



**ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE
SCHOOL OF PUBLIC HEALTH**

DEPARTEMENT OF EPIDEMIOLOGY AND BIOSTATSTICS

**INFECTION PREVENTION COMPLIANCE AND FACTORS AMONG
NURSES WORKING AT DIALYSIS UNITS FOR CHRONIC KIDNEY
DISEASE PATIENTS IN ADDIS ABABA**

BY: TIGLE NADEW

**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, ADDIS ABABA
UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER IN PUBLIC HEALTH WITH A SPECIFIC AREA OF
EPIDEMIOLOGY AND BIOSTATICS**

JUNE, 2024

ADDIS ABABA, ETHIOPIA



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APPROVAL SHEET

EPIDEMIOLOGY AND BIOSTATISTICS DEPARTMENT, COLLEGE OF HEALTH SCIENCE AND ADDIS ABABA UNIVERSITY

As thesis advisers, we hereby certify that we have read and evaluated the thesis prepared by Tigle Nadew under our guidance, which is entitled “Infection Prevention compliance and Associated Factors Among Nurses Working at Dialysis Units for Chronic Kidney Disease Patients in Addis Ababa” in its final format and is consistent and acceptable. Hence, we recommend that the thesis be accepted as it fulfils the University and Department style requirements for the degree of Master of Public Health in Epidemiology and Biostatistics.

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This thesis by Tigle Nadew is accepted in its present form by the board of examiners as satisfying thesis requirements for the review of the degree of masters of public health in Epidemiology and Biostatistics

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Abbreviation and Acronyms

AKI	Acute Kidney Injury
CASH	Clean and Safe Hospital
CAUTI	Catheter Associated Urinary Tract Infection
CDC	Center for Disease Control and Prevention
CDI	Clostridium Difficile Infection
CKD	Chronic Kidney Disease
CRBSI	Catheter-Related Bloodstream Infection
ESRD	End Stage Renal Disease
GFR	Glomerular Filtration Rate
HAI	Hospital Acquired Infections
HCAI	Health Care-Associated Infections
HCWs	Health Care Workers
HD	Haemodialysis
IPC	Infection Prevention and Control
IPPS	Infection Prevention and Patient Safety
PPE	Personal Protective Equipment
PI	Practice Index
PIMA	Practice Index Measurement and Analysis
RRT	Renal Replacement Therapy
SP	Standard Precaution

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Abstract

Background: Chronic kidney disease patients on hemodialysis have an increased risk of infection due to the nature of the disease and the type of treatment they receive. In many developing countries including Ethiopia, there is low level of compliance of infection prevention practice between medical professionals, despite the rise of highly contagious illnesses. Effective interventions can be developed by critically assessing the elements that contribute to this problem.

Objective: To assess infection prevention compliance and associated factors among nurses working at dialysis units for chronic kidney disease patients in Addis Ababa.

Methods: A facility-based cross-sectional study was carried out among nurses working at dialysis units for chronic kidney disease patients in Addis Ababa from Jan-March 2024. A total of 251 nurses were included. A structured self-administered questionnaire which has eight components and a checklist were used for data collection. Descriptive statistics and correlation estimates were used. For regression analysis, the study applies Principal Component Analysis to generate an index. Finally, logistic regression was done and adjusted odds ratio (AOR) with a 95% confidence interval was estimated in the final model. P-values of below 0.05 were regarded as significantly associated variables.

Results: The result showed that 105 nurses 45.66% were non compliant to infection prevention and control practices. The multivariable logistic regression result indicates, monthly salary 10,000.00-20,000.00 [(AOR:3.23 ,95%CI (1.20-8.70)], nurses who had duty [(AOR: 0.48 ,95%CI (0.25-0.93)], and work environment factor [(AOR: 6.57 ,95%CI (3.38-12.78)] were predictors of infection prevention compliance.

Conclusion and recommendation: Infection prevention compliance was not sufficiently practiced among dialysis unit nurses. Monthly salary, frequency of duty and work environment factors were factors associated with infection prevention compliance. Thus, intervention should focus on encouraging nurses by giving competitive benefit through salary increment, decreasing workload and creating good work environmental factors by ensuring sufficient and sustainable resources.

Keywords: *infection prevention, compliance, nurses, dialysis units, Addis Ababa, Ethiopia*

1. Introduction

1.1 Background

An end stage renal disease (ESRD) is defined as having a glomerular filtration rate (GFR) below 15 mL per minute per 1.73 m² of body surface area (1). ESRD patients are unable to maintain their quality of life without dialysis care (2). The nations with the greatest ESRD incidence and prevalence rates worldwide are found in the Asian continent (3). In Sub-Saharan Africa (SSA), end-stage renal disease has appeared as a serious problem. Due to a paucity of renal registries, information on the prevalence and incidence of ESRF in SSA is scarce (4). End-stage kidney disease is becoming more common in Ethiopia as a result of modification in way of life (the substitution of diets which mainly contain plant with higher consumption of processed foods, animal based diets, and saturated fats, together with a decline in physical activity) (5).

For ESRD, dialysis is one form of renal replacement therapy, and Hemodialysis is one of dialysis method that is most commonly used. It is a potentially life-saving technique that requires special nursing care for individuals undergoing dialysis as well as highly trained workers (6). Patients who undergo dialysis treatment are prone to healthcare-associated infections. A healthcare-associated infection (HCAI) is a disease that manifests itself in patients when they are obtaining medical care in a hospital, long-term care facility, outpatient clinic, or in any healthcare setup but was not seen or incubating during patient admission, this term substitute both Hospital-acquired infections and nosocomial infections (7). According to a systematic review of the literature, combined prevalence of infections related to healthcare was 10.1% in low- and middle-income nations and 7.6% in high-income nations. Hospital-acquired infection rates ranged from 12 to 35% in Africa, including Ethiopia (8).

The majority treatments in hemodialysis units are invasive, calling for the use of more hygienic methods and an increased level of compliance (9). Compliance is the degree to which advised behavior is carried out. The HD unit's poor infection control practices compliance may be caused by one or more of the following: a lower degree of understanding among HD staff and inadequate or absent training. Furthermore, there is a poor nurse-to-patient ratio, insufficient staffing, inadequate supplies, a high turnover rate among the nursing staff, and a substandard HD unit design (10).

The second most frequent cause of death and the most frequent cause for hospitalization after cardiovascular disease for hemodialysis (HD) patients is infection (11). Hemodialysis patients are vulnerable to several infections, including bloodstream infections, localized vascular access infections (catheters and grafts), and blood-borne infections including hepatitis B, hepatitis C, and HIV (12). Hemodialysis patients are particularly susceptible to developing HCAI due to several reasons, which encompass being exposed to invasive devices, lack of immunity, absence of distance among patients, and repeated contact with care givers throughout treatment. To prevent and control infections related to healthcare, it is preferable to adhere to standard precautions (13). Nurses are especially susceptible to diseases connected with healthcare due to the nature of their daily tasks, which include close contact with patients (14). The term "standard precautions" (SP) refers to infection control procedures designed to prevent the transmission of illnesses that can be gained through contact with blood, bodily fluids, damaged skin, and mucous membranes. When providing healthcare services, these precautions are intended to prevent and reduce the transmission of known and unknown infections (15). This set of SP measures consists of the following: hand hygiene, personal protective equipment (PPE), safe injection practices, proper waste management, instrument processing, environmental cleaning, client education on IPC, IPC aspect of occupational health, vascular access care and traffic or patient flow (16).

Noncompliance with infection control protocols resulted in a patient's prolonged hospital stay, increased medication resistance brought on by microorganisms, expensive hospital and patient costs, and increased social suffering for the patient and family (17). Numerous studies conducted in Africa have revealed that a significant percentage of medical professionals lacked sufficient knowledge of infection prevention. In Ghana, just 58% of healthcare workers had sufficient knowledge about infection prevention, and in Nigeria, 70–80% did. Comparably, prior research conducted in Ethiopia revealed that just 54–60% of medical professionals possessed sufficient knowledge about infection prevention, and 34–55% of medical professionals exhibited safe infection prevention practices (8).

Based on the available data, it appears that Ethiopian healthcare facilities lack efficient IPC programs. Furthermore, HCW compliance to infection prevention and control (IPC) protocols is extremely low and may be a widespread issue throughout the nation (18). There was a rising understanding of the necessity for good infection prevention practices at all levels to maximize the

prevention of HAIs in Ethiopia (18). Since the second Ethiopian National Infection Prevention Guidelines were released in 2012, significant advancements have been made in the comprehension of fundamental concepts as well as in the acceptance and application of evidence-based infection prevention (IP) practices. For healthcare professionals in all healthcare delivery systems, the national Infection Prevention and Patient Safety (IPPS) document serves as a standardized reference manual (18). Additionally, it aims to assist HCWs by giving them clear instructions on how to implement conventional infection prevention and patient safety practices (18).

1.2 Statement of the problem

Health Care Associated Infections (HCAIs) are major issues for public health in all societies. According to the WHO, 7.1 million HCAI cases occur annually. An infection occurs in a hospital every 20th person. This causes an estimated 32 million dollars in expenses to society each year and 99,000 incidents of death (19). According to the Centres for Disease Control and Prevention (CDC), there could be 2 million HAI cases per year in the US, with up to 100,000 deaths and up to \$4.25 billion in medical expenses (18). According to estimates, 200,000 HAI cases occur in Australia each year, of which 50% can be avoided (20). While the frequency of HAI ranges from 7.6 to 10.3% across Europe and Italy, with major hospitals often having larger prevalence, the prevalence of infected patients ranges from 6.8 to 9.3% (21).

According to a study conducted in eight university hospitals in Iran (with a capacity of 60 to 700 beds), blood-stream infections, SSIs, UTIs, and pneumonia were the most common HCAIs, with an overall frequency of 9.4%. In Southeast Asian nations, HCAIs have an overall prevalence rate of 9.1%, according to a systematic review and meta-analysis regarding HCAIs (22). Studies show that 10–20% of individuals hospitalized in health facilities in India have contracted a nosocomial illness (23).

Infection rates for those undergoing hemodialysis (HD) are more than 26 times greater as compared to the general population, and they are about 100 to 200 times higher for certain specific pathogens (24). One of the biggest hemodialysis units in Ho Chi Minh City in Vietnam had a sero prevalence survey, and the results showed that HCV (6%) and HBV (7%) were 7.5 times and 1.9 times, respectively, higher than the rates in the corresponding population in the same city (25).

Even though sub-Saharan Africa has a substantially greater prevalence of HCAs (18.9% in Mali, 14.8% in Tanzania, 9.8% in Algeria, and 14.90% in Ethiopia), most of healthcare professionals still have very limited awareness of and commitment to infection control techniques (26). The safety of patients and healthcare personnel is seriously threatened by healthcare-associated infections, so healthcare systems and organizations need to prioritize preventing them (27).

The prevalence of HCAs in Ethiopia is a significant public health issue that has an impact on patients. According to a systematic review and meta-analysis study done in Ethiopia, the national pooled prevalence of HCAI is 16.96% which is higher as compared to studies conducted in South Africa (7.67%), China (3.12%), Morocco (10.3%), and Botswana (13.54%). Additionally, other studies suggested that 35% of the nurses in southwest Ethiopia did not follow infection prevention practices, which contributed to Ethiopia's high rate of HCAI (28).

By using appropriate hand hygiene, HAI can be prevented from occurring and spreading. When hand hygiene (HH) compliance is improved, there have been up to 31% fewer HAI cases reported. However, there have been instances of low HH compliance in several therapeutic contexts. According to a systematic review report the pooled HH compliance percentage in Sub-Saharan Africa was 21%, which is lower than the 40% HH compliance rate seen in developed settings (29). Only 49.1% of the study participants in a survey of nurses working in hospitals in Southeast Ethiopia's Bale Zone had appropriate decontamination practices (30). In research done in Ethiopia's West Arsi District, 53.7% and 36.3% of participants, respectively, had adequate knowledge about infection prevention and had safe infection control practices (31).

According to a study done at public hospitals in Addis Ababa, health workers self-reported washing their hands 10.26% of the time before contact with a patient, 12.17% after contact with a patient, and 4.06% if they felt their hands were dirty, (3.58%) during contact with blood or bodily fluids, (5.25%) before wound care, and (2.15%) following glove removal (32). Eka Kotebe General Hospital in Addis Ababa conducted a survey that found that 22.2% of participants generally followed hand hygiene guidelines. The percentages of "my 5 movements" for hand hygiene were 91.4%, 36.9%, 14.6%, 13.6%, and 17.2%, respectively, before patient contact, before the aseptic procedure, after patient contact, and after touching patient surroundings (33).

The Ministry of Health of Ethiopia developed the Infection Prevention and Control Policy, Strategy and Strategy Roadmap, and Monitoring and Evaluation Plan, which are currently being

implemented throughout all health care systems (34). The new guide manual's clear instructions on how to implement conventional IPC protocols will also benefit users at their facility. The Ministry of Health's updated infection prevention and control (IPC) reference manual addresses the need for ongoing readiness and response in the wake of the emergence of emerging and re-emerging infections like the ongoing Covid-19 pandemic, as well as growing concerns about ineffective IPC procedures in healthcare institutions throughout the country (34).

Even though there are researches on infection prevention compliance and factors associated with infection prevention among healthcare professionals in Ethiopia's various general hospitals, there is a lack of research specifically for hospitals found in Addis Ababa. Most studies that are conducted in dialysis units of Ethiopia focus on clinical and epidemiological profiles of patients, survival analysis, predictors of mortality, and lived experience of CKD patients on hemodialysis, but there is a lack of research on the compliance level and factors that influence infection prevention compliance among nurses specifically at the dialysis units in Ethiopia. Therefore, this study assessed infection prevention compliance and associated factors among nurses working at dialysis units for CKD patients in Addis Ababa.

1.3 Rationale of the study

The Ethiopian government is dedicated to raising the standard of healthcare provided to its citizens, and infection prevention and control (IPC) is vital in providing quality medical care. The FMOH is increasing the scope of its IPC initiatives about health facilities and will use any chance to fortify current initiatives. Despite this, estimates of healthcare-acquired infections indicate that hundreds of millions of people are affected annually globally, with low- and middle-income nations having a disproportionately high illness burden (34).

