploma nurse	149	48.5
	BSC nurse	158	51.5
Hospital level	Primary Hospital	124	40.4
	General Hospital	183	59.6
Working unit/ Department	Outpatient department (OPD)	83	27.0
	Maternal and child health (MCH)	24	7.8
	Emergency department	13	4.2
	Injection & dressing units	6	2.0
	Labour and delivery units	38	12.4
	Neonatal intensive care units (NICU)	11	3.6
	Operation Theater	23	7.5
	Medical ward	24	7.8
	ART &TB Unit*	14	4.6
	Ob/guy ward	23	7.5
	Pediatric ward	25	8.1
	Surgical ward	23	7.5
Work experience (years)	0.6-5	184	59.9
	6-10	103	33.6
	11-15	18	5.9
	16-20	2	0.7
*NICU nurse, Emergency Nurse			

## 5.2. Compliance level with Standard Precautions guidelines

### 5.2.1. Self-report Compliance with SPs

Among the nurses who participated in this study 211(68.8%), 198(64.5%), 162(52.8%), and 143(46.6%) reported that they always/mostly wash hands after body fluid exposure, before clean or aseptic techniques, after touching a patient, and immediately after removal of gloves, respectively. Only 173(56.3%) of the respondents reported that they always/mostly protect themselves against body fluid exposure regardless of the diagnosis of patients.

Most of the participants 227(73.9%) stated that they place used sharps in puncture-resistant containers at the point of use. About 221(72%) of the participants did not recap used needles before disposal. Nearly half 162(52.8%) stated that they segregate infectious medical wastes at the point of production.

As indicated, nurses reported the highest compliance 254(82.7%) in wearing gloves whenever there is a possibility of exposure to any body fluids. On the other hand, seven of the items on the scale received a compliance level of below (50%). The lowest compliance level was reported in the item on using eye goggles whenever there is a possibility of body fluid splashing 85(27.7%), followed by wearing a waterproof apron 114(37.1%) and wash hands before touching a patient's 114(37.2%). (Table 2)

In this study (by summing up individual items of the components of SPs and taking those who were always or mostly compliant as an outcome variable), the overall proportion of nurses who were compliant with SPs was found to be 21%. I.e. only 63 (21%) of respondents met the definition set for this study of compliance (rated *always* or *mostly to all 22 items* of SPs and scored  $\geq 80\%$  (Figure 3).

Table: 2 Percentages of nurse survey respondents who indicated compliance with a component of SPs in Jimma Zone Public Hospitals, Southwest Ethiopia, 2019 (N=307)

No	Compliance items	“Always’ or “Mostly” response	
		N	%
1	Wash hands before touching a patient	116	37.7
2	Wash hands before clean or aseptic procedures	198	64.5
3	Wash hands after body fluid exposure	211	68.8
4	Wash hands after touching a patient	162	52.8
5	Wash hands immediately after removal of gloves	143	46.6
6	Wash hands between patient contact	128	41.7
7	Wash hands after touching patient surroundings	114	37.2
8	I provide nursing care considering all patients as potentially infectious	156	50.8
9	I protect myself against body fluids of all patients regardless of their diagnosis	173	56.3
10	I wear clean gloves whenever there is a possibility of exposure to anybody fluids	254	82.7
11	I change gloves between contacts with different patients	191	62.2
12	I avoid wearing my gown out of hospital compounds	216	70.3
13	I wear a waterproof apron whenever there is a possibility of body fluid splashing in my body	114	37.1
14	I wear eye goggles and/or masks whenever there is a possibility of body fluid splashing in my face	85	27.7
15	I sterilize all reusable equipment before being used on another patient	211	68.7
16	I clean and disinfect equipment and environmental surfaces	181	59
17	I segregate noninfectious wastes in a black color-coded dust bin	151	49.2
18	I segregate infectious medical wastes in a yellow colored-coded dust bin	162	52.8
19	I bend needles with my hands	207	67.4
20	I avoid removing used needles from disposable syringes	208	67.8
21	I place used sharps in a puncture-resistant container at the point of use	227	73.9
22	I recap needles	221	72

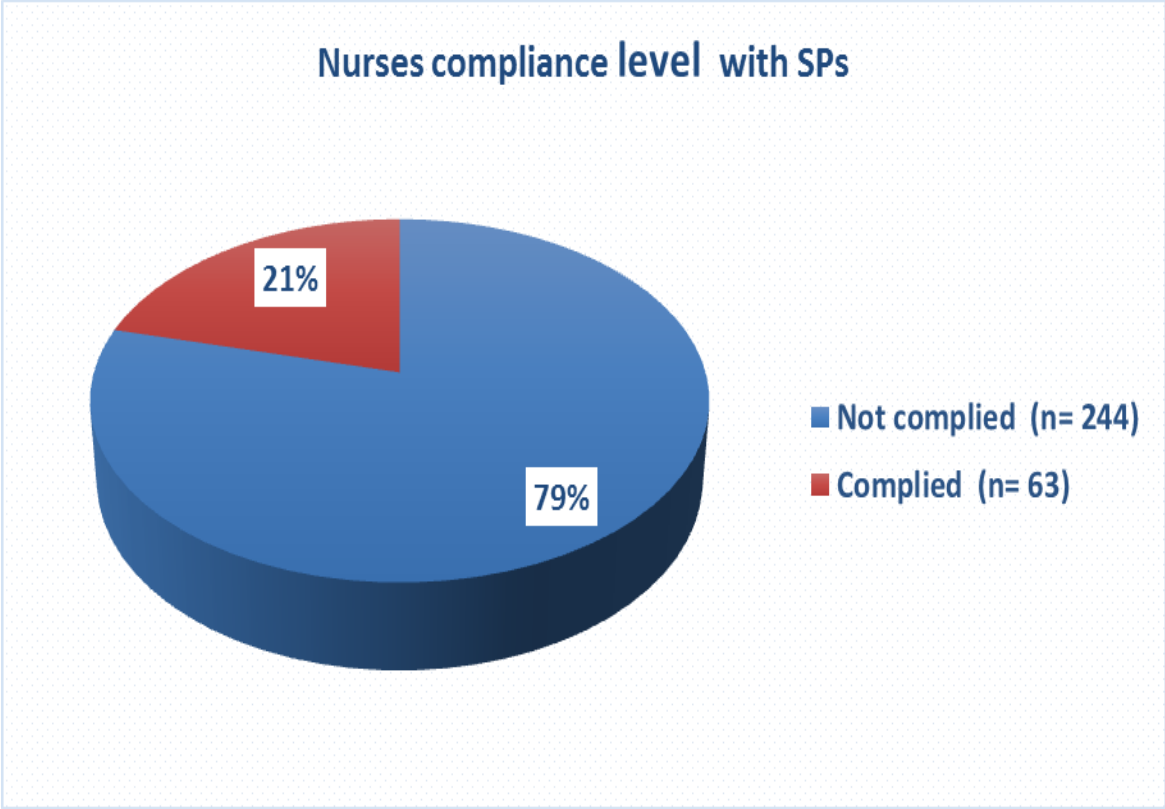


Figure 3: Overall compliance level with Standard Precautions among nurses working in Jimma Zone Public Hospitals, South West Ethiopia, 2019

### 5.2.2. Observed Compliance with SPs Guidelines

#### Hand hygiene:

Out of the 101 observed nurses for SPs practices, less than half (42.5%) performed hand hygiene by washing with water and soap or using alcohol-based hand rub before and after performing any procedure. Only one-fifth of the participants (19.7%) wash hands between patient contacts. Most of the participants (94.5%) performed hand hygiene after contact with contaminated objects whilst (22.5%) wash hands before putting on gloves and after removing gloves. (Figure 4)

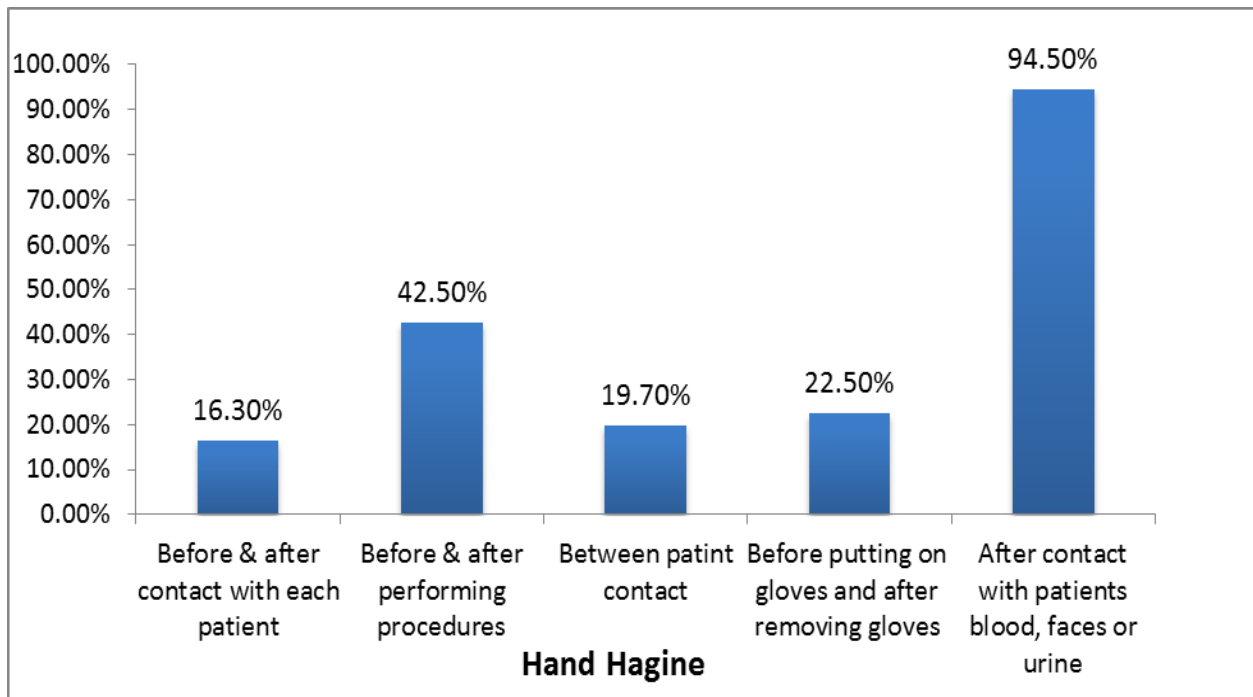


Fig 4: Observed compliance level with hand hygiene among nurses working in Jimma Zone public hospitals, South West Ethiopia, 2019 (N=101)

