

Nurses' Compliance with Infection Prevention and Control Practices (IPC) in Fixed Versus Mobile Family Planning Clinics: A Comparative Study

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Abstract:

Background: Family planning nurses perform a wide range of activities put their health at risk of harm. So they should follow the standard precautions of IPC practices. **Aim of this study** was to compare nurses' compliance with infection prevention and control (IPC) practices in fixed versus mobile family planning clinics. **Research design:** A descriptive comparative research design was utilized to fulfill this study. **Settings:** The study was conducted in two settings at El Beheira Governorate; the first setting was all fixed family planning clinics in four health directorates, and the second setting was all mobile family planning clinics under supervision of sixteen health directorates. **Subjects:** All nurses were working in fixed and mobile family planning clinics in the previously mentioned settings which were 409 nurses (382 nurses in fixed family planning clinics and 27 nurses in mobile family planning clinics). **Data collection tools:** Two tools were used: **Tool (I):** Nurses' Knowledge about IPC Practices in Family Planning Clinics Structured Questionnaire: **Tool (II):** Nurses' Compliance with IPC in Family Planning Clinics Observation Checklist. **Results:** Level of nurses' compliance with IPC practices was high in fixed clinics than those in mobile clinics (86.6%, 66.7%) respectively. There was no significant relationship was found between nurses' level of compliance and their socio demographic characteristics in both settings. **Conclusion:** It can be concluded that total nurses' compliance level with IPC practices was high in fixed clinics than in mobile clinics. **Recommendations:** Regular training program about IPC practices for family planning nurses based on their needs.

Keywords: Fixed, Mobile Clinic, Practices, Knowledge & Compliance

Introduction

Compliance with infection prevention and control practices remains insufficient in general among family planning nurses, Compliance is the level of precision and constancy in prescribed standard protocols to achieve the desired outcomes, (Dorgahm & Obied., 2016).

Lack of appropriate knowledge, lack of personal protective equipment (PPE), shortage of time to implement the precautions, not suitable work environment, shortage of resources, uncomfortable equipment, skin irritation, poor skills, lack of proper training, forgetfulness, and conflict between the need to provide care and self-protection are suggested factors linked to noncompliance to IPC guidelines. (WHO., 2016 & Russell et al., 2018).

Nurses' noncompliance with IPC practices put their health and well-being at risk of harm. So nurses are responsible for taking necessary precautions to prevent healthcare-associated infections.

Healthcare-Associated Infections (HCAIs) occur in a patient during the process of care in healthcare facility and were not present or incubating at the time of admission. (Alrubaiee et al., 2021). HCAIs can affect patients in any type of setting where they receive care and can also appear after discharge, and

include occupational infections among staff. HCAIs are a major public health problem with an impact on morbidity, mortality and quality of life. At any one time, up to 7% of patients in high income countries and 15% in low\ middle income countries will acquire at least one HCAI, (CDC, 2020 & WHO, 2022). However, large percentages are preventable through compliance with standard precaution of infection prevention and control (IPC) practices. (WHO, 2022) Standard precautions According to the World Health Organization guideline (2018) include the following practices: hand hygiene, use of personal protective equipment, safe management of patient care equipment and soiled linen, prevention of needle stick/sharp injuries, respiratory hygiene and cough etiquette, environmental cleaning and spills-management, and waste management. (WHO, 2018 & Kumar et al., 2020).

Community health nurses in family planning clinics play an important role, as they contribute in health promotion and disease prevention including initial assessment of client, counseling, services delivery, infection prevention and control, and also follow up. So they should have good knowledge, training and compliance with standard precautions of IPC practices.

Significance of study:

Nurses' compliance with IPC practices is a very important issue in fixed and mobile family planning clinics that effect on nurses, health team, patients and community. Nurses' noncompliance with IPC practices in family planning clinics has been associated with healthcare-associated infections (WHO, 2020) such as Urinary Tract Infections (UTIs); these infections are often associated with the insertion of IUD when IPC practices not apply during the procedure. Surgical Site Infections (SSIs), that may occur during injection and implant procedure and Reproductive Tract Infections (RTIs), such as infections associated with medical procedures that manipulate the genital tract as unsafe abortion, pelvic examination, and IUD insertion. The impact of HCAs implies prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobials, massive additional financial burden for health systems, high costs for patients and their family, and unnecessary deaths. (Sahiledengle et al., 2018) & (McCauley et al., 2021).