To improve infection prevention compliance among nurses employed at dialysis units, it is necessary to identify the elements that contribute to infection prevention compliance. However, little is known about the degree of infection prevention compliance and the factors that are linked with it among nurses employed at dialysis units in Addis Ababa.

Thus, the purpose of this study is to evaluate the degree of infection prevention compliance and related factors among nurses employed at dialysis units in Addis Ababa.

1.4 Significance of the Study

According to research conducted on the survival rate of patients on hemodialysis in Ethiopia, 45.1% of deaths occur throughout dialysis treatment, 23.1% of deaths occur during the first ninety days of starting dialysis, and only 42.1% of them live above year (35). In addition, hemodialysis nurses have noted that persistent challenges to patient safety include a lack of adherence to established hemodialysis standards and procedures and a sense of "always needing to rush" to get patients into and out of the hemodialysis unit for treatment (36). Since preventing infections is a top priority for many countries, including our own, and it is especially crucial at hemodialysis centers, this study assessed factors associated with infection prevention compliance among nurses working at hemodialysis units for CKD patients in Addis Ababa.

The results of the study enable us to identify factors that are linked to low infection prevention compliance among dialysis unit nurses, and once these factors are identified, it assists Ethiopian policy makers and planners in developing a plan on how to deal with the identified problems to improve patient care quality and the health outcomes of patients receiving hemodialysis. In addition to these, the research will additionally provide a composite index to know the existing practices of infection prevention compliance instead of focusing on a range of all the ten dimensions of standard compliance.

1.5 Research Questions

- Are nurses who work at the dialysis units for CKD patients in Addis Ababa compliant with standard infection prevention practices?
- What are the factors affecting infection prevention practices compliance among nurses working at the dialysis units in Addis Ababa?

2. Literature Review

2.1 Infection at the Hemodialysis Units

The first dialysis program in Ethiopia was launched in 1980 at Tikure Anbessa Specialised Hospital, but a maintenance program debuted at Saint Gabriel Hospital in 2001. Up until recently, the service was only extended to Addis Ababa, and the private sector accounted for the vast majority of dialysis services. Only a small percentage of wealthy city dwellers in Ethiopia have access to renal replacement treatment (RRT), which is extremely rare in the country (2).

Addis Ababa is home to the vast majority of dialysis facilities and patients. Seventy-nine percent of patients receiving maintenance hemodialysis are served by private providers, making them the primary service providers. In the private sector, a single hemodialysis session typically costs 2300 Ethiopian birr, or USD 51. The annual cost of hemodialysis alone for a patient receiving three sessions per week is approximately US\$8000. When this is compared to Ethiopians' estimated US\$850 per capita income, it is clear that most Ethiopians cannot afford maintenance hemodialysis (37).

The predominant vascular access for close to 80% of the incident and 20% of prevalent Patients on hemodialysis is a central venous catheter. One of the most dreaded side effects of dialysis is catheter-related bloodstream infection (CRBSI). Unfortunately, CRBSI is still widespread among the United States who receive hemodialysis. An observational study with almost 500 incidents of patients on hemodialysis, the cumulative risk of CRBSI exceeded 50% in 6 months. In 85% of patients receiving catheter-dependent hemodialysis who have the condition, CRBSI is confirmed, according to a study done at the University of Alabama at Birmingham (38). It has been estimated that between 65% and 70% of infections associated with urine and vascular catheters are preventable (39). The three leading causes of HD patients' deaths in China were infections (19.9%), cardiovascular disorders (31.0%), and stroke (20.3%) (40).

The documented rates of HBV related to hemodialysis in 2004 were 11.8% in the eastern Mediterranean region, 10% in Bahrain, and 6% in Morocco. In Lebanon, the prevalence of HCV related to hemodialysis was 27% in 1996. In Syria, the rate in 1998 was far higher, reaching 48.9%. HBV prevalence in Libya hemodialysis facilities was reported to range from 0% to 75.9% in 2012, and the incidence of HCV conversion was found to range from 1.5% to 31%¹⁴. HCV prevalence in ESRD patients receiving dialysis in Yemen reached 40.2% in 2015 (41).

According to a study done in Asian countries, People with CKD have a 10-15 times higher frequency of TB than the general population, while those on HD had a >50 times higher incident. 7–10% of people receiving maintenance dialysis develop clinically overt TB. A prior study from the region found that ESRD patients with TB had a death rate of 20–30% overall. Poor infection control practices lead to horizontal infection transmission in HD units. A study from Vietnam found that co-infection happened in 1% of cases and that HBV and HCV had respective seroprevalences of 7 and 6%. The biggest risk factors for HD include repeated blood transfusions,

frequent trips to different HD units, and the frequency of HD. Many dialysis facilities won't treat patients who have had any exposure to the hepatitis virus (3).

According to a Cameron study, the most frequent causes of hospitalization for chronic hemodialysis patients were fluid overload (17.93%), anaemia (34.78%), and infections (39.13%). Malaria (n=23, 30.76%), catheter-related sepsis (n=28, 35.89%), and CAP (n=9, 11.53%) were the most prevalent infectious causes (42).

Hepatitis B and C viruses continue to be significant causes of liver damage in chronic renal failure, and chronic liver disease is a significant source of morbidity and mortality in these individuals. Cirrhosis, hepatocellular carcinoma, and hepatocellular failure are some of the consequences of chronic HCV infection, which causes liver damage. The proportion of anti-HCV antibodies in patients on HD in the DOPPS (Dialysis Outcomes and Practise Patterns Study, 2012-2015) was 9.9% globally (21 countries), according to the most recent survey (43). However, there is a deficiency of knowledge about the type of infection and its frequency in Ethiopian dialysis patients.

An elevated prevalence of HCAs was recorded in all regions of the country, ranging from 15.4% in north Ethiopia, 11.4%-19.4% in southwest Ethiopia to 16.4% in central Ethiopia, according to the findings of certain pocket studies. The findings reveal that healthcare facilities in Ethiopia lack efficient infection control programs. Additionally, healthcare workers compliance with infection prevention and control (IPC) methods is alarmingly low and could be a widespread issue throughout the nation (18). Another study in Ethiopia found that among health care workers (HCWs), there was a significant prevalence of both lifetimes (28.8%) and one-year (20.2%) HAI exposure (44).

According to a study on the survival rate of patients receiving hemodialysis in Ethiopia, septicaemia (34.1%), cardiovascular disease (29.3%), and the use of a catheter for vascular access were linked to both short- and long-term survival in hemodialysis patients (35). Research conducted in 2021 among patients on hemodialysis at Saint Paul hospital and Myung Sung Christian Medical Centre in Addis Ababa, Ethiopia, found that treatment facility, type of vascular access, and blood stream infection were significant predictors of mortality (1). A retrospective analysis of hemodialysis patients at three public hospitals in Addis Ababa revealed that the

following factors were shown to be predictive of death: hypertension, cardiovascular complications, infections, and different forms of vascular access (25).

2.2 Infection Prevention Compliance Level

The elements of standard precautions are founded on the idea that all individuals (patient, visitor, or HCW) are possibly infectious and vulnerable to infection and serve to construct protective barriers for infection prevention in patients, visitors and health care workers. The primary component of IPC is hand hygiene, which is one of the most crucial in preventing the transmission of infection. The first research in this area was done in 1847 in a maternity hospital in Vienna, Austria. This study showed that when HCWs washed their hands with an antiseptic substance, the mortality rate among mothers was noticeably reduced (34).

According to a historical comparative study done in China, During the COVID-19 pandemic, hand sanitizer use considerably rose, which suggested that patients and healthcare professionals were using their hands more frequently. Before the pandemic, doctors', nurses', and other staff compliance rates with hand hygiene were 66%, 75.5%, and 55%, respectively. Now, they are 90.5%, 92.5%, and 76.5%, respectively and the percentage of patients who wore masks climbed from 1.5 to 100% (45).

In a study conducted at the Benghazi Nephrology Centre in Libya, the overall percentage of practice for standard precautions was 73.2%, and 88.6% of respondents adhered to using standard precautions when interacting with all patients. Regarding hand washing, 67.1%, 91.4%, and 95.7% of respondents always washed their hands before and after coming into contact with patients and after coming into touch with their blood or bodily fluids. In addition, 78.6% of nurses wash their hands both before and after putting on gloves. More than one-third of participants said they never recap needles. Although the majority of nurses concerning personal protective equipment (91.4%, 81.4%, and 65.7%, respectively) always wore gloves, aprons, and masks during procedures that potentially include blood or body fluids, only 31.4% of nurses used eye protection (goggles) (14).

A Brazilian study claims that Regarding compliance with SP, it was noted that only 6.89% of nursing staff members washed their hands before helping patients, or just occasionally During operations where there was a potential of coming into contact with urine or faeces, 100% of participants reported they always wore gloves. However, during procedures when there was a

potential of coming into contact with sick skin, compliance with the use of this equipment decreased (82.75%). When asked if they always utilized goggles and a mask, 79.31% of respondents answered they did. However, just 48.27% of persons use respiratory etiquette when coughing or sneezing (16).

The study at the Gaza government's HD unit found that only 24% of employees were properly washing their hands with water and soap for 30 to 60 seconds, with an overall adherence rate of 56.2%. About 27% of people wash their hands while taking off their jewellery, watches, and rings, with 10% washing their hands before coming into contact with patients and more than 90% washing their hands after. The majority of healthcare professionals wash their hands after coming into touch with blood, body fluids, secretions, and excretions; additionally, half of them wash their hands before dressing, taking blood samples, disinfecting the area, etc. Furthermore, 60% of medical professionals wash their hands after interacting with a patient's environment (11).

The study's findings in the HD unit verified that there was insufficient waste management and personal protective equipment use, with an overall adherence rate of 49.5% and 87.5%, respectively. 55% of workers recap, break, or bend used needles before disposing of them, and 86% of them separate used needles from syringes before disposing of them. Almost all used needles and syringes are disposed of in safety boxes. Additionally, 40% of healthcare professionals divided hazardous garbage into color-coded bins. Inadequate environmental IC practices were found in the observation data, and 54.3% of the practices were adhered to overall. According to the results, the HD unit was not implementing aseptic techniques sufficiently, and the overall adherence rate was 77.5% (11).

Research conducted in the Wogdie district in North-eastern Ethiopia found that 55% of healthcare professionals followed infection prevention practices. Out of all the participants, 68.4% wash their hands with soap before providing care to patients. Approximately 90.6% of participants replace the chlorine solution every 24 hours, and 50.3% of healthcare personnel have worn complete PPE (46). In 2018, a different survey carried out in government health care facilities in Addis Ababa revealed that (66.1%) of HCWs are compliant to infection prevention practices (47). As per a study conducted in Addis Ababa's government hospitals in 2019, Health professionals employed by hospitals in Addis Ababa had a good Standard Precaution Practice of 50.65%. Of the subjects, 21.11% always recapped used needles and approximately 61.5% always changed gloves between

patient interactions. Only safe injection management was used above fifty percent (50%) of the SPP elements (48).

About 25.5% of respondents to a survey conducted at Jimma University Medical Centre reported using injection safety practices safely, while 74.5% reported using them poorly (49). According to a survey conducted at the Debre Markos hospital, 57.3% of healthcare professionals had good practices towards infection prevention practice. In terms of washing hands, 44% and 66.7% of respondents washed their hands using soap before providing patient care and following patient treatment, or following blood contact respectively. The majority of those surveyed had not worn goggles which is 72 percent (26).

Despite the robust recommendation to wear the essential personal protective equipment (PPE) during instruments processing, only one-fifth (22.6%) of HCWs reported that they always wear all the essential PPE, such as masks, eyewear, aprons, and heavy-duty utility gloves (50).

Research conducted at private clinics in Addis Ababa found that 43.2% of the facilities had effective waste segregation procedures. A majority of the clinics (55%) had poor healthcare waste collection practices overall (51). Studies evaluating the degree of compliance with each component of infection prevention and control practices are scarce at hemodialysis units in Addis Ababa.

2.3 Factors Associated with Infection Prevention Compliance

2.3.1 Sociodemographic Factors

A systematic review revealed that HCWs who said they had adequate IPC training and education were substantially more compliant. Older age, non-Hispanic black race and positive attitude were further indicators of successful adherence to IPC practices (27). A study conducted in northern Jordan found no differences in compliance scores between the sexes, educational degrees, or professional ranks (52).

Research carried out in the West Arsi; southeast Ethiopia found, healthcare personnel who had access to infection control guidelines were 3.34 times higher to practice infection control safety as compared to their counterparts. Additionally, compared to those who have not received training, healthcare personnel who have ever participated in infection prevention training were approximately 5.31 times more likely to adhere to appropriate infection control measures (31).

In a study conducted at Debre Markos Referral Hospital, it was shown that healthcare personnel between the ages of 31 and above were roughly two times more likely to practice infection control measures than those in the 21–25 age range. According to this study, the practise of infection prevention improves with higher educational levels Regarding education. This outcome conflicts with research conducted in the Amhara region Additionally, healthcare personnel with work experience of more than ten years were 3 times more likely to engage in infection control practices as compared those with less than five years of experience, which is supported by research in Bahir-Dar city. Healthcare workers who had received training in infection control were four times more likely to practice infection control than those who don't have training. Health care workers who receive infrastructures of infection prevention (such as soap, masks, and IPC guidelines) had higher odds of engaging in infection prevention practices (AOR = 2.156, 95% CI = [1.90-4.357]) as compared to healthcare workers who can't get adequate infrastructure (26).

From socio-demographic characteristics four of them were substantially connected with good infection prevention practises, according to a study in Ethiopia. Age, gender, profession, and a longer service year among healthcare personnel were found to be the underlying variables linked to safe infection prevention practices. Compared to HCWs of higher age, the ages between 20 and 29 years, 30 and 39 years, and 31 to 40 years had better probabilities of good infection prevention practices. In addition, HCWs who are females were more likely than male HCWs to use safe infection-prevention techniques (18).

Research conducted at a government hospital in Addis Ababa found that when compared to certificate holders in the health field, degree holders practiced standard precautions half as often. This suggests that SPP was negatively impacted by higher educational attainment. This might be the result of more knowledgeable medical personnel ignoring SPPs or placing their patients' needs ahead of their safety. In contrast, elder health professionals showed higher SPP than the younger groups (aged 29–40). This study's conclusion differs from another of its kind. One explanation for this could be that the study's younger health professionals' knowledge wasn't backed up by sufficient abilities(48).