### Use of personal protecting equipment (PPE):

From the observed participants, the majority (90.1%) wore gloves during procedures when contact with blood or body fluids is anticipated. But only 25 (24.8%) of the participants used eye protection during procedures that are likely to generate splashes or sprays of blood or other body fluids to protect the mucous membranes of the eyes. (Figure 5)

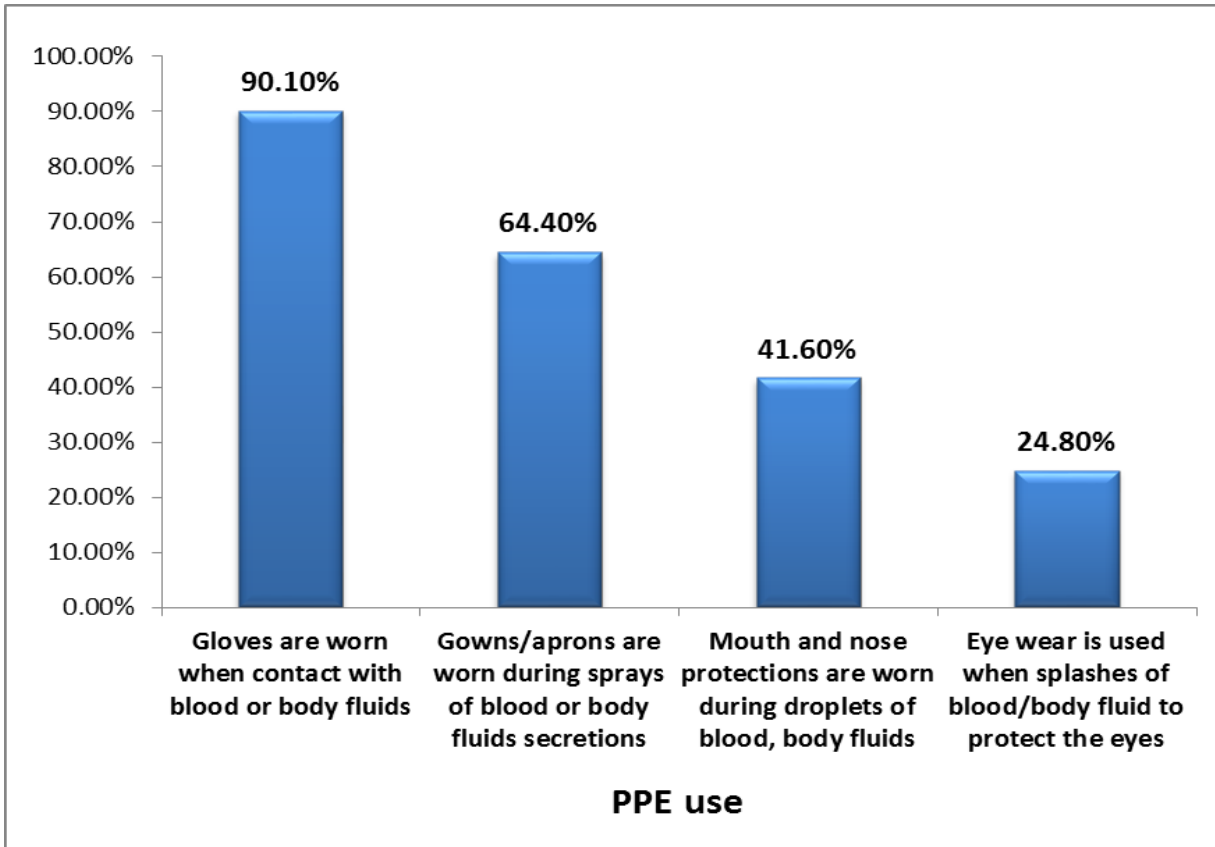


Fig 5: Observed compliance level with PPE utilization among nurses working in Jimma Zone public hospitals, South West Ethiopia, 2019 (N=101)

### Management of Sharps and Solid Clinical Waste:

The majority (91.1%) of the observed participants did not recap or bend needles after use and both needle and syringe are immediately disposed of into a puncture-resistant container. Less than half (43.6%) segregated solid waste at the point of use according to category. (Table 3)

Table 3: Observed compliance level with Waste Management among nurses working in Jimma Zone public hospitals, South West Ethiopia, 2019 (N=101)

Variables	No	%
Management of Sharps and Solid Clinical Waste		
Needles are not recapped, bent, or disassemble after use	92	91.1
Used needle and syringe are disposed of into puncture-resistant containers immediately after use	92	91.1
Solid waste is segregated at the point of use according to category	44	43.6
contaminated waste is discarded into the appropriate receptacle(s)	47	47

### 5.2.3. Observed IP facilities and equipment are in the hospitals

Observations regarding readily accessibility of safety equipment and supplies and the cleanliness and orderliness of the unit were recorded on a unit-by-unit basis. (Table 4)

Of the 60(100%) observed rooms in all hospitals, 28(47%) of the rooms had running water while 56 (93%) of the rooms had sharp collection boxes for sharp objects located closer to the work area.

From all rooms observed 16(27%) of them had written guidelines or pictures on risk communication. Examination gloves were the most accessible personal protection equipment (PPE) in units 46 (77%). The majorities of units 38(63%) were observed to be cluttered and were observed to be crowded 40(67%). Eye protection was identified as the least readily available piece of PPE in the observed rooms 14 (24%).

Table 4: Observed hospital facilities for IP in public hospitals of Jimma Zone, 2019 (N=60)

Variables	Yes (n)	%
Written Hand hygiene policies/guideline available and accessible in the unit	16	27
A functional Hand basin/Sink or bucket with a tap is a near entrance or exit of the room	40	67
There is running water in the unit	28	47
Soap/ Liquid soaps are available adjacent to the hand basin	32	53
Alcohol hand-rub/swabs are present in the unit	50	83
Polices and guideline for use of PPE is accessible	12	20
Clean Examination gloves	46	77
Surgical glove	24	40
Protective suits/aprons	22	37
Masks	30	50
Closed protective shoes	24	40
Eye protective goggles	14	23
Written Injection safety policies are available	2	3
Sharps boxes close to the point of use are available	56	93
Not more than 2/3 full	32	53
Covered containers with a 0.5% chlorine solution /Plastic buckets	44	73
Availability of color-coded dust bins	18	30
Availability waste segregation liner bags	22	37
The unit is clean & orderly	22	37
The unit is not crowded	20	33



### **5.3. Nurses response Level to factors influencing Compliance with SPs**

#### **Individual Factors:**

Table 5 presents the percentages of correct knowledge responses on each questionnaire item for survey respondents. In this study, 182(59.3%) of the participants did not recognize the meaning of standard precaution. Based on the results, more than half 172(56%) of the participants stated that Standard precaution is only applicable for the patient with a confirmed diagnosis of infection. Also, 157(51.1%) of participants stated that the main goal of standard precaution is to protect the medical staff. In this study, only less than half (44%) of the participants were knowledgeable about SPs. Which was obtained by considering the components of knowledge of SPs questions described below in Table 5.

The result of this study revealed that more than half (67.8%) believed that, preventive actions to be effective to protect them from infections. Moreover, 61.6% of the participants perceived high infection risks. While, the majority 85% of nurses perceived barriers (negative attitude) to using PPE, 79.8% of the participants perceived their senior colleague did not practice SPs and 61.6% reported high risk-taking personality. (Table 6)

#### **Institutional Factors:**

Out of participated nurses in this study, 70.7% replied that necessary equipment was not readily accessible in their unit to comply with standard precautions. The majority, 73.3% of participants did not get management support for safety in their hospitals. Furthermore, 72% replied that management provides feedback for safety practices less frequently. Concerning the cleanliness and orderliness of the work unit, 80.1% replied their working area was not to be clean/orderly. Only 24.6% of the respondents reported received training organized by the hospital on standard precautions or other infection control measures in the past 12 months. (Table 6)

Table 5: Knowledge of nurses on Standard Precautions in public hospitals of Jimma Zone, southwest Ethiopia, 2019 (n=307)

No	Questions on Standard Precautions Knowledge	Correct response	
		n	%
1	Do you know what the standard precaution is?	182	59.3
2	Standard precaution is only applicable for the patients with the confirmed diagnosis of infection *	172	56
3	The main goal to implement standard precaution is to protect the medical staff*	157	51.1
4	Washing and disinfecting the hands immediately if contacting any blood, body fluid, secretion, excretion, or dirty substance	204	66.4
5	Washing the hands if contacting different patients	218	71
6	Since the gloves can prevent pollution for the hands, there is no need to wash hands after taking off the gloves*	99	32.2
7	It shall be avoided for the polluted protective articles to contact the surface of other articles	225	73.3
8	It shall not be shared for the personal protective articles such as gloves, mask, etc.	229	74.6
9	The gloves shall be worn in the operation of blood drawing, venous puncture, etc.	229	74.6
10	The gloves shall be worn in the operation might contact with the secretion and excretion of patient	230	74.9
11	The gloves shall be changed if contacting different patients	256	83.4
12	The face mask or mask shall be worn in the operation might induce the spraying of blood, body fluid, secretion, or excretion	233	75.9
13	The protective eye patch or goggle shall be worn in the operation might induce the spraying of blood, body fluid, secretion, or excretion	225	73.3
14	The protective suit shall be worn in the operation might induce the spraying of blood, body fluid, secretion, or excretion	235	76.5
15	The protective cap or shoe shade shall be worn in the operation might induce the flowing or leaking of blood, body fluid, secretion, or excretion	230	74.9
16	The sharps disposal box shall be put in the area close to the sharp applicable area	243	79.2
17	Recapping and re-use of the needle is prohibited	238	77.5
18	The caring for patients with Hepatitis 'C' Virus only needs standard precautions*	125	40.7
19	Caring for patients with active pulmonary TB or varicella needs the standard precaution associated with the prevention of airborne diseases.	224	73
20	Caring for patients with intestinal infection or skin infection needs the SPs associated with the prevention of the diseases by contact transmission.	221	72
	*Correct answer is 'No'		

Table 6: Individual and institutional factors affecting compliance with standard precautions among nurses in public hospitals of Jimma Zone, South West Ethiopia, 2019 (N=307)

<u>Individual Factors</u>	<u>Number</u>	<u>%</u>
Perception of risk-taking personality		
perceived high risk-taking personality	189	61.6
perceived less risk-taking personality	118	38.4
Perception of exemplary behavior of senior colleagues practice SPs		
Perceived senior colleague did not practice SPs	245	79.8
Perceived senior colleague practice SPs	62	20.2
Perception of infection risk		
perceived low infection risk	118	38.4
perceived high infection risk	189	61.6
Knowledge about standard precautions (SPs)		
Not knowledgeable	172	56
Knowledgeable	135	44
Perception of barriers to the use of PPE		
Not perceived barriers to using PPE	46	15
Perceived barriers to using PPE	261	85
Perception of the effectiveness of preventive actions to protect from infections		
Perceived preventive actions not effective	99	32.2
Perceived preventive actions to be effective	208	67.8
<u>Institutional Factors</u>		
Training on standard precautions SPs guidelines		
Reported have not been trained	226	73.6
Reported have been trained	81	26.4
The ready accessibility of safety equipment/materials		
Reported not readily accessibility	217	70.7
Reported to be readily accessibility	90	29.3
Cleanliness/orderliness of working unit		
Not perceived unit to be clean/orderly	246	80.1
Perceived the clean/ordered unit	61	19.9
Management support towards safety climate		
Weak Management support to safety climate	225	73.3
Strong Management support for safety climate	82	26.7
Feedback on safety performance		
Less frequent	221	72
More frequent feedback	86	28

## 5.4. Factors Associated with Compliance with Standard Precautions

### 5.4.1. Bivariate Analysis

Bivariate logistic regression analysis was done for factors influencing compliance with SPs (Table 7). Working units were the only sociodemographic variable that was found to be significantly associated with the overall compliance to SPs ( $p < 0.05$ ). Accordingly, nurses working in maternal and child health, neonatal intensive care units, operation-theater, and pediatric ward showed significant association and candidate for multivariable analysis.

**Table 7:** Bivariate logistic regression analysis of socio-demographic variables and overall compliance with SPs among nurses working in public hospitals of Jimma Zone, South-West Ethiopia, 2019 (N=307)

Variable	Category	Compliance with SPs		COR (95% CI)	p-value
		Noncompliant	Compliant		
		No (%)	No (%)		
Sex	Female	127(76.0)	40(24.0)	1.052(.604 -1.830)	0.106
	Male	117(83.6)	23(16.4)	1	
Age	20-25	71(79.8)	18(20.2)	1.141(.226 -5.748)	0.873
	26-30	109(79.0)	29(21.0)		
	31-35	55(79.7)	14(20.3)		
	>36	9(81.7)	2(18.2)	1	
Marital status	Single	112(76.7)	34(23.3)	1	0.297
	Married	125(81.7)	28(18.3)	0.768(0.468 -1.26)	
	Divorced	5(100)	0(0.0)		
	Widowed	2(66.7)	1(33.3)		
Educational status	Diploma nurse	124(83.2)	25(16.8)	.637(.362 -1.119)	0.116
	BSC nurse	120(75.9)	38(24.1)	1	

Table 7: Continued

Bivariate logistic regression analysis of socio-demographic variables and overall compliance with SPs among nurses working in public hospitals of Jimma Zone, South-West Ethiopia, 2019 (N=307)

Variable	Category	Overall Compliance with SPs		COR (95% CI)	p-value
		Noncompliant	Compliant		
		No (%)	No (%)		
Hospital level	Primary Hospital	97(78.2)	27(21.8)	0.880(0.502-1.542)	0.655
	General Hospital	147(80.3)	36(19.7)	1	
Working unit/ Department	Outpatient department	78(94)	5(6)	1.41(0.156-12.709)	0.759
	Maternal and child health	16(66.7)	8(33.3)	11(1.248-96.951)	0.031*
	Emergency department	13(100)	0(0.0)	0	0.999
	Injection & dressing units	6(100)	0(0.0)	0	0.999
	Labor and delivery units	29(76.3)	9(23.7)	4.841(1.498-15.652)	0.078
	Neonatal intensive care unit	4(36.4)	7(63.6)	38.5(3.67-403.928)	0.002*
	Operation Theater	7(30.4)	16(69.6)	50.286(5.616-450.22)	0.001*
	Medical ward	22(91.7)	2(8.3)	2(0.169-23.695)	0.583
	ART & TB Unit	11(78.6)	3(21.4)	6(0.557-64.576)	0.139
	Ob/guy ward	19(82.6)	4(17.4)	4.632(0.476-45.085)	0.187
	Pediatric ward	17(68.0)	8(32.0)	10.353(1.178-90.953)	0.035*
	Surgical ward	22(95.7)	1(4.3)	1	
Work experience (years)	<5	147(79.9)	37(20.1)	1.012(.656-1.562)	0.957
	6-10	81(78.6)	22(21.4)		
	11-15	14(77.8)	4(22.2)		
	>16	2(100)	0(0.0)	1	

1=Reference group, COR = crude odds ratio, \*Association was significant at p<0

Bivariate logistic regression analysis of the individual and institutional level variables influencing nurses' overall compliance was done (Table 8). Ten (Five individual and five institutional) variables showed a significant association ( $p \leq 0.05$ ) with compliance. Accordingly, Perception of the effectiveness of preventive actions, Perception of risk, Risk-taking personality, Exemplary behavior of colleagues, Knowledge about SPs, cleanliness/orderliness of working area, Feedback on safety performance, Management support towards safety climate, Training on SPs guidelines, and Ready accessibility of safety materials were significantly associated with compliance at a  $p < 0.05$  and candidate for multivariate analysis.

**Table 8:** Bivariate Analysis of Individual factors associated with compliance with SPs among nurses working in public hospitals of Jimma Zone,

Variable	Category	Overall Compliance with SPs		COR (95% CI)	p-value
		Noncompliant	Compliant		
		No (%)	No (%)		
Perception of the effectiveness of preventive actions	Perceived not effective	94(94.9)	5(5.1)	1	<.001*
	Perceived preventive actions to be effective	150(72.1)	58(27.9)	7.269(2.814 -18.782)	
Perception of risk	perceived low risk of infection	111(94.1)	7(5.9)	1	<.001*
	perceived high risk of infection	133(70.4)	56(29.6)	6.677(2.926 - 15.238)	
Risk-taking personality	perceived less risk-taking personality	107(90.7)	11(9.3)	1	<.001*
	perceived high risk-taking personality	137(72.5)	52(27.5)	.271(.135 -.544)	
Perception of barriers to using PPE	Not perceived barriers	212(81.2)	49(18.8)	1	0.074
	perceived barriers to PPE	32(69.6)	14(30.4)	.0528(0.262 – 1.065)	
Exemplary behavior of colleagues	Not Perceived colleague behavior	211(86.1)	34(13.9)	1	<.001*
	Perceived colleague behavior to use SPs	33(53.2)	29(46.8)	5.454(2.944 -10.102)	
Knowledge about SPs	Not knowledgeable about SPs	163(94.8)	9(5.2)	1	<.001*
	Knowledgeable about SPs	81(60.0)	54(40.0)	12.074(5.679 -25.671)	

Table 8: Continued

Bivariate Analysis of Institutional factors associated with compliance with SPs among nurses working in public hospitals of Jimma Zone, south-west Ethiopia, 2019 (n=307).