2.3.2 Nurses Work Schedule

A study carried out in two hospitals in Egypt claims that morning shifts had higher overall mean scores for nurses' compliance with conventional infection control practices than evening shifts did

(10). This may be explained by the fact that day time working are marked by the presence of the head nurse, sufficient resources and apparatus, and sufficient amount of nurses who are in charge of the unit's patients. Additionally, there were insufficient supplies, equipment, senior staff, and members of IPPS committee during the overnight hours. This finding is confirmed by other researchers, who found that due to a lack of time, a paucity of nurses, inadequate supervision, in addition to the burden in the HD unit, adherence of nurses with SPs during the day time scored better than that of nurses at the night shifts, but contradicted with another research done in 2001 who said that increased adherence with hand hygiene was recorded during the night shift compared to the day time shift (10).

Predictors of HCW's noncompliance, according to a systematic review done in Saudi Arabia included work overload, increased patient-to-nurse ratios, additional beds, time constraints and factors unique to a given professional category (27). In the Ethiopian context, there is a lack of studies on the association between the nurses' work schedule on infection prevention compliance, so this study will fill the gap by assessing the relationship between, the length of time, the frequency of duty, and the workload of nurses and their infection prevention compliance.

2.3.3 Work Environment Factors

Work environment factors include infrastructures that are directly related to infection prevention compliance and work-related infrastructures for treating patients that create good work environment for staffs. Barriers to HCWs to follow conventional measures included the lack of infrastructures like(soap, a nearby sink, and alcohol based hand rub and paper towel), as well as uncomfortable or difficult to apply hand agents according to a systematic review in Saudi -Arabia (27).

Based on a study that was done in public hospitals in Addis Ababa, as Compared to healthcare workers at institutions where their department does not have a constant supply of water, continuous water supply employees were 1.6 times more likely to follow infection prevention practices (AOR=1.68, 95%CI: 1.11-2.56) in Contrary to the findings from West Arsi. However, availability of water and other facilities have a direct impact on the practice (47).

The likelihood of using safe infection control techniques is higher for healthcare personnel who work in environments with a constant water supply. In a similar vein, the probabilities of

preventive practice are higher for healthcare workers who work in facilities where working departments have access to infection prevention guidelines. Lastly, the most significant element in line with infection prevention practice included the kind of healthcare facility, working department, and the completion of official infection prevention training according to a systematic review and meta-analysis done in Ethiopia (18).

2.3.4 Knowledge and Attitude About Infection Prevention and Control

A systematic review conducted in Saudi Arabia found that increased IPC awareness, along with the impression of danger associated with disobeying IPC directives, encouraged HCWs to be more compliant (27). One of Ghana's top teaching hospitals, the Korle-bu Teaching Hospital in Accra, conducted a study in 2006 with 50 medical professionals, ranging from students to consultants, and results revealed a gap between knowledge of SPs and practice. In the Greater Accra Region of Ghana, a survey of 422 HCWs found that those with sufficient awareness of safety and health were more likely to adhere to SPs (53).

Research conducted in Ethiopia in government-run healthcare institutions in Addis Ababa found that HCWs who were knowledgeable about infection control procedures were 1.5 times more likely to practice infection control as compared to their counterparts (47). In comparison to HCWs who had a negative attitude towards infection prevention practices, those with a positive attitude were twice as likely to have better infection prevention practices and studies from China and other comparable studies lend support to this conclusion(47). Additionally, this study showed that a positive attitude towards infection prevention practices is essential for healthcare facilities to implement effective infection prevention practices (47). Similarly, a systematic review and meta-analysis carried out in Ethiopia discovered that the most frequently observed factors associated with the aforementioned practice were awareness of infection prevention recommendations and having a positive attitude towards infection prevention measures (18).

2.3.5 Communication with other staff

A possible contributing factor to healthcare professionals' noncompliance with infection control measures is inadequate communication regarding infection control requirements while giving care (54). In more than 30% of transfers involving patients with MRSA or VRE, standard infection

control procedures were not followed based on a recent investigation of inpatient transfers to radiology. Further observations of the transfer procedure showed that non-compliance may be caused by inadequate disclosure of a patient's infectious status. Unless the transport team was informed of the patient's infectious state, standard precautions were rarely followed during transfers, even though they were recommended for managing patients whose infectious status was unknown (54).

2.4 Conceptual Framework on factors associated with IPC practice

This conceptual framework is developed after reviewing different literature on factors associated with infection prevention compliance among nurses which includes, work schedule sociodemographic, knowledge, attitude, work environment, and communication ability of nurses.

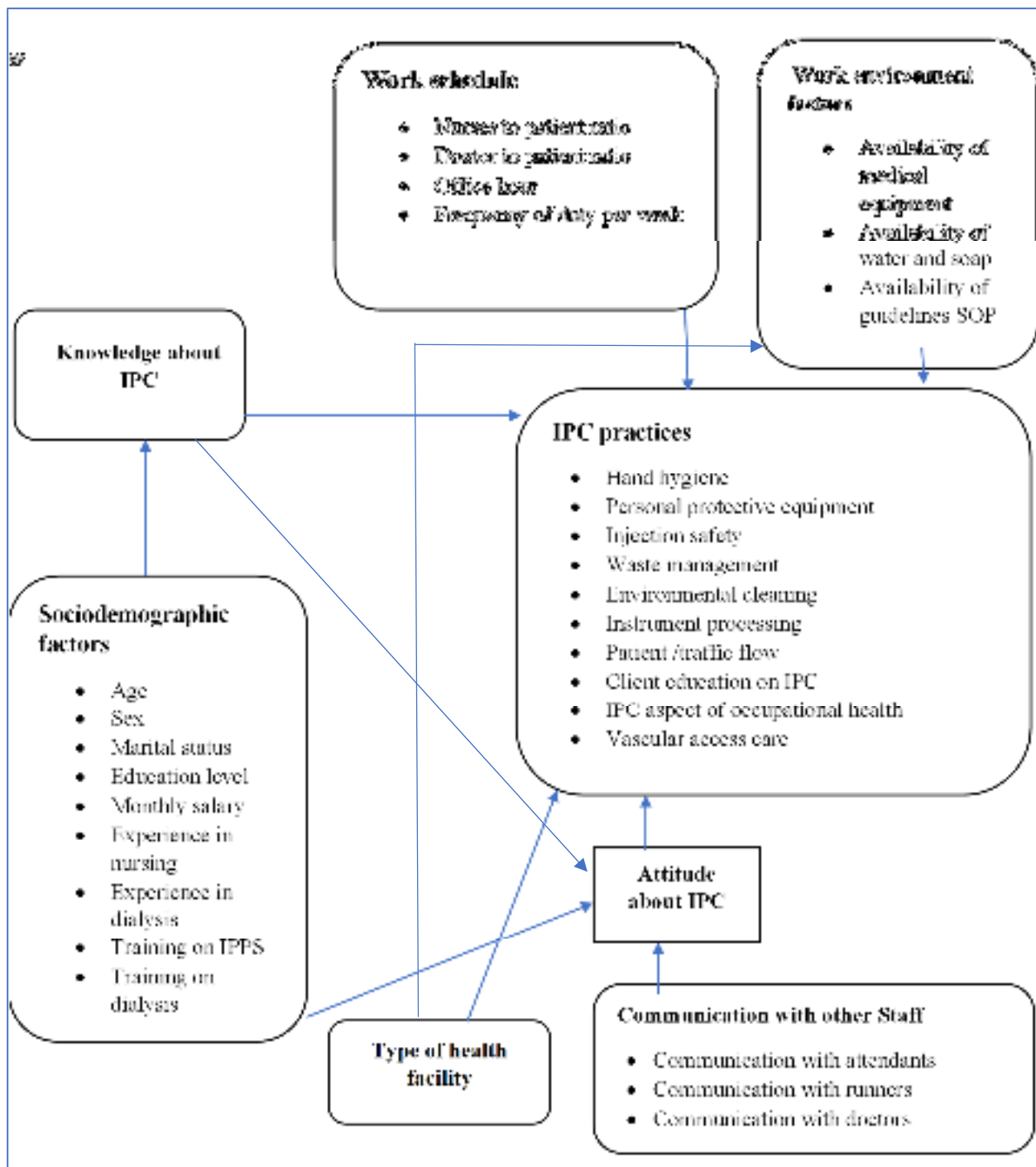


Figure 1: Conceptual Frame Work on Factors Associated with IPC Practice Developed Based on Review of Literatures (10), (27), (31), (47), (48). (December, 2023)

3 Objective

3.1 General Objective

- To assess infection prevention compliance and associated factors among nurses working at dialysis units for chronic kidney disease patients in Addis Ababa in 2024.

3.2 Specific Objectives

- To assess the compliance of infection prevention practice among nurses working at dialysis units for chronic kidney disease patients in Addis Ababa in 2024.
- To identify factors associated with the compliance of infection prevention practice among nurses working at dialysis units for chronic kidney disease patients in Addis Ababa in 2024.

4. Methods and Materials

4.1 Study Area and Period

The study was conducted in dialysis units found in Addis Ababa that offer dialysis services for CKD patients from January to May 2024. These dialysis units include clinics that exclusively provide dialysis services, government hospitals, and private hospitals that have dialysis services for CKD patients in addition to the general health care service delivery. Here the dialysis services do not include those for Acute Kidney Injury only, The term "acute kidney injury" (AKI) refers to a sudden decline in kidney function, with a range of possible outcomes (including complete renal recovery, the development of CKD, and death) (55). However, services that are primarily for people with chronic kidney disease (CKD) but may also benefit AKI patients are included. Addis Ababa has a population size of 3,435,028 in 2020. There are 13 government and more than 34 private hospitals in the centers providing different public health services (56).

Currently, there are 13 public hospitals, but it was a little difficult to fix the number of private hospitals because there are some that are closed and the study aims to include any new dialysis units if any up to the end of data collection. Dialysis service is available for CKD patients in 20 private hospitals, while 4 governmental hospitals—St. Paul Hospital, Millennium Medical College, Zewditu Memorial Hospital, Minilik II Hospital, and Torhayloch Hospital—also provide the service. Additionally, Addis Ababa is home to 4 dialysis-only clinics (facilities that provide only dialysis service) that provide chronic dialysis patients with their needed services based on the previous study and by addition of a newly opened dialysis unit after the study. Currently, there are a total of 251 nurses working at the dialysis unit for CKD patients in Addis Ababa.

4.2 Study Design

A facility-based cross-sectional study was conducted among nurses working at the dialysis unit for CKD patients in Addis Ababa.

4.3 Source Population

All nurses working at the dialysis units for CKD patients in Addis Ababa.

4.4 Study Population

All nurses working at the dialysis units for CKD patients in selected health facilities in Addis Ababa during the study period.

4.5 Inclusion Criteria

Nurses who work for more than 6 months at the dialysis units for CKD patients and who are willing to participate are included in the study. (More than six months of employment qualify a person as a permanent employee).

4.6 Exclusion Criteria

Nurses who are on annual leave, maternity leave, or students were excluded from the study.

4.7 Sample Size Determination

The study includes all the nurses (251) working at dialysis unit for CKD patients in Addis Ababa (census data). The sample size calculation below is to check the power of the study.

Sample size-based on Objective 1: A single population proportion formula was used to assess the compliance level considering the following assumptions:

Z = level of confidence (1.96)

P = single population proportion of infection prevention compliance (66.1%), from a study conducted in Addis Ababa (47)

d = margin of error (5%)

n = sample size

$$n = \frac{(Z_{\alpha/2})^2 pq}{d^2}$$

The sample size n=344

since the above sample is to be taken from a relatively small population(N=251). The required minimum sample was obtained by using the correction formula, so the final sample size could be n final = 145 Moreover, considering a 10% non-response rate **Final Sample Size =160** using the following correction formula:

$$n_{final} = \frac{n}{1 + \frac{n}{N}}$$

Sample size based on objective 2: The sample size was also calculated based on the second objective using Epi-Info version 7 for selected variables under the assumptions of 95% confidence intervals (CI), 80% power, and a ratio of exposed to unexposed is 1.

Table 1: Estimated sample size based on objective 2

Variable	% in unexposed	The ratio of exposed to non-exposed	Power	Confidence level	OR	Sample size	Correction formula	Non-response rate (10%)	citation
Knowledge of IPC	57.4	1:1	80%	95%	1.53	784	190	209	47
Attitude toward IPC	48.5	1:1	80%	95%	2.03	282	133	146	47

The sample size calculated based on objective 2 is the largest of all, the sample size for the study is 209 if we are to conduct a survey.

The total number of nurses (census data) in the dialysis unit for CKD patients in Addis Ababa is 251 using this, the estimated power of the study is 88.8%.

4.8 Characteristics of Dialysis Units in Addis Ababa

Here is a description of the current status of hospitals in Addis Ababa and how we plan to access dialysis services. Since census data is used for this study, no sampling procedure is used for data collection. The first step was to identify all public and private hospitals in Addis Ababa this was done by collecting information from Addis Ababa health bureau and searching online for the health facilities. These hospitals offering dialysis service for CKD patients are included so hospitals without dialysis service and those having dialysis service only for AKI patients are excluded because their treatment is different from CKD patients. Lastly, dialysis clinics that offer exclusively dialysis treatments for CKD patients are included. All of the nurses who qualify for the study are included after facilities have been found.