Variable	Category	Overall Compliance with SPs		COR (95% CI)	p-value
		Noncompliant	Compliant		
		No (%)	No (%)		
Cleanliness/orderliness of working area	Not Perceived unit to be clean/orderly	215(87.4)	31(12.6)	1	<.001*
	Perceived the clean/ordered unit	29(47.5)	32(52.5)	7.653(4.084 - 14.340)	
Feedback on safety performance	No feedback Reported	190(86.0)	31(14.0)	1	<.001*
	Reported frequent feedback	54(62.8)	32(37.2)	3.632(2.035 - 6.481)	
Management support towards safety climate	Perceived weak Management support to safety climate	200(88.9)	25(11.1)	1	<.001*
	Perceived strong Management support for safety climate	44(61.1)	28(38.9)	6.909(3.788 - 12.602)	
Training on SPs guidelines	Reported have not been trained	189(83.6)	37(16.4)	1	0.003*
	Have been trained	55(67.9)	26(32.1)	2.415(1.346 - 4.333)	
The ready accessibility of safety materials	Reported not readily accessible	201(92.6)	16(7.4)	1	<.001*
	Reported safety equipment to be readily accessible	43(47.8)	47(52.2)	13.731(7.126 - 26.45)	

1=Reference group, COR = crude odds ratio, \*Association was significant at p<0.05

#### 5.4.2. *Multivariable logistic regression analysis*

To determine the independent factors associated with compliance with SPs, multivariable logistic regression was used; backward logistic regression analysis was considered, and to check the correctness of the final model, the Hosmer and Lemeshow test for the overall goodness of fit was used, with a value of 0.86 that is insignificant, which means the final model was correct. Accordingly, some variables remained independent predictors for compliance with SPs.

In the results of multivariable modeling: working unit, perception of the effectiveness of preventive actions, perception of risk, risk-taking personality, exemplary behavior of colleagues, knowledge about SPs, cleanliness/orderliness of working area, organizational/management support towards safety climate and ready accessibility of safety materials were significantly associated with compliance at a  $p < 0.05$ .

In this study, nurses who had to work in Neonatal intensive care units, Operation Theater rooms, and Pediatric ward were 16.99(AOR 16.99, 95% CI 1.38 - 206.91), 40.05(AOR 40.05, 95% CI 4.17 - 384.74), and 9.13(AOR 9.13, 95% CI 1.09 - 81.92) times more likely compliant with SPs than those who had to work in the surgical ward, respectively (Table 9).

In this study, nurses who had perceived preventive actions to be effective were 5.41(AOR =5.41, 95% CI= 1.313 - 22.29) times more likely always/mostly compliant with SPs than those who had not perceived the effectiveness of the preventive actions.

This study shows that nurses who had higher infection risk perception were 5.56(AOR=5.56, 95% CI=1.30 - 23.99) times more likely always/mostly compliant with SPs as compared to those who had lower infection risk perception.

Moreover, nurses who had reported high risk-taking personality were 83% less likely compliant with SPs than those do reported less risk-taking personality (AOR=0.17, 95% CI=0.06 - 0.52).

Nurses who had perceived exemplary behavior of colleague to use SPs were 15.14 (AOR=15.14, 95% CI=4.52- 45.70) times more likely compliant with SPs than those who did not perceive the behavior of colleagues.



The result of this study showed that nurses who were knowledgeable on SPs guidelines were 17.11(AOR 17.11, 95% CI 6.42 - 45.61) more likely compliant with SPs as compared to those who had not knowledgeable.

Besides, nurses who had readily available PPE were 4.96(AOR=4.96, 95% CI 1.76 - 14.00) times more likely to be always/mostly compliant than those who had not readily available PPE.

Nurses who had perceived strong management/organizational support for safety climate were 4.41(AOR 4.41, 95% CI 1.30 - 14.91) times more likely compliant with SPs than those who had perceived weak management support.

The study further identified that nurses who had perceived that their unit was clean/ordered were 5.65(AOR 5.65, 95% CI 1.55 - 19.97) more likely compliant with SPs than those who had not perceived their unit to be clean/order.

Table 9: Multivariable analysis of factors associated with overall compliance with SPs among nurses working in public hospitals of Jimma Zone, south-west Ethiopia, 2019. (n=307)

Variable Category	Category	Compliance with SPs		AOR (95% CI)	p-value
		Noncompliant (n=244)	Compliant (n=63)		
		No (%)	No (%)		
Educational status	Diploma nurse	124(83.2)	25(16.8)	0.949(0.481-1.872)	0.88
	BSC nurse	120(75.9)	38(24.1)	1	
Working unit	Outpatient department	78(94.0)	5(6.0)	0.308(0.018-5.156)	0.413
	Maternal and child health	16(66.7)	8(33.3)	8.345(0.651-107.03)	0.103
	Emergency department	13(100)	0(0.0)	0	0.997
	Injection & dressing units	6(100)	0(0.0)	0	0.999
	Delivery units	29(76.3)	9(23.7)	4.78(0.362-63.113)	0.235
	Neonatal intensive care units	4(36.4)	7(63.6)	16.899(1.380 - 206.91)	0.02*
	Operation Theater	7(30.4)	16(69.6)	40.052(4.169 - 384.74)	0.001*
	Medical ward	22(91.7)	2(8.3)	2.074(0.174-24.735)	0.564
	ART &TB Unit	11(78.6)	3(21.4)	5.678(0.522-61.761)	0.154
	Ob/guy ward	19(82.6)	4(17.4)	3.835(0.331-44.392)	0.282
	Pediatric ward	17(68.0)	8(32.0)	9.134(1.018 - 81.916)	.048*
	Surgical ward	22(95.7)	1(4.3)	1	

Table 9: Continued

Multivariable analysis of factors associated with compliance with SPs among nurses working in public hospitals of Jimma Zone, southwest Ethiopia, 2019. (n=307)

Variable Category	Variable	Category	Compliance with SPs		AOR (95% CI)	P-value
			Noncompliant	Compliant		
			No (%)	No (%)		
Individual Factors	Perception of effectiveness of preventive actions	Perceived not effective	94(94.9)	5(5.1)	1	0.019*
		Perceived preventive actions to be effective	150(72.1)	58(27.9)	5.409(1.313 - 22.29)	
	Perception of infection risk	perceived low risk	111(94.1)	7(5.9)	1	0.021*
		perceived high risk	133(70.4)	56(29.6)	5.56(1.295 - 23.896)	
	Risk-taking personality	Not perceived risk-taking	107(90.7)	11(9.3)	1	0.002*
		perceived risk taking personality	137(72.5)	52(27.5)	0.17(0.056 - 0.522)	
	Attitudes towards PPE use	Have positive attitude	212(81.2)	49(18.8)	1	0.08
		Have negative attitude	32(69.6)	14(30.4)	0.283(0.069 - 1.164)	
	Exemplary behavior of colleagues	Not Perceived colleague behavior	211(86.1)	34(13.9)	1	<.001*
		Perceived colleague behavior to use SPs	33(53.2)	29(46.8)	9.708 (3.76 -25.046)	
	Knowledge about SPs	not knowledgeable	163(94.8)	9(5.2)	1	<.001*
		Knowledgeable	81(60.0)	54(40.0)	17.1 (6.419- 45.605)	

Table 9: Continued

Multivariable analysis of factors associated with compliance with SPs among nurses working in public hospitals of Jimma Zone, southwest Ethiopia, 2019. (n=307)

Variable Category	Variable	Category	Compliance with SPs		AOR (95% CI)	p-value
			Noncompliant	Compliant		
			No (%)	No (%)		
Institutional Factors	Cleanliness/orderliness of working area	Not Perceived unit to be clean/orderly	215(87.4)	31(12.6)	1	.009*
		Perceived the clean/ordered unit	29(47.5)	32(52.5)	5.646(1.55 - 19.966 )	
	Feedback on safety performance	Perceived less frequent feedback	190(86.0)	31(14.0)	1	.889
		Perceived more frequent feedback	54(62.8)	32(37.2)	1.197(0.531- 2.703)	
	Management support towards safety climate	Perceived weak Management support to safety climate	200(88.9)	25(11.1)	1	.008*
		Perceived strong Management support for safety climate	44(61.1)	28(38.9)	4.407(1.30 - 14.906)	
	Training on SPs guidelines	Reported have not been trained	189(83.6)	37(16.4)	1	.850
		Reported have been trained	55(67.9)	26(32.1)	1.074(.32 - 3.601)	
	The ready availability of safety materials	Reported not readily available	201(92.6)	16(7.4)	1	0.002*
		Reported safety equipment to be readily available	43(47.8)	47(52.2)	4.96(1.756 - 14.003)	

1=Reference group, AOR= Adjusted Odds Ratio, \*Association was significant at  $p < 0.05$

Hosmer and Lemeshow Test: Chi-square =3.953, df = 8, Sig = 0.860; Cox & Snell R Square = 0.473, Nagelkerke R Square = 0.742

## 6. Discussion

### 6.1. Nurses Compliance with standard precautions

The current study was conducted at six governmental hospitals in Jimma Zone, revealed, nearly half of the study participants were male, and four-fifths (244) of the studied nurses were aged between 20 to 30 years old. The majority of the 184 (59.9%) had less than five years' experience.

This compliance with SPs questioner has collected information on the extent of nurses practiced on hand hygiene, using gloves and other personal protective equipment (PPE), appropriate cleaning and disinfection of patient-care equipment and environment surfaces, appropriate waste disposal, and correct management of used needles and other sharp objects. Also, identifies socio-demographic, individual, and institutional factors which affect compliance with SPs among nurses.

In this study, nurses' overall compliance level with SPs was found to be very low. Fewer than one-fifth (21%) of the nurses reported '*always or mostly*' compliant with all 22 SPs items. This result is lower than with many similar studies in Ethiopia [ (25) (26) (32) (51) ]. This could be due to differences in study variables, study participants, a difference in the definition of satisfactory practice, and other methodological concerns. Also may be explained by the fact that the vast majority of nurses in the study area (73.6%) had not received standard precaution training and (66%) had inadequate knowledge of standard precautions. As well (59.9%) of these nurses had less than five year's work experience.

The current finding much lower when compared to the study conduct in the Philippines showed that very high compliance among nurses in 82.6% (19 out of 23 activities) of the SP (52). Also study conducted in China has shown that 64% of nurses have good compliance with standard precautions (30). The reason maybe because of the availability of necessary IPC facilities and the work climate of the hospitals.

The current study is better than those findings in Gonder University specialized Hospital where overall compliance with SPs reported only in 12% of health care workers (18). Similarly, the finding is better than a study in five general hospitals in the Republic of Cyprus that pointed out that only 9.1% of nurses adopt the SP as recommended (11). The difference might be due to the

different study participants in that the northern Ethiopia study involved all health care workers, the difference in total compliance scoring, and the burden of acute cases at such hospitals.

However, when each of the specific components of SPs was analyzed, better results have been observed in some of the items. For instance, a relatively higher (82.7%) proportion of nurses were found to be always/mostly compliant with wearing clean gloves whenever there is a possibility of exposure to any body fluids, (79.2%) of nurses were changing gloves between contacts with different patients.

A relatively similar finding has been observed in Jimma University Medical Center, southwest Ethiopia in which 82.25% of nurses wore gloves when giving patient care (25). In line with our study, a study in a Kenyan hospital (38) was noted that gloves were the most utilized PPE by 88.9% of the participants.

A better result has been also observed in placing used sharps in a puncture-resistant container at the point of use (73.9%). Similar results among nurses in the Nigerian study revealed that 80% of participants disposed of sharps immediately in a puncture-resistant safety box (53). This study was also supported by an observed practice that; the majority (93%) of the rooms had collection material for sharp objects located closer to the practice area. Provision of sharps collection containers for proper disposal of sharps and placing these containers close to the point of use have a high contribution for prevention of needle stick injuries and recapping of used needles in the hospitals.

This study found out 68.8% of the participants washing hands after body fluid exposure. Comparable with the study done in southwest Ethiopia among nursing staff in which 64.9% had washed their hands immediately when they encountered unwanted contact with blood fluids (25). A similar study was also observed in the Afar region, Ethiopia among health professionals (including nurses) in which 56.1% always/usually washed their hands after contact with patients (54).

On contrary, relatively low compliance was recorded in Wash hands before touching a patient (37.7%), Wash hands between patient contact (41.7%), Wash hands immediately after removal of gloves (46.7%), and Wash hands after touching patient surroundings (37.2%). But, compared with a study done among nurses in Nairobi district hospital, Kenya in which only 5.6% Wash

hands between patient contact and 3.3% of the participants wash hands before putting and after removing gloves (38).

However, the observed practice was much less than the reported practice that was only 36% of the nurses washes their hands during procedures, 22.5% wash hands before and after removals of gloves and 19.7% wash their hands between patient contacts. This difference may be due to social desirability bias; that nurses exaggerated their reported compliance of handwashing than the actual. Besides, shortage of water could be a reason for non-compliance; it was observed from the unit assessment of hospitals that in most of the working units (53%) running water was not always available (especially in adult OPDs, and emergency rooms, and inpatient wards) and there was an inconsistent supply of alcohol hand rub.

Almost half (49%) of the participants segregated solid wastes according to category. In like manner, a study conducted among nursing staff in India a low compliance rate reported in placing contaminated waste (55). Ideally, healthcare waste disposal should never be mixed; instead, these should be categorized and disposed of appropriately in color-coded plastic bags (17). In this case, participants fail to follow the proper protocol for healthcare waste disposal. This may be due to a shortage of material as supported by the observed findings only 30% of the units in the assessed hospitals had color-coded waste containers.

Moreover, a very low proportion of nurses had reported that they were always/mostly compliant with wearing goggles and/or masks whenever there is a possibility of body fluid splash in their face (27.7%), wearing waterproof apron whenever there is a possibility of body fluid splashing in their body (37.1%). These findings were consistent with other studies in that a lesser proportion (21%) of participants always compliant with wearing goggles/face-masks and wearing a waterproof apron (18). A study in India where compliance to the use of eye protection was 32% was observed (56).

The noted poor compliance level to the use of PPEs like eye protection and apron are likely pointers to inadequate or non-supply of these equipment's or devices and inaccessible at point of use, workload and discomfort or unfitness of Personal protective equipment.

Also, it was noted from the unit observation that in most of the departments certain personal protective equipment (e.g., eye goggles, aprons, and face-masks) was rarely available.

On the contrary, the current study showed that higher percentages (79.2%) of nurses were changing gloves between patients. This finding could strengthen the assumptions that the noncompliance in other components might be due to the unavailability of protective supplies.

Although significant numbers of nurses were always/mostly compliant with some of the components of SPs (e.g., washing hands after body fluid exposure) in the current study, it seems that nurses are more concerned with protecting their lives in most cases. Therefore, one of the most important implications of these findings could be that the nurses were not protecting patients, families, visitors, and the community at large from hospital-acquired infections as per the recommended guidelines.

On the other hand, higher proportions of nurses were not always compliant with some other components of SPs (e.g., in providing nursing care considering all patients potentially infections, in using eye goggles and waterproof aprons whenever appropriate) which were mainly important to protect themselves (and also their families) from acquiring blood born and other deadly infections. SPs should serve to protect the life of both patients and providers.

The possible explanation for these findings could be the lack of up-to-date training on the principles of SPs. As the majority (63%) of the participants in this study were reported that had not trained on SPs in the previous year. Most inadequate facilities and materials in various units of the studied hospitals were other ones. Moreover, inconsistent management support to workplace safety may also be additional potential reasons for the lower performance.



## **6.2. Factors associated with SPs compliance level**

From the results obtained in the present study, individual factors (Perception of risk, Risk-taking personality, Exemplary behavior of colleagues, and Knowledge about SPs) and institutional factors (Cleanliness/orderliness of working area, Organizational/Management support towards safety climate, and Ready availability of safety materials) were associated with the overall compliance level in the multivariable regression analysis; and were the variables which influenced nurses compliance in implementing SPs at their work area.

In this study, the only working unit was associated with compliance with SPs among socio-demographic factors. Nurses working in NICU, OR, and Pediatric wards were more likely always compliant with SPs than those who had to work in a surgical ward. This is probably such precautions reflect the specificity of departments that care for patients at high risk of infection, which likely result from safety management awareness and due to trained nurses. Another possible reason might be PPE and safety facilities were more readily available and the greater orderliness and cleanliness than other observed units. This finding was of course supported by observation. But, regardless of type, all units should have protective equipment readily available to workers.

Similar to the finding of this study, In South Korea, nurses complied better in the ICU (36). And in the Philippines, nurses assigned to the pediatric ward had the highest compliance (52).

In this study, whether in the bivariate analysis or multivariable analysis, knowledge of the standard precautions was found to exert a great impact on the individual's compliance with the precautions. Nurses who were knowledgeable with SPs guidelines were 17 times more likely to always/mostly comply with SPs than those who had not knowledgeable. This finding is supported by the Chinese study which shows that knowledge exerts a positive impact on compliance with precautions and suggested that nurses with better knowledge comply more with SP (30). Also, a strong association between knowledge of SPs and compliance as evidenced by a Brazilian study (43). The fact that the majority of the nurses in this study are perceived of the risk of exposure to pathogens but less familiar with the SP guidelines means that nurses do not know how to protect themselves from the risk of exposure.

Several personal behavior variables were identified as significant with professionals' compliance.

In this study, nurses who had reported high risk-taking personality were 83% less likely to comply with SPs than those who report less risk-taking personality. Other findings in the literature also report that a less risk-taking personality is associated with nurses' compliance (33). This factor also aligns with Cyprus finding that nurses who failed to follow some or all of the guidelines stated they did so because they had confidence in their capabilities and enough experience to make a judgment about the situation (11). Such behavior is outside the guidelines. Furthermore, nurses who reported risk-taking behavior is not only ignored patient safety but might also be perceived as that they will not be at risk.

This study showed that nurses who had a higher perception of infection risk were almost 6 times more likely to always comply with standard precautions than those who had a lower perception of risk. This finding could be explained by the fact that whenever nurses have increased perception of exposure to infection, their level of compliance to preventive guidelines would increase. This finding was similar to the study reported from Italy where performing appropriate antisepsis was higher among nurses with a higher perception of risk of transmitting an infectious disease while working (11).

In this study, the exemplary behavior of senior colleagues has significantly influenced nurses' compliance with SPs. Nurses who had perceived exemplary behavior of colleague to use SPs were 10 times more likely compliant with SPs than those who did not perceive the behavior of colleagues. Another study also reported similar findings; lack of role models was cited as a reason not to perform hand hygiene as senior nurses did not wash their hands, thereby, acting as negative role models (57). Evidence from the literature suggests that the role model could play a pivotal role in changing human behavior.