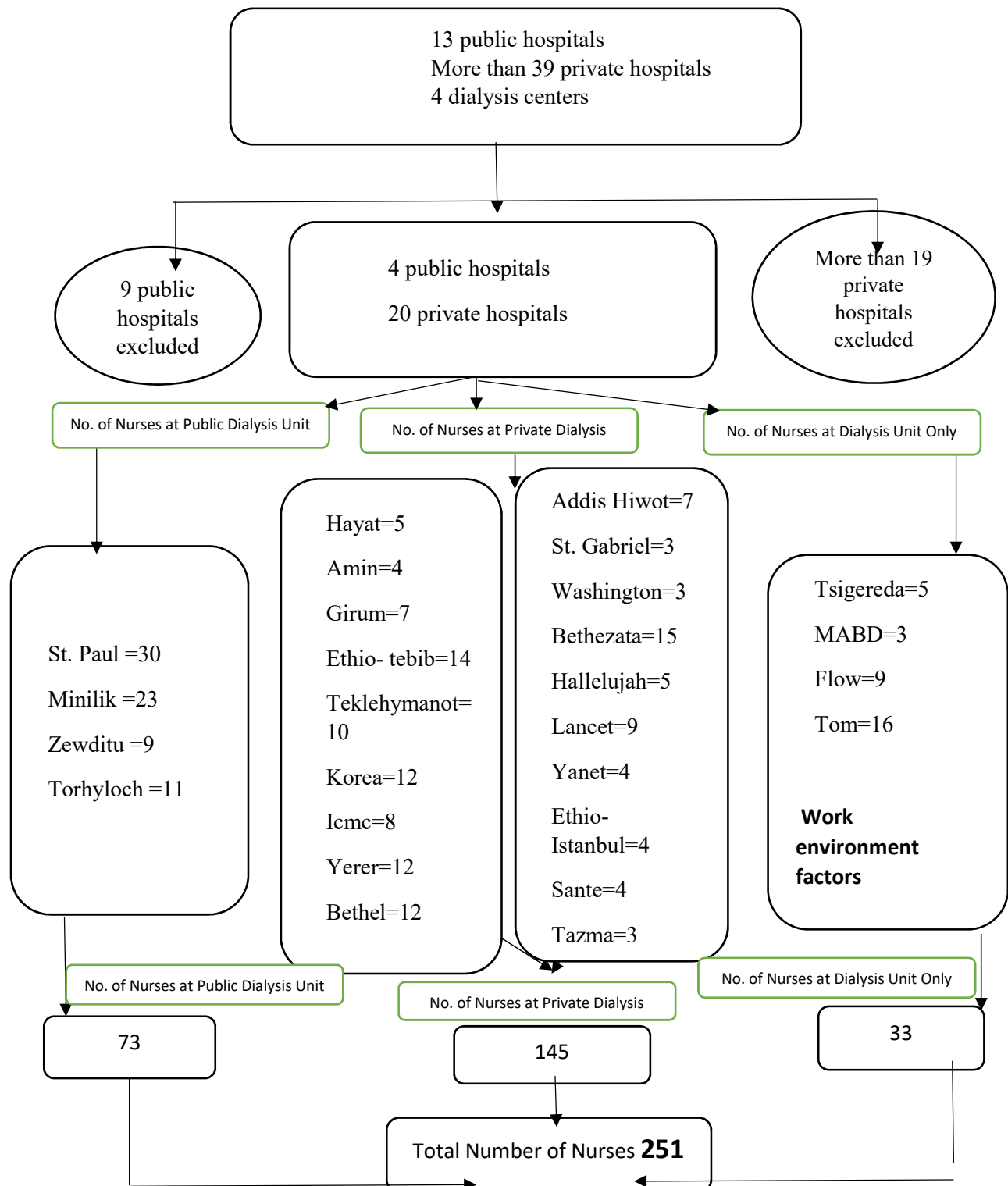


Figure 2: The Characteristics of Dialysis Services for CKD patients in Addis Ababa, Ethiopia (December,2023)

4.9 Variables

4.9.1 Dependent Variables

- Infection prevention and control practices (Hand Hygiene, PPE, Injection Safety, Waste Management, Environmental Cleaning, Instrument Processing, Patient/ Traffic Flow, Client Education, IPC Aspect of Occupational Health, and Vascular Access Care). It develops a composite index based on these dimensions as a continuous variable as well as categorizes it into two groups: compliant with IPC and noncompliant.

4.9.2 Independent variables

- Sociodemographic Factors: (age, sex, marital status, education level, monthly salary, experience in nursing, experience in dialysis, training on IPPS, training on dialysis)
- Nurses Work Schedule :(nurse to patient ratio, doctor to patient ratio, office hour, frequency of duty per week)
- Work environment Factors :(availability of medical equipment, availability of water and soap, availability of guideline SOP)
- Knowledge of IPC
- Attitude
- Communication
- Type of facility: (government and private)

4.10 Data Collection Procedure

Data collection was held between January - March 2024 through data collection by observation using covert participant type for the IPC practice part. Covert participant observation's primary benefit is that it avoids the observer effect so that participants do not know that their behaviours and actions are being studied. The observation was done by head nurses of the dialysis unit after explaining the whole procedure on how to fill the checklist for each nurses and it was explained well the importance of the study if we get the true observation, this was done to encourage head nurses to fill the observation being unbiased for their own facility .The remaining questions are addressed through a self-administered questionnaire adopted from different literature (6), (17),

(34), (48), and (54). Initially the self-administered data was collected from the nurses and it was coded and given to the head nurses to align the self-administered questionnaire with the observation for each nurse. For some of the nurse's data was not collected on the day it was administered because they were busy in treating patients and didn't get time to fill during the working hour, so they replay after filling the questionnaire at home. The data collection procedure was done by the principal investigator with data collectors and supervisors. Two Data collectors and one supervisor who have health-related educational backgrounds and have experience in research work and our work colleagues were involved and have been trained for 2 days concerning the purpose of the study, data collection process, and ethics of the research. The ethical clearance letter was distributed to each facility to get permission to collect the data after explaining well the importance of the study to all hospital CEO and later to the matron. All dialysis units give us permission to collect the data except one private hospital which were not volunteer to undergo the data collection. The questionnaire was pretested two weeks before the actual data collection among 5% or (13) participants in Addis Ababa. The reliability of the study instrument was ensured by calculating Cronbach's alpha coefficient to measure the internal consistency of the IPC practice, knowledge, and the Likert scale items and it was above 0.7 for all. The questionnaire contains (eight) sections which include: sociodemographic, knowledge, attitude, questions on nurses' work schedules, work environment -related questions, and Communication skills, type of facility and infection prevention practice compliance questions). The questionnaire was prepared in English, since the study participants are educated with a nursing educational background, the English version of the questionnaire was used.

4.11 Data Quality Management

The daily completed questionnaires and checklists were handed over to the supervisor on each day of data collection. The supervisor has checked filled questionnaires for completeness and accuracy and submitted the filled questionnaire to the principal investigator. Appropriately filled or missed ones had been sent back to data collectors for correction. Any confusion is corrected on the next day of data collection. Data backups are created by storing data in various folders of the computer, flash, and email.

4.12 Operational Definition

- **Infection prevention practice compliance:** refers to the degree to which nurses follow the state of guidelines in real life. It was computed from 35 yes or no questions, using the PCA nurses with practice index PI equal to or above zero were classified as good practice (compliance) and PI less than zero as Poor practice (non-compliance) (57).
- **Knowledge of infection prevention:** - it's an awareness (being informed or having information) and understanding of nurses working at the dialysis unit on infection prevention activities when caring for patients. It was computed from 17 yes or no questions. Nurses' knowledge of infection prevention was categorized using the PCA analysis, as having adequate knowledge if the score was equal to or above zero. Respondents were classified as having inadequate knowledge if they score less than zero (57).
- **The attitude of infection prevention:** - is a nurse's desired behaviour with infection prevention. There are 13 attitude questions with five –point Likert-type scale response options including strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. Using the principal component analysis nurses were classified as having unfavourable attitude for Scores below zero and a favourable attitude for scores equal to zero and above (57).
- **Communication:** Good communication between nurses and other staff specifically runners, patient attendants, and doctors is important for the successful outcome of nursing care of each patient (54). Each question is rated using a Likert-style scale from 1 to 5. Using the principal component analysis nurses were classified as having poor communication for Scores below zero and good communication for scores zero or above (57).
- **Work environment factors:** refers to how often infrastructures are available. A Likert-type scale ranging from 1 to 5 were used to rate the items. Using the principal component analysis nurses were classified as having good work environment factor if the score was equal to or above zero and poor work environment factor for scores less than zero (57).
- **Healthcare-associated infections:** A healthcare-associated infection (HCAI) is an infection that manifests itself in a patient when they are being treated in a hospital, long-term care facility, outpatient clinic, or in any healthcare institution but was not present or incubating at the time of admission this term replaces both Hospital-acquired infections and nosocomial infections (7).

4.13 Data Analysis Procedure

Data are carefully entered and cleaned using Epi Data and exported to STATA Version 17 for analysis. The study applies Principal Component Analysis to generate an index for the practice part and for some of the independent variables. Descriptive statistical analysis is applied to participants' socio-demographic data, level of attitude, level of knowledge, work environment factors, communication skills, work schedule of nurses, type of facility and level of compliance. Pearson correlation estimates are used to test the relationship between the continuous and indexed independent variables and the chi-square test for the categorical variables.

Finally, multivariable logistic regression based on step-wise forward estimation is employed since the dependent variable is based on the composite index and taking zero as a cut-off point. In all cases, p-values of less than 0.05 and 95% confidence interval of non-inclusive null value were considered as significantly associated variables with the outcome variable.

Hosmer -Lemeshow test was used to assess goodness of fit for the model, the value was greater than 0.05, which indicate a good fitting model. Collinearity was checked using Kendall's tau-b and Spearman rho tests the correlation coefficient for each variable was less than 0.75, indicating the specific independent variable was not influenced by other independent variable in the model.

4.14 Ethical Consideration

Ethical clearance was secured from the AAU School of Public Health, Research, and Ethics Committee and AARHB (Addis Ababa Regional Health Bureau). An official support letter was written and provided to concerned bodies. Participants who meet the eligibility requirements were notified about the purpose of the study and that participation was entirely voluntary and they were free to withdraw at any time. The data collected for the study was only used for the study and confidentiality was maintained. No one other than the principal investigator has access to the data.

4.15 Dissemination of the Results

The study findings could be presented and submitted at the Addis Ababa University School of Public Health as a requirement for a public health master's degree. Results shall also be disseminated for Addis Ababa Regional Health Bureau and other related organizations. Results will also be disseminated through the publication of the research.

5. Results

5.1 Sociodemographic Characteristics of The Respondents

A total of 251 dialysis unit nurses were approached among which 230 dialysis unit nurses were consented to involve in the study with a response rate of 92%. Out of all respondents, 187 (81.3%) of them were females and 61.7% of respondents were less than 30 years old with mean age of 28.80 years (28.80 ± 4.71 SD). Regarding marital status 116(50.43%) of respondents were single followed by 58(25.22%) married and 56(24.35%) others (divorced or widowed). The majority of respondents 184(80%) were bachelor degree holders followed by diploma 25(10.87%) and masters 21 (9.13%). Regarding facility type, 64 (27.83%) nurses are employed by government hospitals, while 166 (72.17%) work in private hospital. (Table 2)

Table 2: Sociodemographic Characteristics of Dialysis Unit Nurses in Addis Ababa, Ethiopia

Variables	Categories	Frequency	Percent %
Age	Less than 30	142	61.74
	30 – 39	84	36.52
	40 – 49	3	1.30
	50 years& More	1	0.43
Sex	Male	43	18.7
	Female	187	81.3
Marital status	Married	58	25.22
	Single	116	50.43
	Others (divorced &widowed)	56	24.35
Education	Diploma	25	10.87
	Bachelor degree	184	80
	Masters	21	9.13
Salary	Less than, 10,000	195	84.78
	10,000-20,000	35	15.22
Experience in Nursing			
	Less than 5	125	54.35
	6 – 10	76	33.04
	11- 15	23	10.00
	16 years and more	6	2.61
Experience in Dialysis			
	Less than 5	183	79.57
	6 – 10	43	18.70
	11- 15	4	1.74
Facility	Government	64	27.83
	Private	166	72.17
Training on IPPS	Yes	166	72.17
	No	64	27.83
Training on dialysis	Yes	185	80.43
	No	45	19.57

5.2 Nurses Work Schedule

As indicated below in Figure 3, the mean of nurse-to-patient ratio and doctor-to-patient ratio was 3.72 (3.72 ± 1.75) and 14.96 (14.96 ± 10.30) respectively. With a maximum of one nurse for every

9 patients and one doctor for every 48 patients. The frequency of duty ranges from 0 to 4 days per week with a mean of 1.62 (1.62 ± 1.40). The respondent's office hour ranges from 8 hours to 10 hours with a mean of 8.29 (8.29 ± 0.71). (Figure 3)

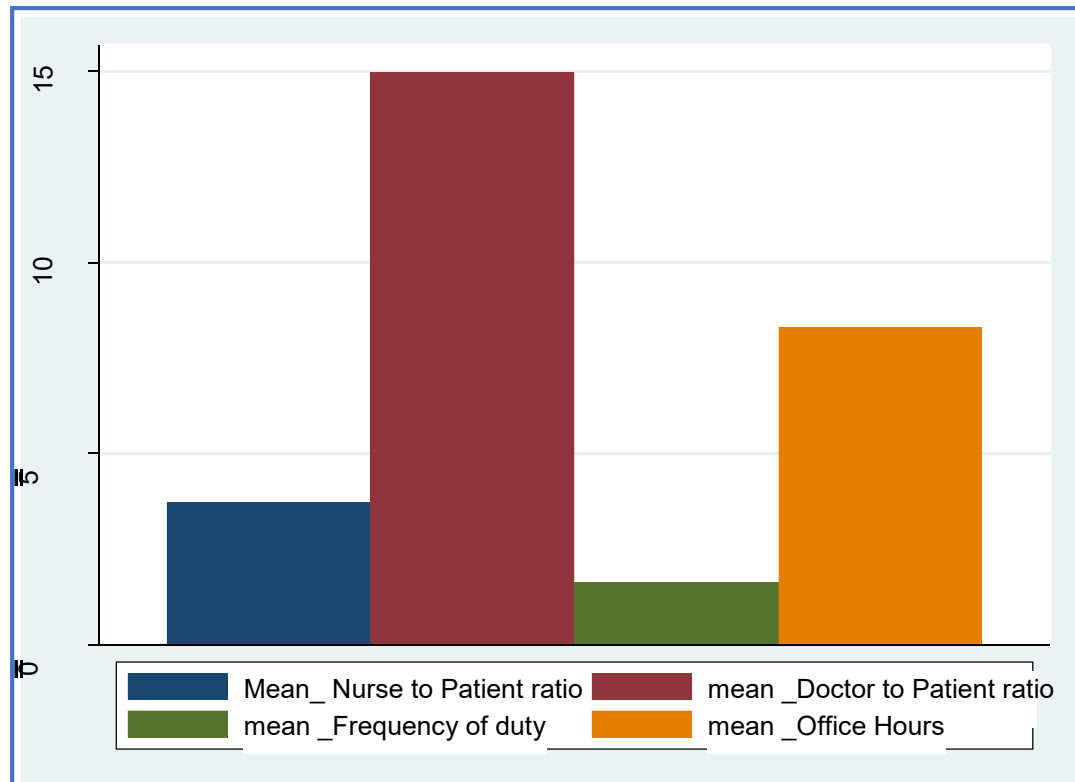


Figure 3: Dialysis Unit Nurses Work Schedule in Addis Ababa, Ethiopia, 2024

The study applies Principal component analysis, but the results based on mean score analysis below are presented for comparison purpose

5.3 Work Environment Factors

According to our study 215 (93.48%) of the respondents had IPC guidelines, this is done by assessing the availability in each facility. More than three fourth 77.83% of the respondents had always access to continuous water supply, 66.96 % of the respondents had always access to soap, 67.83 % of them had always access to alcohol-based hand rub, 76.09 % had always disposable gloves.