In line with Ethiopian, Brazilian and Canadian studies (18), (58) (33) in that management support positively impacted compliance of nurses with SPs, this study also revealed that nurses who had more frequent management support towards safety environment in their hospitals were 4 times more likely to always comply with SPs as compared to those who had less frequent management support. This might be because management bodies could play a key role and are responsible to make accessible all necessary safety equipment for those nurses who need it and

to build a safe workplace safety climate for themselves, nurses, and patients at large. It is also obvious that, without management support and decision, it could be very difficult to renovate infrastructures suitable to infection control and it could hardly be possible to allocate a sufficient budget for infection prevention activities.

Moreover, management support could also increase the compliance of nurses with SPs by recognizing role models and establishing a rewarding system for those who consistently implement recommended guidelines and policies. In addition to that, management support could also help to strengthen infection prevention activities by designing controlling mechanisms and taking corrective measures on noncompliant nurses.

In this study, nurses who did not have readily accessible personal protective equipment were less likely to always/mostly comply with SPs as compared with those who had readily accessible personal protective equipment. This finding could be explained by the fact that almost all SPs require some kind of personal protective equipment that needs to be accessible at the point of use. On the other hand, unless a nurse has a favorable attitude towards complying with SPs, he/she might take the absence of certain modalities and equipment as an advantage not to practice recommended guidelines.

This result is inconsistent with the findings of the study done in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia, in which HCWs who had access to PPE were 3 times more compliant than those who had no access (18). Lack of inaccessibility of resources such as hand hygiene facilities is recognized factors that can interfere with nurses' decisions and actions to apply Standard Precautions (11).

An association was found between compliance and nurses' perception of a safe environment. Nurses who had perceived that their unit was clean/orderly were 6 times more likely compliant with SPs than those who had not perceived their unit to be clean/orderly. A finding in the literature confirms this association, in that greater cleanliness and organization of the work post-show that better working conditions imply greater compliance (43).

### **6.3. Strength and Limitation of the study**

The strength of this study may be the measurement of the effect of factors from both individual and hospital levels on SPs compliance is also an attempt to address the gap identified.

This study has the following limitations:

A temporal relationship cannot be established between the explanatory and the outcome variables, due to the cross-sectional nature of the study design.

Self-reported compliance is high. This was maximized by combining observation with a self-administered questionnaire

Moreover, out of the 307 participated nurses, only 101 were observed on their infection prevention compliance. This could have biased the results since some of the participants who were not observed could have had some unusual IP practices.

It is also important to note that the use of ‘high correct score answers to all the questions might have probably resulted in a loss of some information and statistical power. Hence, an assessment of the average level of compliance to the SPs among these same participants could result in different outcomes

Finally, since the study was conducted in governmental hospitals, and only among nurses’ staffs. The generalizability of the study findings is limited to these governmental healthcare facilities nurses.

Further studies are also suggested among different health care workers to assess the level of compliance.

## **7. Conclusion and recommendation**

### **7.1. Conclusion**

SPs represent the most important infection prevention and control actions to reduce the transmission of microorganisms to other patients or healthcare providers. Thus, supporting nurses to engage in such behaviors, as first-line workers, is a core component of infection control.

The level of compliance with SPs guidelines among nurses working in public hospitals of Jimma Zone was observed to be very low. The low compliance of a greater percentage of nurses to the majority of the components of SPs guidelines places patients and nurses at significant risk of acquiring blood born and other infections.

This study identified variables such as working unit, perception of infection risk, risk-taking personality, exemplary behavior of colleagues, and knowledge about SPs were factors associated with compliance to SPs at the individual level, while cleanliness/orderliness of working area, management support towards safety climate and ready accessibility of safety materials were factors significantly associated with SPs at the institutional level.

Thus, compliance with SPs among nurses was majorly influenced by both the individual level and hospital-level factors in public hospitals of Jimma Zone. It appears that any attempts to improve compliance to Standards Precaution needs to address each of these factors where equal attention is given if any sustained behavior change to address poor compliance to SP is to be successful.

## **7.2. Recommendation**

Due to the observed very low level of compliance to the SP, this study calls for the following recommendations which require interventions at the Regional Health Bureau, management level, and nurses' level:

There is a need for the Oromia Regional Health Bureau to ensure periodic supervision of the hospitals to check the levels of compliance to the SPs principles.

Likewise, the hospitals' management should also have a system of periodically assessing compliance to the SPs among their staff.

There is a need for the hospital management team to provide sustainable supplies, which include all types of personal protective equipment, provision of infrastructures like handwashing facilities, water supply, and other related supplies.

Make more visibly and easily accessible in all working areas of the hospitals, and ensure consistent availability to reinforce compliance with standard precautions.

As a result, the hospitals' management teams need to organize in-service training. These training programs should not only focus on supplying nurses with knowledge of the SPs but also focus on behavior modification to improve the practice of the SPs.

There is also a need for an IP committee in collaboration with the hospital's management team to develop training programs for all new nurses.

Each hospital has an infection prevention committee and they need to work to have close supportive supervision, monitoring, and evaluation of standard precautions practice as one of their responsibility by providing immediate feedback and ensuring that performance is per the national IPPS guidelines.

At the unit level, front-line managers should involve nurses in issues related to SPs and enforce compliance with guidelines and ensure strict implementation of these policies.

Nurses should endeavor to practice standard precautions always irrespective of the patient's diagnosis or presumed health status.

Further studies are also suggested using mixed methodology such as quantitative and qualitative to assess the level of compliance.

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## **9. Annex**

### **9.1. Annex IA: English version Information Sheet**

**Project title:** Compliance with Standard Precautions and associated factors among nurses working in public hospitals of Jimma Zone, South West Ethiopia, 2019

#### **What is this study about?**

This is a research project being conducted by Mr. Nuredin Hassen at Jimma University. We are inviting you to participate in this research because you are the best person that can give us accurate information. The purpose of this research is to determine the nurses' level of compliance with standard precautions and to know if some factors are influencing it among nurses in Jimma Zone.

#### **What will be asked to do if I agree to participate?**

You will be asked to complete a short questionnaire about your compliance to the principles of Standard Precautions that will take some minutes. This will be taking place at the hospital, where you are working in that specific ward or unit, during working hours but during break time or at your own convenient time. You don't have to worry about any things because everything is confidential.

#### **Would my participation in this study be kept confidential?**

We will do our best to keep your personal information confidential. To help protect your confidentiality, I will be making use of identification codes only on the data forms and these forms will be collected by myself and will be stored away. So these are anonymous and your name will not be placed on the questionnaire only the code then identification key will be used for only the researcher to link the code to your identity.

If we write a report or article about this research project, your identity will be protected.

Per legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authority's information that comes to our attention concerning child abuse or neglect or potential harm to you or others.

#### **What are the risks of this research?**

There may be some risks from participating in this research study. There are no known risks that could harm you during this study but if you feel that this study has psychological or emotional

or any other sort of risk to yourself, you have the right to withdraw. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

**What are the benefits of this research?**

This research is not designed to help you directly, but the results may help the investigator learn more about compliance with standard precautions. We hope that, in the future, other people might benefit from this study through an improved understanding of the importance of infection control.

**Do I have to be in this research and may I stop participating at any time?**

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

**What if I have questions?**

This research is being conducted by Mr. Nuredin Hassen at the department of health management and policy, Institute of Health, Jimma University. If you have any questions about the research study itself, please contact Mr. Nuredin Hassen: 0917751875, [nurehasen@gmail.com](mailto:nurehasen@gmail.com).

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact Jimma University Institute of Health Ethical Review Board.

## 9.2. Annex IB: Consent form

**Title of the research project:** Compliance with standard precautions and associated factors among nurses working in public hospitals of Jimma Zone.

The study has been described to me in a language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

Participant's name.....

Participant's signature.....

Date.....

### 9.3. Annex II: English version of the questionnaire

#### Questionnaire on compliance with standard precautions among nurses

Study ID \_\_\_\_\_ Date \_\_\_\_\_

Title of the research project: **Compliance with Standard Precautions and associated factors among nurses working in public hospitals of Jimma Zone, South West Ethiopia, 2019**

**Dear Colleague!**

My name is Nuredin Hassen; I am inviting you to part in a study I am conducting for the degree of Masters of Health care and Hospital Administration at Jimma University institute of health, department of health management and policy.

The purpose of this research is **to measure the magnitude of compliance with IP standard precautions and to identify factors influencing compliance among nurses working in direct patient care of the six public hospitals of Jimma zone**. All categories of nurses (general nurses, midwives, anesthetic nurses, etc.) who have direct contact with patient care are invited.

The survey is anonymous and confidential. To protect your identity no names will be recorded and no record will be kept of the unit or the department from which the completed questionnaires come, only codes then identification keys will be used by the researcher. Your participation is purely voluntary, and will in no way affect your relationship with your employers.

It is very important to answer all questions exactly as you feel about them because the information gained from you who are involved in direct patient care is vital and may provide information for developing interventions and strategies to enhance compliance to infection prevention standard precautions. The questionnaire has 4 parts: demographics, compliance, individual, work environment, and organizational factors with 5 pages.

(43)Do not write your name in any part of this form.

Completion of the survey should take approximately 25-30 minutes of your time. Upon completion of the questionnaire, please return it to the researcher.