The overall mean score of work environment factors of the study participants was 4.38 ± 0.70 (median score=4.66). Moreover, 149(64.78%) of the study participants had a good work environment factor with a score of 4.38 and above. (See Annex 4)

5.4 Knowledge of Nurses About Infection Prevention and Control

For the most part, respondents answered between 50% and 98.26% of the knowledge questions. However, just 30 % of them are aware that there is no need to wear the same pair of gloves for multiple patients as long as there is no visible contamination .Only 10.43% of them are aware that the previously applied procedure (all instruments should be decontaminate first thoroughly cleaned and dried before being sterilized) no more used currently and only 24.78% of them are aware that the procedure (after proper decontamination and cleaning 0.1% chlorine solution for 20 minutes provide HLD) no more used currently.

The study participants overall mean score of knowledge was 0.72 ± 0.09 (median score=0.70). Furthermore 117 (50.9%) of the study participants had inadequate knowledge as indicated by a knowledge score below 0.72 (See Annex 5).

5.5 Attitude of Nurses About Infection Prevention and Control

From all participants 91.3 %agree on the fact that following standard operation procedures decreases the risk of contamination similarly, 91.31% of them believe that ventilating the ward by opening windows and doors decreases infection transitions. 92.18% of the respondents believe that using personal protective equipment (PPE) decreases HCAIs.92.61% agree that washing hands before and after contact with patients is important, 84.34% of the respondents believe that hospital facilities can be the source of infection in the absence of universal precaution.87.39% of them think separating needle and other types of waste is visible. 88.7% agree on the fact that using biohazard material is better for waste management. 85.65% agree that a patient's awareness about the transmission of microorganisms decreases the risk of HCAIs.85.65% agree that recapping is the cause of needle prick injury.90.87% believe that nosocomial infection can pose a serious outcome.87.39% believe the CLABSI prevention guidelines are useful.92.17% believe hand hygiene before and after the replacement of dressings is important to reduce CLABSI. 90% agree that it is necessary to establish an occupational protection training course in their opinion. (the above description considers strongly disagree, disagree, and indifferent as disagree while agreeing and strongly agree as agree).

The overall mean score of attitudes of the study participants was 4.27 ± 0.76 (median score=4.38). Moreover, 136(59.13%) of the study participants had favourable attitudes as evidenced by an attitude score of 4.27 and above. (See Annex 6)

5.6 Communication of Nurses

Most of the study participants had good communication in consistently delivering accurate, clear, and concise messages and effectively informing attendants about infection and its prevention. But, the majority of the respondents had poor communication in consistently delivering accurate, clear, and concise messages and effectively informing runners about infection and its prevention, and also poor communication in encouraging an open exchange of ideas and different points of view; with doctors.

The overall mean score of communication of the study participants was 3.93 ± 0.93 (median score=4.00). Moreover, 135 (58.69%) of the study participants had good communication as indicated by a communication score of 3.93 and above. (Annex 7)

5.7 Nurse's Infection Prevention Practice Compliance

Hand hygiene:

The overall mean score of hand hygiene practice of the study participants was 0.78 ± 0.26 (median score=1.00). 122 (53.04%) of the study participants had good hand hygiene practices with a practice score of 0.78 and above.

Personal Protective Equipment (PPE): The overall mean score of PPE practice of the study participants was 0.69 ± 0.23 (median score=0.75). 130 (56.52%) of the study participants in the study had good PPE practice with practice score of scores of 0.69 and above.

Instrument processing: The overall mean score of instrument processing practice of the study participants was 0.25 ± 0.24 (median score=0.33). Moreover 142 (61.73%) of the study participants had good instrument processing practice with a practice score of 0.25 and above.

Injection safety: The overall mean score of injection safety practice of the study participants was 0.90 ± 0.16 (median score=1.00). Moreover, 155 (67.39%) of the study participants had good injection safety practices as evidenced by a practice score of 0.90 and above.

Environmental cleaning: The overall mean score of environmental cleaning practice of the study participants was 0.91 ± 0.20 (median score=1.00). Additionally, 191 (83.04%) of the study participants had good environmental cleaning practices as evidenced by a practice score of 0.91 and above.

Waste management: The overall mean score of waste management practice of the study participants was 0.88 ± 0.18 (median score=1.00). furthermore, 208 (90.43%) of the study participants had good waste management practices with a practice score of 0.88 and above.

Patient /Traffic flow: The overall mean score of traffic flow practice of the study participants was 0.74 ± 0.28 (median score=0.75). Moreover, 161 (70 %) of the study participants had good traffic flow practice with a practice score of 0.74 and above.

Vascular access care: The overall mean score of vascular access care practice of the study participants was 0.90 ± 0.11 (median score=1.00). Moreover, 122 (53.04 %) respondents had good vascular access care practices with a practice score of 0.90 and above.

Client education: The overall mean score of client education practice of the study participants was 0.83 ± 0.34 (median score=1.00). Additionally, 182 (79.13 %) of the study participants had good client education practice with a practice score of 0.83 and above.

Occupational health: The overall mean score of occupational health practice of the study participants was 0.78 ± 0.41 (median score=1.00.) Moreover, 180 (78.26 %) of the study participants had good occupational health practice with a practice score of 0.78 and above.

The overall mean score of infection prevention practice compliance of the study participants was 0.77 ± 0.13 (median score=0.79). Moreover, 132 (57.39 %) of the study participants are compliant to IPC practice with a practice score of 0.77 and above. (See Table 3)

Table 3: Dialysis Unit Nurses Practice on Infection Prevention and Control based on mean score analysis in Addis Ababa,2024

S/N	Standard Precautions	Mean Score	Compliant (%)
1.	Hand hygiene	0.78 ± 0.26 (median score=1.00)	53.04
2.	Personal protective equipment	0.69 ± 0.23 (median score=0.75)	56.52
3.	Instrument processing	0.25 ± 0.24 (median score=0.33)	61.73
4.	Injection safety	0.90 ± 0.16 (median score=1.00)	67.39
5.	Environmental cleaning	0.91 ± 0.20 (median score=1.00)	83.04
6.	Waste management	0.88 ± 0.18 (median score=1.00)	90.43
7.	Traffic flow	0.74 ± 0.28 (median score=0.75)	70.00
8	Vascular access care	0.90 ± 0.11 (median score=1.00)	53.04
9.	Client education	0.83± 0.34 (median score=1.00)	79.13
10	Occupational health	0.78 ± 0.41(median score=1.00)	78.26
	Total (overall mean score)	0.77 ± 0.13(median score=0.79)	57.39

5.8 Principal Component Analysis

5.8.1 Principal Component Analysis for Compliance with IPC Practice

Principal components analysis is a method for explaining the maximum amount of variance among a set of items by creating linear functions of those items for the purpose of identifying the smallest number of linear functions necessary to explain the total variance observed for the item set in the correlation matrix, PCA identifies the smallest number of components necessary to explain as much (or all) of the variance as possible and help to avoid multicollinearity (58).

In addition to this, the Principal Component Analysis (PCA) gives unequal weight to each dimension to compute the index of compliance with IPC practices and for some of the independent variables, unlike the mean score computation. This also gives a comparative advantage over the mean score discussed above, which provides equal weight to each dimension of the questionnaire. Therefore, the discussion below focuses on working out the PCA for each dimension and finally gets the index of compliance to IPC practices based on unequal weight. Once the index is developed, one can say that there is compliance with the IPC practices if its value falls above zero, and noncompliance if it is below zero. This approach is very common in science and the World Bank governance indicator is also applied with a score above zero indicating effective governance and a score below zero indicating ineffective governance. Let's see how the stata performs PCA

in detail for the hand hygiene practice as an example, so the others will be computed similarly and discussed briefly.

Regarding the principal component analysis for hand hygiene, the study takes on washing hands with soap and water before and after patient care, washing hands After touching blood, body fluids, secretions, excretions, and contaminated items (including in front of the hemodialysis machine), Washing hands immediately after removal of gloves and use antiseptic hand rub to clean hands in line with hand hygiene practice and applies the principal components factoring. The result is presented in Table 4 which contains the Eigenvalues for each factor the rotated factor loadings and unique variances of the observable variables.

The LR test using the chi2 test with $\text{Prob.} > \chi^2 = 0.0000$ indicates that the model is good and statistically significant at a 5 percent level of significance. The Eigenvalues show that total variance is accounted for by each factor. The sum of all Eigenvalues is equal to the total number of variables. The Kaiser criterion suggests retaining those factors with eigenvalues equal to or higher than one so that factor 1 is retained and considered. The difference tells the difference between one eigenvalue and the next one. The proportion part explains the relative weight of each factor in the total variance given that the sum of Eigenvalues is equal to the total number of variables. Therefore, it is computed by the ratio of Eigenvalue to the total number of factors so that the retained factor 1 explains 47.04 percent of the total variance.

In the table of factor loadings and unique variances, factor loadings are the weights and correlations between each variable and the factor. The higher the load the more relevant in defining the factor's dimensionality. A negative value, if any, indicates an inverse impact on the factor. Here, factor 1 is retained because of its eigenvalue over 1. Uniqueness is the variance that is 'unique' to the variable and not shared with other variables. It is equal to $1 - \text{commonality}$ (variance that is shared with other variables). In this regard, 43.69 percent of (Washing hands with soap and water before and after patient care) is not shared with other variables in the overall factor model at an equal level. Notice that the greater 'uniqueness' the lower the relevance of the variable in the factor model.

As shown in the table below, factor 1 fits the necessary statistical requirement which is its Eigen value is 1.88. Besides this, the Kaiser- Meyer-Okl (KMO) sampling adequacy measure is 0.61 which is greater than 0.5. This result indicates that the sample size was sufficient to run factor

analysis using the principal component factor. In line with this, the factor loading of all factors is greater than + 0.3 which satisfies the minimum level of factor loading of 0.3 and higher.

The relative size of variables scoring has relevant policy implications (the higher the coefficient score, the more important it is and more policy attention should be given to it). In general, as mentioned above in the methodology part, the indicators factor weight is used to estimate the Hand Hygiene index. As a result, the factor 1 indicator was used to estimate the Hand Hygiene index. It was estimated as;(HH - hand hygiene)

$$HH = 0.47 * Factor1$$

The result obtained $HH = 0.47 * Factor1$ was further used in estimating the overall hand hygiene index for each dialysis unit nurse. Thus, the study employs the same procedures as the other components of the Practice Index Measurement and Analysis (PIMA) model.

Interpretation:122 (53.04 %) dialysis unit nurses have good hand hygiene practice indicated by a Hand Hygiene index score>0.

Regarding the principal component analysis for personal protective equipment (PPE), the LR test using the chi2 test with Prob.>chi2 = 0.0000 indicates that the model is good and statistically significant at a 5 percent level of significance. Factor 1 and factor 2 are retained and considered as the eigenvalue is greater than 1. Factor 1 and factor 2 explain 37.59 and 34.68 percent of the total variance. As a result, Factor 1 and Factor 2 indicators were used to estimate PPE index. It was estimated as;(PPE – personal protective equipment)

$$PPE = [0.37 * factor1 + 0.34 * factor2] / 2$$

Interpretation:128 (55.65%) dialysis unit nurses have good PPE practice indicated by PPE index score>0.

Regarding the principal component analysis for instrument processing, the LR test using the chi2 test with Prob.>chi2 = 0.0000 indicates that the model is good and statistically significant at 5 percent level of significance. Factor 1 is retained and considered as the eigenvalue is greater than 1. Factor 1 explains 48.7 percent of the total variance.

As a result, the Factor 1 indicator was used to estimate the Instrument Processing index. It was estimated as;(I.P –instrument processing)

$$I.P = 0.48 * Factor1$$

Interpretation:186 (80.86%) dialysis unit nurses have poor instrument processing practice indicated by an Instrument Processing Index score < 0.

Regarding the principal component analysis for injection safety, the LR test using the chi2 test with Prob.>chi2 = 0.0000 indicates that the model is good and statistically significant at 5 percent level of significance. Factor 1 and Factor 2 were retained and considered, as the eigenvalue is greater than 1. Factor 1 explains 36.13 percent and Factor 2 explains 21.56 percent of the total variance. As a result, Factor 1 and Factor 2 indicators were used to estimate the injection safety index. It was estimated as;(I.S- injection safety)

$$I.S = [0.36 * factor1 + 0.21 * factor2] / 2$$

Interpretation:132 (57.39%) dialysis unit nurses have good injection safety practices indicated by an Injection Safety Index score > 0.

Regarding the principal component analysis for environmental cleaning, the LR test using the chi2 test with Prob.>chi2 = 0.0182 indicates that the model is good and statistically significant at 5 percent level of significance. Factor 1 was retained and considered, as the eigenvalue is greater than 1. Factor 1 explains 57.76 percent of the total variance. As a result, the Factor 1 indicator was used to estimate the environmental cleaning index. It was estimated as;(E.C–environmental cleaning)

$$E.C = 0.57 * Factor1$$

Interpretation:191 (83.04%) dialysis unit nurses have good environmental cleaning practices indicated by an Environmental Cleaning Index score > 0.

Regarding the principal component analysis for waste management, the LR test using the chi2 test with Prob.>chi2 = 0.0000 indicates that the model is good and statistically significant at 5 percent level of significance. Factor 1 and Factor 2 were retained and considered, as the eigenvalue is greater than 1. Factor 1 explains 39.46 percent and Factor 2 explains 26.00 percent of the total

variance. As a result, Factor 1 and Factor 2 indicators were used for the Waste Management Index. It was estimated as;(W.M-waste management)

$$W.M = [0.39 * factor1 + 0.26 * factor2] / 2$$

Interpretation:132 (57.39%) dialysis unit nurses have good waste management practices indicated by a Waste Management Index score > 0.