If you have any questions or queries regarding this study, please contact:

Nuredin Hassen: 0917751875,

Email- [nurehasen@gmail.com](mailto:nurehasen@gmail.com)



For each question provided in the tables below, please circle your answer after reading the questions. Thank you.

**Section I. Demographic variables**

No	Socio-Demographic Questions			
1	Your sex?			
	A	Male	b	Female
2	Your age in years?			
	_____years			
3	Marital status?			
	A	Single	c	Divorced
	B	Married	d	Widowed
4	Your professional category?			
	A	General nurse (BSC, clinical)	e	Scrub nurse
	B	Midwifery nurse	f	Optometry nurse
	C	Anesthetic nurse	g	Other _____
	D	Psychiatry nurse		
5	What is your educational status?			
	A	Diploma	c	Masters
	B	BSC /bachelor degree		
6	How long have you worked as a nurse?			
	_____years			
7	What is the level of the hospital you are working in?			
	A	Primary hospital	b	General hospital
8	In which department or unit do you working?			
	A	Outpatient department (OPD)	g	OR
	B	Maternal and child health (MCH)	h	Medical ward
	C	Emergency department	i	Surgical ward
	D	Injection & dressing	j	Ob/guy ward
	E	Delivery units	k	Pediatric ward
	F	Neonatal intensive care units (NICU)	l	Other _____

■ Please be reminded that all responses will be kept confidential and being honest in your responses!

## Section II. Compliance with standard precautions

Please circle the number of how consistently you practice each principle in your workplace

The items scored as: 1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Mostly, 5 = Always

No	Compliance with Standard precautions	Never	Seldom	Someti mes	Mostly	Always
9	Wash hands before touching a patient	1	2	3	4	5
10	Wash hands before clean or aseptic procedures	1	2	3	4	5
11	Wash hands after body fluid exposure	1	2	3	4	5
12	Wash hands after touching a patient	1	2	3	4	5
13	Wash hands immediately after removal of gloves	1	2	3	4	5
14	Wash hands between patient contacts	1	2	3	4	5
15	Wash hands after touching patient surroundings	1	2	3	4	5
16	I provide nursing care considering all patients as potentially infectious	1	2	3	4	5
17	I protect myself against body fluids of all patients regardless of their diagnosis	1	2	3	4	5
18	I wear clean gloves whenever there is a possibility of exposure to anybody fluids	1	2	3	4	5
19	I change gloves between contacts with different patients	1	2	3	4	5
20	I avoid wearing my gown out of the unit of a hospital	1	2	3	4	5
21	I wear a waterproof apron whenever there is a possibility of body fluid splashing in my body	1	2	3	4	5
22	I wear eye goggles whenever there is a possibility of body fluid splashing in my face	1	2	3	4	5
23	I sterilize all reusable equipment before being used on another patient	1	2	3	4	5
24	I clean and disinfect equipment and surfaces	1	2	3	4	5
25	I segregate noninfectious wastes in a black color-coded dust bin	1	2	3	4	5
26	I segregate infectious medical wastes in a yellow colored-coded dust bin	1	2	3	4	5
27	I bend needles with my hands	1	2	3	4	5
28	I avoid removing used needles from syringes	1	2	3	4	5
29	I place used sharps in a puncture-resistant container at the point of use	1	2	3	4	5
30	I recap needles	1	2	3	4	5

**SECTION III: Factors that influence compliance with standard precautions (SPs)**

Please circle one of the options you preferred after reading the questions. The items scored as:  
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

No	Individual Factors influence compliance with SPs	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
31	I am at risk of becoming infected with communicable blood-borne pathogens through work.	1	2	3	4	5
32	I am concerned I may acquire communicable blood-borne infections at work.	1	2	3	4	5
33	I am concerned my colleagues may catch a communicable blood-borne illness at work.	1	2	3	4	5
34	My job duties interfere with my being able to follow standard precautions (SPs)	1	2	3	4	5
35	I have enough time in my work to always follow standard precautions	1	2	3	4	5
36	Wearing gloves gives me a sense of safety when I practice clinical procedures	1	2	3	4	5
37	I can reduce my risk of occupational blood-borne infections by complying with standard precautions	1	2	3	4	5
38	Wearing personal protective equipment's interferes with my ability to do my job	1	2	3	4	5
39	Putting on the gloves takes too long	1	2	3	4	5
40	I don't wear gloves as I cannot feel veins	1	2	3	4	5
41	I am clumsier when I wear gloves and risk having to repeat the procedure	1	2	3	4	5
42	I can decide whether or not to use Personal Protective Equipment based on the clinical risks to me	1	2	3	4	5
43	I assess what is wrong with a patient before deciding whether or not to implement standard precautions	1	2	3	4	5
44	The more experienced I become at my job, the more likely I am to be able to decide when I need to use standard precaution	1	2	3	4	5
45	I am more likely to wear Personal Protective Equipment if I see my colleagues wearing them	1	2	3	4	5
46	My senior colleagues practices standard precautions	1	2	3	4	5
47	My experience with bloody exposure prevents me from practicing standard precautions	1	2	3	4	5

Please circle one of the answers that you feel is correct after reading the questions.

No	Questions on Standard Precautions Knowledge	Yes	No	Don't know
48	Do you know what the standard precaution is?	1	2	3
49	Standard precaution is only applicable for patients with the confirmed diagnosis of infection.	1	2	3
50	The main goal to implement standard precaution is to protect the medical staff	1	2	3
51	Washing and disinfecting the hands immediately if contacting any blood, body fluid, secretion, excretion, or dirty substance	1	2	3
52	Washing the hands if contacting different patients:	1	2	3
53	Since the gloves can prevent pollution for the hands, there is no need to wash hands after taking off the gloves:	1	2	3
54	It shall be avoided for the polluted protective articles to contact with the surface of other articles:	1	2	3
55	It shall not be shared for the personal protective articles, such as gloves, mask, etc.	1	2	3
56	The gloves shall be worn in the operation of blood drawing, venous puncture, etc.	1	2	3
57	The gloves shall be worn in the operation might contact with the secretion and excretion of the patient:	1	2	3
58	The gloves shall be changed if contacting different patients:	1	2	3
59	The face mask or mask shall be worn in the operation might induce the spraying of blood, body fluid, secretion, or excretion:	1	2	3
60	The protective eye patch or goggle shall be worn in the operation might induce the spraying of blood, body fluid, secretion, or excretion:	1	2	3
61	The protective suit shall be worn in the operation might induce the spraying of blood, body fluid, secretion, or excretion:	1	2	3
62	The protective cap or shoe shade shall be worn in the operation might induce the flowing or leaking of blood, body fluid, secretion, or excretion	1	2	3
63	The sharps disposal box shall be put in the area close to the sharp applicable area	1	2	3
64	Recapping and re-use of a needle is prohibited	1	2	3
65	The caring for patients with Hepatitis 'C' Virus only needs standard precautions	1	2	3
66	Caring for patients with active pulmonary TB or varicella needs the standard precaution associated with the prevention of airborne diseases.	1	2	3
67	Caring for patients with intestinal infection or skin infection needs the SPs associated with the prevention of the diseases by contact transmission.	1	2	3

**Please circle the number that most accurately reflects your current work situation. The items scored as: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strong Agree**

No	Institutional level Factors	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
68	I am provided with all necessary Personal Protective Equipment (e.g. gloves, masks, eye goggles,...) to comply with standard precautions	1	2	3	4	5
69	Personal Protective Equipment's (PPE) that fit me are readily available in my unit/work area	1	2	3	4	5
70	Hand washing sinks with running water readily accessible where I work	1	2	3	4	5
71	The personal protective equipment materials available are of quality	1	2	3	4	5
72	My work area is clean	1	2	3	4	5
73	My work area is not crowded.	1	2	3	4	5
74	My unit is adequately staffed	1	2	3	4	5
75	The hospital policy that addresses the use of PPE is available	1	2	3	4	5
76	The protection of workers from occupational exposure to communicable blood born disease is a high priority where I work	1	2	3	4	5
77	My workplace has a functioning infection prevention/IPPS committee	1	2	3	4	5
78	My senior colleague often discusses safe work practices which include standard precaution with me	1	2	3	4	5
79	In my current work area, written policies for infection preventions are readily accessible	1	2	3	4	5
80	On my unit, there is open communication between management and staff	1	2	3	4	5
81	In my current work area, my coworkers support me in following safe work practices	1	2	3	4	5
82	I received training organized by the hospital on standard precautions or other infection control measures in the past 12 months.	1	2	3	4	5
83	I am familiar with the content of the standard precautions guidelines	1	2	3	4	5
84	In my unit, nurses are encouraged to become involved in safety and health matters.	1	2	3	4	5
85	My supervisor enforces compliance with guidelines and workplace policy regarding the proper use of PPE	1	2	3	4	5

**Thank you very much for your time!**

#### 9.4. ANNEX III: Observation Checklists

##### Unit assessment checklist

Unit assessment checklist				
Hospital _____ Unit _____ Assessor _____ Date _____				
I	<b>HAND HYGINE FACILITES &amp; SUPLIES</b>	Yes	No	Remark
	Written Hand hygiene policies, guideline, poster available and accessible in the unit			
	A functional Hand basin/Sink or bucket with a tap is a near entrance or exit of the room			
	Easily accessible running water in the unit			
	Soap, or detergent, and Liquid soaps are available adjacent to the work area			
	A paper hand towel is available in the unit			
	Alcohol hand-rub is present in the unit			
II	<b>PERSONAL PROTECTIVE EQUIPMENT TYPES</b>			
	Polices and guideline for use of PPE is available			
	Is right sizes available: small, medium, large			
	Gloves d/t type (Clean Examination gloves, Utility gloves, sterile surgical gloves)			
	Protective suits/Gowns, aprons			
	Masks			
	Caps			
	Closed protective shoes			
	Eye goggles/glasses			
III	<b>SHARPS MANAGEMENT EQUIPMENTS</b>			
	Written Injection safety policies are available			
	Sharps container close to the point of use available			
	Sharps container, not free-standing			
	Sharps container marked clearly			
	Not more than 2/3 full			
IV	<b>INSTRUMENT DECONTAMINATION</b>			
	Covered containers with a 0.5% chlorine solution /Plastic buckets			
V	<b>WASTE MANAGEMENT equipment</b>			
	Availability of color-coded dust bins			
	Availability waste segregation liner bags			

**NB:** Measures of the availability of PPE are made at point-of-use meaning on a cart or shelf or within a short walking distance (up to 3 meters away).

**PRACTICE OBSERVATION CHECKLIST:**

Hospital_____ Unit/Department_____ Date_____				
	Recommended Nursing practice	Yes	No	Remark
I	Washing hands with water and soap or using alcohol-based hand rub is done:			
1	Before touching a patient			
2	Before putting on gloves			
3	Before performing procedures			
4	After body fluid exposure			
5	After touching a patient and patient surroundings			
6	Immediately after removal of gloves			
7	Between patient contacts			
II	The following PPEs are used as follows:			
1	Appropriate gloves are worn when contact with blood or body fluids, mucus membranes, non-intact skin			
2	Change gloves Between tasks and procedures on the same patient, After contact with each patient			
3	Remove gloves and discard after single-use			
4	Waterproof aprons are worn during procedures that are likely to generate splashes or sprays of blood or other body fluids secretions, or excretions			
5	The gown is removed and HH is performed before leaving the patient room			
6	Masks shall be worn during procedures and patient care activities that are likely to generate droplets of blood, other body fluids, or tissue			
7	Eyewear and/or facial protection is used when a procedure is likely to generate splashes of blood or body fluid to protect the mucous membranes of the eyes			
8	PPE is removed before leaving the work area			
9	Single-use protective barriers should be discarded into the appropriate receptacle(s)			
10	Re-usable protective barriers should be, cleaned, and disinfected			
III	<b>Safe practices in handling &amp; disposal of Sharps objects</b>			
1	Needles are not recapped, bent, or disassemble after use			
2	Avoid removing used needles from disposable syringes			
3	Used needle and syringe are immediately disposed of into puncture-resistant containers immediately after use			
4	Sharps containers are closed, seal and disposed of when ¾ full			
6	Collect non-sharp infectious wastes in color-coded bags			
7	Clean and decontaminate all equipment and environmental surfaces			

## 9.5. Annex IV: Factor Analysis

Factor Analysis was performed on the survey scales used to measure individual and Institutional factors that can influence nurses' compliance to SPs.

Questioner responses to the factors influencing nurses' compliance with SPs scale items were submitted to the Principal components analysis (PCA) with varimax rotation, to determine the underlying factor structure. Before performing PCA, the suitability of data for factor analysis was assessed. The results revealed the presence of many coefficients of 0.4 and above, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.896, and a Barlett's Test of Sphericity ( $P < 0.001$ ).

This indicates that the sampling adequacy and the matrix were suitable to perform factor analysis (44). To assist in the decision concerning the number of factors to retain and create the index, the following criteria were used: 1) factors with an eigenvalue greater than one as common factors, 2) An item-to-factor loading of 0.5 or greater, 3) A minimum of two items loading on a factor and 4) Catell's scree plot test which recommends retaining all factors above the elbow, or breaks in the plot, as these factors contribute the most to the explanation of the variance in the items data set.

When the 35 items (17 items for individual & 18 items for Institutional factors) were entered into the principal component analysis; 28 items remain after successive iterations.

Nine components/factors solution were extracted with simple independent structure grouped under Individual and Institutional factors. Under the individual groups, four factors explained 71% of the variance and were labeled: Risk-taking personality (3 items), Perception of infection risk (3 items), Exemplary behavior of colleague (3 items), and Attitudes towards PPE use (3 items).

Five factors grouped under institutional factors and labeled: Ready availability of safety equipment (4 items), cleanliness/ orderliness of the workplace (3 items), Training on SPs (2 items), organizational support on health & safety (5 items), and safety performance feedback (2 items).

The factor loadings, eigenvalues, and percentages of the variance explained for each factor used in the study were presented in an annex (Annex V).



## 9.6. Annex V: Principal component analysis of the Factors Influencing Compliance Scale

Factor loadings of items in Individual Factors Scale, nurses working in Jimma Zone public hospitals. (N=307)

A. Factor loadings of items in Individual-level factors items	Components			
	Risk-taking personalit	Perception of risk	colleague behavior	Attitudes to use PPE
I can decide whether or not to use Personal Protective Equipment based on the clinical risks to me	0.86			
I assess what is wrong with a patient before deciding whether or not to implement standard precautions	0.837			
The more experienced I become at my job, the more likely I am to be able to decide when I need to use SPs	0.818			
I am concerned I may acquire communicable blood-borne infections at work.		0.903		
I am at risk of becoming infected with communicable bloodborne pathogens through work.		0.873		
I am concerned my colleagues may catch a communicable blood-borne illness at work.		0.766		
My senior colleagues practices standard precautions			0.805	
I am more likely to wear Personal Protective Equipment if I see my colleagues wearing them			0.802	
My experience with bloody exposure prevents me from practicing standard precautions			0.773	
Putting on the gloves takes too long				0.792
Wearing personal protective equipment's interferes with my ability to do my job				0.788
I am clumsier when I wear gloves and risk having to repeat the procedure				0.709
I don't wear gloves as I cannot feel veins				0.55
Extraction Method: Principal Component Analysis.				
Rotation Method: Varimax with Kaiser Normalization.				
a. Rotation converged in 5 iterations.				
Eigenvalue	3.218	2.529	1.825	1.006
% of variance Explained (total 71.484)	23.648	19.241	16.039	12.555
Reliability Statistics (Cronbach's Alpha)	0.842	0.833	0.71	0.6
Determinant	0.012			

B. Factor loadings of items in Institutional factors Scale (N=307)					
Item	Component				
	The ready availability of safety equipment	cleanliness/orderliness of the workplace	Training on SPs	organizational support on health & safety	safety performance feedback
Personal Protective Equipment (PPE) that fit me are readily available in my unit/work area	.771				
I am provided with all necessary Protective Equipment to comply with SPs	.673				
The personal protective equipment materials available are of quality	.643				
Hand washing sinks with running water readily accessible where I work	.640				
My work area is not crowded.		.811			
My unit is adequately staffed		.751			
My work area is clean		.682			
I received training organized by the hospital on standard precautions in the past 12 months			.770		
I am familiar with the content of the standard precautions guidelines			.701		
The hospital policy that addresses the use of PPE is available				.755	
The protection of workers from occupational exposure to communicable blood born disease is a high priority where I work				.746	
My supervisor enforces compliance with guidelines and workplace policy regarding the proper use of PPE				.737	
My senior colleague often discusses safe work practices which include standard precaution with me				.728	
In my current work area, written policies for infection preventions are readily accessible				.717	
My workplace has a functioning infection prevention/IPPS committee				.641	
In my current work area, my coworkers support me in following safe work practices					.756
In my unit, nurses are encouraged to become involved in safety and health matters.					.645
Eigenvalue	2.043	1.937	1.513	1.399	1.395
% of variance Explained	15.714	14.897	11.635	10.759	10.729

**9.7. Annex VI: Case Definitions and Reliability test for Explanatory Variables/constructs used in this study**

Case Definitions for Explanatory Variables				Reliability
Category	Variable	Case Definition	Survey Items	Alpha ( $\alpha$ )
Individual-level factors	Perception of the effectiveness of preventive actions	Perceived preventive actions to be effective (SA/A with all 2 items)	136, 137	0.788
	Perception of infection risk	Perceived high infection risk (SA/A with all 3 items)	131,132,133	0.833
	Risk-taking personality	The reported presence of risk-taking personality (SA/A with all 3 items)	142,143,144	0.828
	Attitudes towards PPE use	Reported Negative attitude (SA/A with at least 1 of 3 items)	138,140,141	0.67
	Exemplary behavior of colleagues	Perceived colleague behavior to use SPs (SA/A with all 3 items)	145,146,147	0.71
	Knowledge of standard percussions	Knowledgeable (answered to 16 of the 20 knowledge items correctly)	148-167	0.771
Institutional level factors	Cleanliness/orderliness of working area	Perceived the clean/order unit (SA/A with all 3 items)	172,173,174	0.772
	Feedback on safety performance	Reported frequent Feedback on safety performance (SA/A with the 2 items)	181,184	0.744
	Management support towards safety climate	Perceived strong Management/organizational support for health and safety (SA/A with all 5 items)	175, 176,177,178 , 179,185	0.849
	Training on SPs guidelines	Reported training on SPs (SA/A with 2 items)	182,183	0.757
	The ready availability of safety materials	Reported PPE to be readily available (SA/A with all 4 items)	168,169,170 , 171	0.75
Outcome variable	Compliance with standard precautions (SPs)	Compliant with SPs (Always/Mostly to all 22 items)	09-30	0.886