Regarding the principal component analysis for traffic flow, the LR test using the chi2 test with Prob.>chi2 = 0.0182 indicates that the model is good and statistically significant at 5 percent level of significance. Factor 1 was retained and considered, as the eigenvalue is greater than 1. Factor 1 explains 46.25 percent of the total variance. As a result, the Factor 1 indicator was used to estimate the Traffic Flow Index. It was estimated as (T.F-traffic flow)

$$T.F = 0.46 * factor1$$

Interpretation:118 (51.30%) dialysis unit nurses have good Traffic flow practice indicated by the Traffic Flow Index score > 0.

Regarding the principal component analysis for vascular access care, the LR test using the chi2 test with Prob.>chi2 = 0.0000 indicates that the model is good and statistically significant at 5 percent level of significance. Factor 1, Factor 2, and Factor 3 were retained and considered, as the eigenvalue is greater than 1. Factor 1 explains 22.87 percent, Factor 2 explains 20.66 percent and Factor 3 explains 18.74 percent of the total variance.

As a result, Factor 1 Factor 2 and Factor 3 are indicators used to estimate the Vascular Access Care index. It was estimated as(V.A-vascular access care)

$$V.A = [0.22 * factor1 + 0.20 * factor2 + 0.18 * factor3] / 3$$

Interpretation:138 (60.00%) dialysis unit nurses have good vascular access care practice indicated by vascular access care index score > 0.

Regarding the principal component analysis for client education, the LR test using the chi2 test with Prob.>chi2 = 0.0000 indicates that the model is good and statistically significant at 5 percent level of significance. Factor 1 was retained and considered, as the eigenvalue is greater than 1. Factor 1 explains 86.11 percent of the total variance.

As a result, the Factor 1 indicator was used to estimate the client education index. It was estimated as (C.I-client education)

$$C.E = 0.86 * factor1$$

Interpretation: 182 (79.13%) dialysis unit nurses have good client education practice indicated by client education index score > 0.

Now, it is time to assemble each practice dimension to compute the practice index of dialysis unit nurses. Suppose that all computed factors were normally distributed with mean zero and variance equal to one, a factor analysis was run using the principal component factoring method through the software package of Stata version thirteen. Table 4 also summarizes the findings obtained through the principal component factoring method. The Table presents, the first three factors explain 60.90 percent of the total variation in the factors. In addition to this, three factors were retained as a result of their Eigen values greater than or equal to one.

The relative size of the score of each dimension has its role in the estimation of the overall practice index. Within the factors weight of each dimension overall practice index estimation is as follows.

$$PI = [0.32 * factor1 + 0.16 * factor2 + 0.11 * factor3] / 3$$

The practice index is a multiple-component index that shows the status of dialysis unit nurses' compliance with infection prevention and control, as mentioned above, zero is the accepted cut-off point and line of segment to delineate compliance from non-compliance.

Interpretation: Using a cut-off point, $PI > 0$ is classified as compliance and $PI < 0$ as non-compliance, 125 (54.34%) of dialysis unit nurses are compliant with infection prevention and control while 105 (45.66%) of them are noncompliant to infection prevention and control. the KMO sampling adequacy measure is 0.69. This finding shows that the sample size was sufficient to run factor analysis.

Table 4: Dialysis Unit Nurses Practice on Infection Prevention and Control based on principal component analysis in Addis Ababa,2024

S/N	IPC Practices	Factors	Eigenvalue	Difference	Proportion	Cumulative	Compliant (%)
1.	Hand Hygiene	Factor 1	1.88151	0.88728	0.4704	0.4704	53.04
2.	Personal Protective Equipment	Factor 1	1.50305	0.11623	0.3759	0.3759	55.65
		Factor 2	1.38727	0.76515	0.3468	0.7227	
3.	Instrument Processing	Factor 1	1.46136	0.48090	0.4871	0.4871	19.14
4.	Injection Safety	Factor 1	1.80649	0.72826	0.3613	0.3613	57.39
		Factor 2	1.07823	0.09093	0.2156	0.5769	
5.	Environmental Cleaning	Factor 1	1.15522	0.31045	0.5776	0.5776	83.04
6.	Waste Management	Factor 1	1.57823	0.53837	0.3946	0.3946	57.39
7.	Traffic Flow	Factor 1	1.84981	0.98802	0.4625	0.4625	51.30
8.	Vascular Access Care	Factor 1	1.37250	0.13273	0.2287	0.2287	60.00
		Factor 2	1.23977	0.11544	0.2066	0.4354	
		Factor 3	1.12433	0.25667	0.1874	0.6228	
9.	client education	Factor 1	1.72211	1.44422	0.8611	0.8611	79.13
	Overall practice index	Factor 1	2.92397	1.42070	0.3249	0.3249	54.34
		Factor 2	1.50327	0.44912	0.1670	0.4919	
		Factor 3	1.05415	0.17534	0.1171	0.6090	

5.8.2 Principal Component Factor Analysis for the Independent Variables

Thus, the study employs the same procedures as the other components or independent variables (knowledge, attitude, work environment factors, and communication), and here is the interpretation of the results

Principal Component Analysis for knowledge :126 (54.78 %) of dialysis unit nurses have adequate knowledge indicated by the knowledge index >0

Principal Component Analysis for attitude: 136 (59.13 %) of dialysis unit nurses have favorable attitude indicated by attitude index >0

Principal Component Analysis for work environment factors: 149 (64.78 %) of dialysis unit nurses have good work environment factors indicated by work environment factors index >0

Principal Component Analysis for communication: 131 (56.95 %) of dialysis unit nurses have good communication indicated by a communication index >0

5.9 Correlation Analysis of Compliance with the IP Index

5.9.1 Correlation Analysis of PI with Continuous Variables

In the correlation matrix below, nurse-to-patient ratio, doctor-to-patient ratio, and office hours had a statistically significant relationships with PI. All had positive relationship with practice index.

Table 5: Correlation of IPC Practices Index (PI) with Continuous Variables

S/N	Continuous Variable	Correlation Coefficient (P-value)
1.	Nurse-to-Patient ratio	0.1294(0.0500)
2.	Doctor to Patient	0.1568(0.0173)
3.	Office Hour	0.1432 (0.0302)

N.B: - Figures in parenthesis indicate the P-values

5.9.2 Correlation Analysis of PI with Categorical Variables Using Two-sample t-test

As we can see from table 6 males and females do not have the same mean PI. The mean PI for males is -0.11762 (bad IPC practices on average) and the mean PI for females is 0.027046 (good IPC practices on average). According to the two-sample t-test there is a statistical difference between females and males in a relationship with the IPC practices index at a 5 percent level of significance, females are by far better than males.

Nurses with good and poor work environment factor do not have the same mean PI. The mean PI for nurses with poor work environment factor is negative (bad IPC practices on average) and the mean PI for nurses with good work environment factor is positive (good IPC practices on average).

The mean value of salary below 10,000 is negative and that of 10,000-20,000 is positive, implying being paid less than 10,000 has not been compliant with the IPC practices as per the standard of guideline and compliance to IPC practice has a positive association with those paid above 10,000.

The mean value of the composite compliance with the IPC practices index for private health providers is 0.109118 (compliant) and that of the government-owned is -0.28302 (non-compliant). And, their variation is also statistically different at a 5 percent level of significance.

However, Knowledge, attitude, and communication have a statistically insignificant relationship with compliance to IPC practices index.

Table 6: Two-Sample Test of Practices Index with Categorical Variables

Sex	Obs.	Mean	Std. Err.	Std. Dev.	[95% Confidence Interval.	
Male	43	-0.11762	0.05974	0.39174	- 0.23818	0.00294
Female	187	0.027046	0.027615	0.377632	-0.02743	0.081526
combined	230	7.11E-10	0.025296	0.383626	-0.04984	0.049842
Diff		-0.14467	0.064313		-0.27139	-0.01794
H0: Diff = 0 ; H1: Diff ≠ 0; Pr(T > t) = 0.0254						
Work environment	Obs.	Mean	Std. Err.	Std. Dev.	95% Confidence Interval	
0	81	-0.262379	0.042284	0.380560	-0.3465287	-0.1782309
1	149	0.142636	0.024749	0.302108	0.0937276	0.1915444
combined	230	7.11E-10	0.025296	0.383626	-0.04984	0.049842
Diff		-0.405015	0.045797		-0.495257	-0.3147745
H0: Diff = 0 ; H1: Diff ≠ 0; Pr(T > t) = 0.0000						
Salary	Obs.	Mean	Std. Err.	Std. Dev.	[95% Confidence Interval	
0	194	-0.03137	0.028564	0.397862	-0.0877129	0.024966
1	36	0.1690682	0.039145	0.234875	0.0895978	0.2485385
combined	230	7.11E-10	0.025296	0.383626	-0.04984	0.049842
Diff		-0.20044	0.068495		-0.3354074	-0.0654759
H0: Diff = 0 ; H1: Diff ≠ 0; Pr(T > t) = 0.0038						
Facility	Obs.	Mean	Std. Err.	Std. Dev.	[95% Confidence Interval	
0	64	-0.28302	0.049932	0.399454	-0.3828	-0.18324
1	166	0.109118	0.024578	0.31667	0.060589	0.157646
combined	230	7.11E-10	0.025296	0.383626	-0.04984	0.049842
diff		-0.39214	0.050255		-0.49117	-0.29312
H0: Diff = 0 ; H1: Diff ≠ 0; Pr(T > t) = 0.0000						

5.10 Factors Associated with Infection Prevention Compliance

The multivariable logistic regression was done using the step-wise estimation method based on forward selection, adding terms with p-value ≤ 0.25 was applied. The dependent variable was classified into two categories: 1 for complaint with IPC (good practices with the PI > 0) and zero for noncompliant with IPC (bad practices with the PI < 0).

Th stata results indicate that nurses with good work environment factors, nurses' salary that ranges from 10,000.00 to 20,000.00, and nurses who had duty were statistically significant at 5% level of significance.

Nurses who earn a monthly salary under the category of 10,000.00 through 20,000.00 had 3.2 times higher odds of good practices than nurses with the salary group that falls below 5,000.00 [(AOR:3.23 ,95%CI (1.20-8.70)]. Regarding work environment factor, nurses with good work environment factor had 6.6 times higher odds of having good practice as compared to those with poor work environment factors [(AOR: 6.57,95%CI (3.38-12.78)]. The other significant variable was frequency of duty, Nurses odds of being compliant to infection prevention and control practice were 57 % lower for those who had duty as compared to those who don't have duty. [(AOR: 0.48,95%CI (0.25-0.93)].

Table 7: Multivariable Logistic Regression for Factors Associated with Infection Prevention and Control Practice among Nurses

Explanatory Variables	Crude OR (95% C.I)	Adjusted OR (95% C.I)	P-Value
Forward Selection, adding terms with p-value <= 0.25			
Salary (RG-less than 10,000)			
10,000 – 20,000 Vs RG	3.5(1.51-8.06)	3.23(1.20-8.70)	0.020**
Work environment (RG-bad work environment)			
Good work environment Vs RG	6.60(3.59-12.12)	6.57(3.38-12.78)	0.000**
Frequency of duty (RG- no duty)			
Nurses with duty Vs RG	0.43(0.24-0.75)	0.48(0.25-0.93)	0.032**
Knowledge (RG-inadequate knowledge)			
Adequate knowledge Vs RG	1.03(0.61-1.74)	1.43(0.78-2.64)	0.242
Sex (RG-male)			
Females Vs RG	2.35(1.19-4.66)	2.05(0.88-4.77)	0.096

N.B: **denote statistical significance at 5%

RG- reference group

6. Discussion

Standard precautions should be followed by nurses to prevent infection while providing care to patients. This facility-based cross-sectional study assessed infection prevention compliance among dialysis unit nurses which also identify factors influencing compliance. It was challenging to compare our results with other studies specifically in our country, since there is limitation of studies with this area so comparison is made with studies carried out in general hospital settings and outside of Ethiopia.

The study reported that 54.34% of dialysis unit nurses are compliant to IPC practices. This finding is in line with studies conducted among healthcare workers in general hospital of Ethiopia (8) (26),(31) ,(44) ,(46) and (48). This figure is lower than the rate reported in Libya (14) and Sudan (59). The differing findings might be due to sample size, socio demographic difference, healthcare setting, population investigated and variation how compliance was measured. From our study of nurse-to-patient ratio one nurse is to a maximum of 9 patients and if one nurse is not compliant, he or she is able to infect 9 patients on average. From our result more than forty percent are not compliant to IPC, so this number is critical in infection transmission. Ethiopia's Federal Ministry of Health has been working tirelessly to improve patient safety and infection prevention by organizing updated information and effective interventions in these areas. This is part of an effort to reform the country's healthcare system. Despite this attempts in Ethiopia there is high prevalence of healthcare-associated infections and low infection prevention compliance (31). It is therefore preferable to evaluate current infection prevention practices, and it is essential to have supportive supervision from an infection prevention committee in addition to other organizational supports.

From the components of IPC practice hand hygiene compliance rate was 53.04%, . This figure is higher as compared to a study conducted in Eastern Ethiopia (60), North west Ethiopia (61) and North east Ethiopia (62), but in line with a study conducted in Addis Ababa (63) , but the above studies are conducted in general hospital set up . This may be explained by the fact that being in capital city may be advantageous for the availability of different infrastructures and well organized IPPS committees . This study is also in line with a study conducted in Egypt (11). Hand hygiene is cornerstone of IPC and the single most important measure to prevent the transmission of infections as a result, initiatives to promote better hand hygiene, such as campaigns, should be

prioritized in all clinical settings as hand hygiene is fundamental and affordable, and it helps to lower the risk of healthcare-associated infections (31).

High rate of non-compliant was detected among nurses on instrument processing practice, where 80.86 % of them were non-compliant, this poor instrument processing practice could be explained by the fact that the IPC guideline was updated a year back which includes the instrument processing practice, even though it's announced and distributed in the country, it lacks sufficient awareness creation and training to the staffs. Furthermore, a number of research conducted in various nations have shown that HCWs lack compliance to specified protocols for infection control and disinfection practices (50).

Based on the correlation analysis, the two-sample t-test implies that there was a statistical difference between females and males in a relationship with the IPC practices index, male nurses had bad IPC practices and females had good IPC practices on average. IPC practices index for private health providers shows compliance and that of the government-owned is noncompliant. Knowledge, attitude, and communication had a statistically insignificant association with practice, in contrary to a study done in Libya and India where there is positive correlation between knowledge and practice (14) ,(64). It appears that knowledge does not necessarily translate into good practice, as evidenced by the discovery of a linear association between practice and knowledge. Poor infection control practices in healthcare facilities have been linked to a number of problems, including a lack of resources, an excessive workload, and time constraints (64).

Monthly salary showed a statistically significant association with compliance to IPC practice. Nurses who earn a monthly salary under the category of 10,000.00 through 20,000.00 had 3.2 times higher odds of good practices than nurses with the salary group that falls below 10,000.00, this finding was supported by a study conducted during the covid -19 pandemic in different clinical setting in Ethiopia (65). This study is also consistent with a study conducted in Kenya but with different scenario which is compliance with tuberculosis IPC, where there was a statistically significant relationship between participant salary per month and compliance (66). This could be explained by the fact that better salary empowers employees to commit on their mandate without considering any service disruption that would delay commitment to provide service. In addition, adopting an incentive structure that offers both monetary and non-monetary prizes is essential to increases employee motivation, keeping staff members at a particular hospital, where they can

develop new skills, learn more effective problem-solving techniques, and creating sense of belonging (66). Another explanation could be due to the fact that Healthcare professionals are exposed to a variety of risks, such as medico-legal issues, harm to medical equipment, and the possibility of infection or even death. Professionals will be encouraged to comply to all hospital procedures with a high degree of adherence if they get competitive benefit and incentives for their job (65).

Work environment factor was significant predictor of infection prevention compliance, nurses with good work environment factor had 6.6 times higher odds of having good practice as compared to those with poor work environment factors. Other researches did work environment factors individually like by assessing presence of IPC guideline or availability of continuous water supply and others. The Global Report of WHO 2022 on IPC states that adequate and continuous resources for disinfection and cleaning help HCWs adhere to SPs (67). Our study is in line with a study conducted in Ethiopia where presence of continuous water supply and presence of IPC guideline were associated with good infection prevention practices (18), (31), (47).

The other significant variable was frequency of duty, Nurses odds of being compliant to infection prevention practice were 52 % lower for those who had duty as compared to those who don't have duty. This is supported by a study conducted in Saudi, where nonavailability of resources, high workload and time limitation have been reported as the main factors influencing HCWs' compliance with IPC practice (27). Our result is in line with a study conducted in Egypt dialysis unit nurses' (10). Even though an Egypt study assess morning shift versus night shift practices, we used it for comparison because the day times characteristics works for our dialysis units too. This may be attributed to daytime characteristics include having a head nurse on staff, enough supplies and equipment, and availability of enough nurses despite the workload (10).

In our study, Knowledge and attitude were insignificant in predicting compliance to infection prevention practices in contrary with a study conducted in Ethiopia where knowledge and attitude were significant predictors of infection prevention compliance (18), (31), (47). The finding was also in contrary to a study done in Ghana (53) and south Korea (68). In line with a study conducted in Turkey during the covid 19 pandemic, where they assess the compliance of physicians during the first year and the second year of the pandemic and despite continuous training and education their compliance to infection prevention decreased during the second year (69). From the above

result we can see that, good knowledge does not necessarily predict infection prevention compliance, other factors like psychosocial, physical and mental fatigue could be associated with low infection prevention compliance.

7. Strength and Limitation

7.1 strength

- The observational assessment of common standard precautions practices avoids the Hawthorne effect, which frequently compromises the validity of study findings. Standard precaution compliance is often overestimated by self-assessment, and self-reports of compliance do not match well with the compliance that is measured by direct observation.
- The study applies principal Component Analysis (PCA) to generate a composite index in particular for the dependant variable and for some of the independent variables. This also helps to provide unequal weight of each dimension, unlike the mean score method. It also helps to reduce the number of variables and avoid multicollinearity.
- Since the study uses census data (including all nurses at the dialysis unit for CKD patients in Addis Ababa) and involves all governmental and private facilities, it could be generalized at the capital city level.

7.2 Limitations

- Presence of limited similar studies globally and specifically in our country for comparison purposes.
- In our study different methods of data collection were assessed for the observation part to avoid desirability bias and observation by head nurses were chosen being better to limit bias as compared to others. but it has its own limitation as observing own staff members can have its own draw backs.

8. Conclusion and Recommendation

8.1 Conclusion

The present study identified that the overall infection prevention practices were not sufficiently practiced by nurses. From the components of IPC practices instrument processing was practiced poorly in the dialysis units in Addis Ababa. Monthly salary, work environment factors and

frequency of duty were found to influence infection prevention compliance whereas knowledge and attitude were insignificant predictors for infection prevention compliance.

8.2 Recommendation

A: Minster of health

- Implement an established curriculum for dialysis unit nurses to follow standard infection control procedures.
- Nurses' well-being and ability to care for patients by following standard precautions will be significantly impacted by their workplace dissatisfaction and lack of support. One way to encourage them would be to increase their income

B: Directors of hospitals should

- Hospital administrators need to make sure the dialysis unit has the resources and infrastructure it needs to prevent infections.
- Staffing the dialysis unit with additional nurses to decrease the workload

C: The infection prevention and control team should

- Provide HD units with documented policies and infection control procedures, and review them.
- Update nurses regularly with all relevant protocols as new information becomes available.

D: Researchers

- There are also factors like psychosocial, physical and mental fatigue that affect infection prevention compliance which this study didn't assess, so this factor needs better investigation by other researchers.

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Annex I: Information Sheet

Introduction

My name is I am working as data collector for master of public health student project in Addis Ababa University. We are conducting research entitled “Infection Prevention Compliance and Associated Factors Among Nurses Working at Dialysis Units for CKD patients in Addis Ababa, Ethiopia.

Purpose of the Research Project: to assess the level of compliance and factors associated with infection prevention compliance among nurses working in dialysis units for CKD patients in Addis Ababa.

Risk- It will take some time for you to complete the form, However, the information you provide will have paramount importance to conduct this research.

Benefit: There will be no direct benefit for the participants but, the results of the study enable us to identify factors that are linked to low infection prevention compliance among dialysis unit nurses, and once these factors are identified, it assists Ethiopian policy makers and planners in developing a plan on how to deal with the identified problems in order to improve the health of HCW, patient care quality and the health outcomes of patients receiving haemodialysis.

Procedures: - If you agree to participate in the study, you will answer some questions about research related questions and yourself, it will take 20 minutes.

Confidentiality: The information that you provide will be kept confidential by using codes and locking the data. The information is collected without revealing your name. No one will have access to the data except the principal investigator. The data will not be used for purposes other than the study.

Autonomy: your participation is voluntarily and You have the right to choose not to take part in this study. If you choose to take part, you have the right to stop at any time. If you are willing to participate or refuse or decide to withdraw later, you will not be subjected to any ill-treatment.

Person to contact: if you want more information about the research, the following contact addresses is given to contact the investigator at any time.

አባሪ 1: የመረጃ ቅጽ

መግቢያ

ስሜ በአዲስ አበባ ዩኒቨርሲቲ የፕብሊክ ጤና ተማሪዎች የማስተርስ ፕሮጀክት ላይ በመረጃ ሰብሳቢነት እየሰራሁ ነው። በአዲስ አበባ ውስጥ “በኩላሊት እጥበት /ዳያሊስስ ክፍል በሚሰሩ ነርሶች ኢንፌክሽን ስለመከላከል የሚያስችሉ ሕግጋት ተገዢነት እና ተያያዥነት ባላቸው ጉዳዮች” በሚል ርዕስ ምርምር እያደረግን ነው።

የምርምር ፕሮጀክቱ ዓላማ: በአዲስ አበባ ውስጥ ሥር የሰደደ ኩላሊት ሕመማን እጥበት ክፍል ውስጥ በሚሰሩ ነርሶች መካከል ያለውን የኢንፌክሽን መከላከል ተገዢነት ደረጃን እና ምክንያቶቻቸውን ለመገምገም።

ስጋት- ቅጹን ለመሙላት የተወሰነ ጊዜ ይወስዳል ነገር ግን ያቀረቡት መረጃ ይህንን ጥናት ለማካሄድ ከፍተኛ ጠቀሜታ ይኖረዋል።

ጥቅማ ጥቅሞች: ለተሳታፊዎች ቀጥተኛ ፋይዳ አይኖራቸውም ነገር ግን የጥናቱ ውጤት በዳያሊስስ ክፍል ነርሶች መካከል ካለው ዝቅተኛ የኢንፌክሽን መከላከል ጋር ተያይዞ የሚመጡትን ምክንያቶች ለይተን እንድናውቅ ያስችለናል። የነርሶች እና የታካሚዎች የጤና ውጤቶችን ለማሻሻል ተለይተው የሚታወቁትን ችግሮች እንዴት መቋቋም እንደሚቻል ዕቅድ ለማውጣት ይረዳል።

ሂደቶች:- በጥናቱ ለመሳተፍ ከተስማሙ፣ ከጥናትና ምርምር ጋር የተያያዙ ጥያቄዎችን እና እራስዎን በተመለከተ አንዳንድ ጥያቄዎችን ይመልሳሉ፣ 20 ደቂቃ ይወስዳል።

ምስጢራዊነት:- እርስዎ የሚያቀርቡት መረጃ ሚስጥራዊ ሆኖ የሚቀመጠው ኮዶችን በመጠቀም ነው። መረጃው የሚሰበሰበው ስምዎትን ሳይገልጽ ነው። ከዋናው ተመራማሪ በስተቀር ማንም ሰው መረጃውን ማግኘት አይችልም። መረጃው ከጥናቱ ውጪ ለሌላ ዓላማዎች ጥቅም ላይ አይውልም።

ራስን በራስ ማስተዳደር: የእርስዎ ተሳትፎ በፈቃደኝነት ነው እና በዚህ ጥናት ላይ ላለመሳተፍ የመምረጥ መብት አለዎት። ለመሳተፍ ከመረጡ በማንኛውም ጊዜ ለማቆም መብት አለዎት። ለመሳተፍ ፈቃደኛ ከሆኑ ወይም እምቢ ካሉ ወይም በኋላ ለመውጣት ከወሰኑ ምንም አይነት በደል አይደርስብዎትም።

መረጃ የሚጠይቁ ሰው: ስለ ጥናቱ ተጨማሪ መረጃ ከፈለጉ፣ የሚከተሉት የአድራሻ አድራሻዎች ተመራማሪውን በማንኛውም ጊዜ ለማነጋገር ይችላሉ።

ትግሌ ናደዉ፣ አዲስ አበባ ዩኒቨርሲቲ, የጤና ሳይንስ ኮሌጅ, ኤፒዲሚዮሎጂ እና ባዮስታስቲክስ ትምህርት ክፍል: ዋና ተመራማሪ, ስልክ: 0929017489, ኢሜል: tige212009@gmail.com

Annex II: Informed Consent

Addis Ababa University, School of public health

The study has been explained to me and I have understood the provided information about the purpose of the study. I've had the chance to ask questions, and the answers I've received have satisfied me. I consent voluntarily to be part of the study and understand that I have the right to withdraw from the study at any time, without giving a reason and without cost. Even though - It will take some time for me to complete the form and that there will be no direct benefit for me but, the results of the study enable us to identify factors that are linked to low infection prevention compliance which are important to measure and later improve the health of the nurses as a whole and patients receiving haemodialysis treatment. The information I provide will be kept confidential by using codes and locking the data and information is collected without revealing my name. No one will have access to the data except the principal investigator. The data will not be used for purposes other than the study.

Tigle Nadew, AAU University, College of Health Sciences, Department of Epidemiology and Biostatistics: Principal Investigator

Phone: 0929017489

Email: tige212009@gmail.com

Participant

Signature _____ Date _____

Data collector

Name _____ Signature _____

አባሪ II፡ በመረጃ የተደገፈ ስምምነት

አዲስ አበባ ዩኒቨርሲቲ የህብረተሰብ ጤና ትምህርት ቤት

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ስልክ፡ 0929017489

ኢሜል፡ tigle212009@gmail.com

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Annex III: - Questionnaire

Date of data collection: / / /DD/MM/YY

Name of the facility_____

Name of the data collector: _____ Signature_____

Name of the supervisor: Date _____ Signature_____

Code _____

Part 1: Questions to assess the Socio-demographic Characteristics of the Participant

1)	Gender	☐ Male	☐ Female
2)	Age	_____	
3)	Marital Status	☐ Married	☐ Single ☐ Others
4)	What	is	your monthly salary? - _____
5)	What is your nursing education level? ☐ Nursing diploma ☐ Bachelor's degree in Nursing ☐ Masters in nursing ☐ If other specify_____		
6)	How many years of experience do you have in nursing? _____		
7)	How many years of experience do you have in dialysis units? _____		
8)	Have you Participated in-service training on infection prevention? ☐ Yes ☐ No		
9)	Have you Participated in-service training on nurse's dialysis care? ☐ Yes ☐ No		

Part 2: Nursing work schedule

S/N	Questions	
1	What is the average ratio of nurses to patients in your service delivery?	
2	What is the average ratio of doctors to patients in your service delivery?	
3	How frequent you are on duty / frequency of duty / per week?	
4	How many hours do you work in the office hour	

Part 3: Practice of the Standard Precaution/ Compliance

S/N	Question	Yes	No
	Hand hygiene		
1	Wash hands with soap and water before and after patient care		
2	Wash hands After touching blood, body fluids, secretions, excretions and contaminated items (including front of the hemodialysis machine)		
3	Wash hands immediately after removal of gloves		
4	use antiseptic hand rub to clean hands?		
	PPE		
5	Wearing gloves when giving patient care		
6	Wear goggles to protect the eyes during procedure that generates spray of blood or body fluids.		
7	change gloves between patients.		
8	wear apron or gown when performing operations/procedures that might induce spraying of blood, body fluid, secretions and excretions		
	Instrument processing		
9	Don't soak contaminated items after any medical or surgical procedure in 0.5% chlorine solution before you perform cleaning		
10	Do not place contaminated items in decontaminate solution for 10 minutes		
11	use heavy duty glove when handling, clean and process contaminated medical equipment		
	Injection safety		
12	Preparation of injections is using aseptic technique and in a clean, well-ventilated and illuminated area		
13	Do not administer medications from single-dose or single-use vials, ampoules or bags or bottles of intravenous solution to more than one patient		
14	Never administer medications from the same syringe to multiple patients, even if the needle is changed or the injection is administered through an intervening length of intravenous tubing		
15	Do not reuse a syringe to enter a medication vial or solution		
16	Dispose off used syringes and needles at the point of use in a sharps container that is closable, puncture-resistant and leak-proof		
	Environmental cleaning		
17	clean the machine after every patient procedure?		
18	Rooms are well ventilated and illuminated		

	Waste management		
19	Infectious and non-infectious wastes are properly segregated		
20	There is no spilled solid and liquid waste in service areas		
21	Dispose nonreusable sharp materials wastes in safety box		
22	Sharp waste segregation is separate and no mixing		
	Traffic flow		
23	Limit traffic to authorized staff and patients at all times.		
24	Keep talking to a minimum in the presence of a sterile field.		
25	Keep the doors closed at all times, except during movement of staff, patients, supplies, and equipment		
26	Staff should wear clean and closed shoes that will protect their feet from fluids and dropped items		
	Vascular access care		
27	Use of a surgical mask for staff and patient for all catheter system connect, disconnect and dressing procedures		
28	The catheter exit-site should be examined for proper position and absence of infection before accessing the bloodstream at each hemodialysis session		
29	Catheter manipulation is kept at a minimum		
30	To cleanse the skin, apply antiseptic solution before cannulation (alcohol-based chlorhexidine or 10% povidone iodine solution and/or 70% alcohol)		
31	Administer Heparin bolus injection before the start of dialysis		
32	Apply Sterile dressing on the catheter site		
	Client education		
33	Education on Signs and symptoms of infection		
34	Education on Basic infection control practices during catheter accessing process		
	Occupational health		
35	Don't recap needle after injection		

Part 4: Knowledge about Standard Precautions

S/N	Question	Yes	No
1	Have you heard about infection prevention principle?		
2	gloves cannot provide complete protection against acquiring/transmitting infection?		
3	healthcare-associated pathogens can be found on normal and intact patient skin?		
4	washing your hands with soap or alcohol-based antiseptic decreases the risk of transmission of hospital acquired infection?		
5	use of an alcohol-based antiseptic for hand hygiene is as effective as soap and water if hands are not visibly dirty?		
6	gloves reduce the contamination of the hand but do not prevent it completely?		
7	need to wash hands before doing procedures that do not involve bodily fluids?		
8	no need to wear the same pair of gloves for multiple patients as long as there is no visible contamination?		
9	TB is carried in airborne particles that are generated from patients with active pulmonary TB?		
10	Do you know to what level safety boxes should be filled before closing and sealing?		
11	Do you know specific waste disposal buckets according to the level of their contamination?		
12	All instruments should not be decontaminated first, thoroughly cleaned and dried before being sterilized		
13	After proper decontamination and cleaning 0.1% chlorine solution for 20 min doesn't provide HLD		

14	Replace catheter site dressing every 7 days for sterile semipermeable dressing or if the dressing becomes visibly soiled or loosened?		
15	Flush the CVC lumen with saline after the administration of medication or fluid?		
16	Do you know What actions should you take when a sharp injury occurs:		
17	Do you know the best period to take prophylaxis for HIV after exposed to contaminated items of HIV patient?		

Part 5: Attitude on Infection Prevention Standard Precaution

S/N	Questions	1.Strongly Disagree	2.Disagree	3.Indifferent	4.Agree	5.Strongly Agree
1	Do you believe that following standard operation procedures decreases the risk of contamination?					
2	Do you think ventilating the ward by opening windows and doors decreases infection transitions?					
3	Do you think using personal protective equipment (PPE) decreases HCAs?					
4	Do you believe washing hands before and after contact with patients is important?					
5	Do you agree that hospital facilities can be the source of infection in the absence of universal precaution?					
6	Do you think separating needle and other types of waste is visible?					
7	Do you think using biohazard material better for waste management?					
8	Do you think that a patient's awareness about the transmission of microorganisms decreases the risk of HCAs?					
9	Do you agree that recapping is the cause of needle prick injury?					
10	Do you believe that nosocomial infection					

	can pose a serious outcome?					
11	Do you believe the CLABSI prevention guidelines are useful?					
12	Do you believe hand hygiene before and after the replacement of dressings is important to reduce CLABSI?					
13	Is it necessary to establish an occupational protection training course in your opinion?					

Part 6: Work Environment Factors

Questionnaire for head nurse

1. Do you have IPC guideline (1) Yes (2) No

S/N	Questions	Never	Rarely	Sometimes	Very often	Always
2	Do you have access to continuous water supply?					
3	Do you have access to soap?					
4	Do you have alcohol-based hand rub access?					
5	Do you have access to disposable glove?					
6	Do you have enough supply of IV set?					
7	Do you have enough supply of IV fluid bag					
8	Do you have enough access to IV cannula of the required gauge?					
9	Do you have access to Haemodialysis Catheter, Fistula Needles and transfusion set, water treatment,					
10	Do have access to heparin					

Part 7: Communication Skills

S/N	Questions	Never	Rarely	Sometimes	Very often	Always
1	Consistently delivers accurate, clear and concise messages and effectively inform attendants about infection and its prevention					
2	Consistently delivers accurate, clear and concise messages and effectively inform runners about infection and its prevention					
3	Encourages an open exchange of ideas and different points of view; with doctors					

Annex IV: Dialysis Unit Nurses Work Environment Factors in Addis Ababa, Ethiopia, 2024

S/N	Questions			Frequency	Percent	Mean
1	IPC guidelines	Yes		215	93.48	1.06
		No		15	6.52	
S/N	Questions			Frequency	percent	
2	Access to a continuous water supply	Rarely		1	0.43	4.70
		Sometimes		16	6.96	
		Very often		34	14.78	
		Always		179	77.83	
3	Access to soap					4.50
		Rarely		1	0.43	
		sometimes		36	15.65	
		Very often		39	16.96	
		Always		154	66.96	
4	Access alcohol-based hand rub access	Rarely		18	7.83	4.34
		Sometimes		40	17.39	
		Very often		16	6.96	
		Always		156	67.83	
5	Access to disposable gloves					4.66
		Rarely		10	4.35	
		Sometimes		3	1.30	
		Very often		42	18.26	
		Always		175	76.09	
6	Enough supply of IV set	Rarely		1	0.43	4.70
		Sometimes		20	8.70	
		Very often		25	10.87	
		Always		184	80.00	
7	Enough supply of IV fluid bag	Never		35	15.22	4.19
		Rarely		1	0.43	
		Sometimes		9	3.91	
		Very often		24	10.43	
		Always		161	70.00	
8	Access to the IV cannula of the required gauge	Rarely		53	23.04	4.15
		Sometimes		4	1.74	
		Very often		28	12.17	
		Always		145	63.04	
9	Access to Hemodialysis Catheter, Fistula Needles and transfusion set, water treatment					4.65
		Rarely		4	1.74	
		Sometimes		13	5.65	
		Very often		41	17.83	
		Always		172	74.78	
10	Access to heparin	Never		50	21.74	3.55
		Rarely		10	4.35	
		Sometimes		31	13.48	
		Very often		41	17.83	
		Always		98	42.61	
	Mean core	4.38 ± 0.70 (median score=4.66).				

Annex V: Dialysis Unit Nurses' Knowledge about Infection Prevention and Control in Addis Ababa, 2024

S/N	Question		Frequency	Percent
1	Heard about the infection prevention principle	Yes	226	98.26
		No	4	1.74
2	Gloves cannot provide complete protection against acquiring/transmitting infection	Yes	159	69.13
		No	71	30.87
3	Healthcare-associated pathogens can be found on normal and intact patient skin.	Yes	207	90.00
		No	23	10.00
4	Washing hands with soap or alcohol-based antiseptic decreases risk of transmission of HAI	Yes	220	95.65
		No	10	4.35
5	Use of alcohol-based antiseptic for hand hygiene is as effective as soap and water if hands not visibly dirty	Yes	151	65.65
		No	79	34.35
6	Gloves reduce contamination of the hand but do not prevent it completely	Yes	170	73.91
		No	60	26.09
7	Need to wash hands before doing procedures that do not involve bodily fluids	Yes	189	82.17
		No	41	17.83
8	No need to wear the same pair of gloves for multiple patients as long as there is no visible contamination	Yes	69	30.00
		No	161	70.00
9	TB is carried in airborne particles that are generated from patients with active pulmonary TB.	Yes	203	88.26
		No	27	11.74
10	Know what level safety boxes should be filled before closing and sealing	Yes	195	84.78
		No	35	15.22
11	Know specific waste disposal buckets according to the level of their contamination	Yes	208	90.43
		No	22	9.57
12	All instruments should not decontaminate first, thoroughly cleaned and dried before being sterilized	Yes	24	10.43
		No	206	89.57
13	After proper decontamination and cleaning 0.1% chlorine solution for 20 min doesn't provide HLD	Yes	57	24.78
		No	173	75.22
14	Replace catheter site dressing every 7 days for sterile semipermeable dressing or if the dressing becomes visibly soiled or loosened.	Yes	115	50.00
		No	115	50.00
15	Flush the CVC lumen with saline after the administration of medication or fluid.	Yes	210	91.30
		No	20	8.70
16	Know What action to take when a sharp injury occurs	Yes	221	96.09
		No	9	3.91
17	Know the best period to take prophylaxis for HIV after being exposed to contaminated items of HIV patients	Yes	221	96.09
		No	9	3.91
	Mean score	0.72 ± 0.09 (median score=0.70).		

Source: Result from Survey Data, 2024

Annex VI: Dialysis Unit Nurses' Attitude to Infection Prevention and Control in Addis Ababa,2024

S/N	Questions		Frequency	Percent	Mean	Decision
1	Following standard operation procedures decreases the risk of contamination	Strongly disagree	14	6.09	4.30	Favorable
		Disagree	2	0.87		
		Indifferent	4	1.74		
		Agree	90	39.13		
		Strongly agree	120	52.17		
2	Ventilating the ward by opening windows and doors decreases infection transitions	Strongly disagree	9	3.91	4.30	Favorable
		Disagree	3	1.30		
		Indifferent	8	3.48		
		Agree	98	42.61		
		Strongly agree	112	48.70		
3	Using personal protective equipment (PPE) decreases HCAIs	Strongly disagree	11	4.78	4.35	Favorable
		Disagree	3	1.30		
		Indifferent	4	1.74		
		Agree	87	37.83		
		Strongly agree	125	54.35		
4	Washing hands before and after contact with patients is important	Strongly disagree	12	5.22	4.47	Favorable
		Disagree	0.00	0.00		
		Indifferent	5	2.17		
		Agree	63	27.39		
		Strongly agree	150	65.22		
5	Hospital facilities can be the source of infection in the absence of universal precaution	Strongly disagree	9	3.91	4.16	Unfavorable
		Disagree	8	3.48		
		Indifferent	19	8.26		
		Agree	93	40.43		
		Strongly agree	101	43.91		
6	Separating needles and other types of waste is visible	Strongly disagree	8	3.48	4.22	Unfavorable
		Disagree	10	4.35		
		Indifferent	11	4.78		
		Agree	95	41.30		
		Strongly agree	106	46.09		
7	Using biohazard material is better for waste management	Strongly disagree	11	4.78	4.23	Unfavorable
		Disagree	3	1.30		
		Indifferent	12	5.22		
		Agree	100	43.48		
		Strongly agree	104	45.22		
8	Patient's awareness of the transmission of microorganisms decreases the risk of HCAIs	Strongly disagree	9	3.91	4.14	Unfavorable
		Disagree	10	4.35		
		Indifferent	14	6.09		
		Agree	103	44.78		
		Strongly agree	94	40.87		
9	Recapping is the cause of needle prick injury	Strongly disagree	10	4.35	4.14	Unfavorable
		Disagree	8	3.48		
		Indifferent	15	6.52		
		Agree	102	44.35		
		Strongly agree	95	41.30		
10	Nosocomial infection can pose a serious outcome	Strongly disagree	10	4.35	4.26	Favorable
		Disagree	2	0.87		
		Indifferent	9	3.91		
		Agree	105	45.65		
		Strongly agree	104	45.22		

11	CLABSI prevention guidelines are useful	Strongly disagree	7	3.04	4.23	Unfavorable
		Disagree	3	1.30		
		Indifferent	19	8.26		
		Agree	100	43.48		
		Strongly agree	101	43.91		
12	Hand hygiene before and after the replacement of dressings is important to reduce CLABSI	Strongly disagree	8	3.48	4.36	Favorable
		Disagree	2	0.87		
		Indifferent	8	3.48		
		Agree	93	40.43		
		Strongly agree	119	51.74		
13	Necessary to establish an occupational protection training course in your opinion	Strongly disagree	8	3.48	4.31	Favorable
		Disagree	2	0.87		
		Indifferent	13	5.65		
		Agree	94	40.87		
		Strongly agree	113	49.13		
	Mean score	4.27 ± 0.76 (median score=4.38).				

Source: Result from Survey Data, 2024

Annex VII: Dialysis Unit Nurses communication about infection prevention and control in Addis Ababa,2024

S/N	Questions		Frequency	percent	Mean	Decision
1	Consistently delivers accurate, clear, and concise messages and effectively informs attendants about infection and its prevention	Never	5	2.17	4.12	Good communication
		Rarely	11	4.78		
		Sometime s	49	21.30		
		Very often	51	22.17		
		Always	114	49.57		
2	Consistently delivers accurate, clear, and concise messages and effectively informs runners about infection and its prevention	Never	10	4.35	3.85	Poor communication
		Rarely	14	6.09		
		Sometime s	60	26.09		
		Very often	62	26.96		
		Always	84	36.52		
3	Encourages an open exchange of ideas and different points of view; with doctors	Never	13	5.65	3.83	Poor communication
		Rarely	23	10.00		
		Sometime s	49	21.30		
		Very often	48	20.87		
		Always	97	42.17		
	Total	3.93 ± 0.93 (median score=4.00).				

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