Nurses' noncompliance to IPC practices has been linked to a number of factors but the main factors are; lack of knowledge and lack of practices about seven components of IPC practices such as hand hygiene, use of personal protective equipment, safe management of patient care equipment and soiled linen, prevention of needlestick\sharp injuries, environmental cleaning and spills management, respiratory hygiene and cough etiquette and waste management. So this study aimed to assess nurses' compliance with IPC practices in fixed versus mobile family planning clinics. (WHO, 2018) & (Alqahtani, 2020)

Aims of the study:

Compare nurses' compliance with infection prevention and control practices in fixed versus mobile family planning clinics.

Research Question:

What is the difference between nurses' compliance with infection prevention and control practices in fixed versus mobile family planning clinics?

Materials and Subjects**Research Design:**

A descriptive comparative research design was utilized to fulfill this study.

Setting:

The current study was conducted in two settings

- All fixed family planning clinics in primary health care facilities for both urban and rural areas from four health directorates out of sixteen in El Beheira Governorate.

1. Rural Fixed Family Planning Clinics are Family Health Units and Family Health Centers

2. Urban Fixed Family Planning Clinics are Health Office, Sub Clinics, District Clinics and Maternal and Child Health Centers

Four selected health directorates were Damanhour, Kafer Eldawar, Etay Elbarod and Komhamada.

- All mobile family planning clinics under supervision of sixteen health directorates in El Beheira Governorate.

Subjects:

All nurses were working in fixed and mobile family planning clinics in the previously mentioned settings, and fulfilling the following inclusion criteria.

- Full time working nurses.
- Had experience not less than 6 months.
- Willing to participate in the study.

Sample size:

- For fixed family planning clinics, all nurses were working in primary health care facilities for both urban and rural areas in the four health directorate from El Beheira Governorate were included in the study. The minimum sample size estimated was 382 nurses.

- For mobile family planning clinics, all nurses in the all mobile family planning clinics (31) under supervision of sixteen health directorates from El Beheira Governorate were included in the study. The sample size was 33 nurses.

- The total sample size for fixed and mobile family planning clinics was 415 nurses.

Sampling technique:

A two stage sampling techniques were used to select the required sample and the following steps were been done:

El Beheira Governorate is composed of sixteen health directorates.

For fixed family planning clinics.

- Four out of the sixteen health directorates were be selected by using the proportional allocation method, constitute 25% of the total health directorates and based on the greatest number of nurses in fixed family planning clinics .

- All fixed family planning clinics in both urban and rural primary health care facilities were selected from each of the previously mentioned health directorates.

- All nurses were working in the fixed family planning clinics and fulfilling the inclusion criteria was selected from each of the previously mentioned primary health care facilities to be included in the study. (n=382 nurses)

For mobile family planning clinics

- All mobile family planning clinics (31) selected from all sixteen health directorates in El Beheira Governorate.

- All nurses were working in the mobile family planning clinics and fulfilling the inclusion criteria

were selected from each of the previously mentioned health directorates to be included in the study (n =33 nurses).

Tools:

The data of the study was collected by using two tools:

Tool I: Nurses' Knowledge about Infection Prevention and Control Practices (IPC) in Family Planning Clinics Structured Questionnaire:

The tool was developed by the researcher after reviewing the recent literature (WHO, 2018). It was included the following parts:

Part I: Nurses' Personal Characteristics: such as: age, sex, level of education, marital status, family income and years of working experience.

Part II: Nurses' knowledge about standard precautions of Infection Prevention and Control Practices (IPC) in Family Planning Clinics

This part used to assess the nurse' knowledge about seven components of standard precautions of IPC practices in fixed / mobile family planning clinics. Comprised of (33) questions regarding:

1. General information about seven components of standard precautions of IPC Practices (7 questions) such as definition of standard precautions, goals of standard precautions and important of IPC practices in family planning clinic.
2. Hand hygiene (3 questions) such as types of hand washing, duration of routine hand washing and five moments of hand hygiene.
3. Use of personal protective equipment (PPE) (6 questions) such as types of PPE, safely removal of PPE, and PPE worn when there may be risk of splashing.
4. Safe management of patient care equipment and soiled linen (6 questions) such as first step in reprocessing equipment, definition of linen and safe removal of contaminated bed linen
5. Prevention of needle stick/sharp injuries (4 questions) such as safe disposal of used needle, most common cause of needlestick injuries and disease transmitted by a needle-stick.
6. Respiratory hygiene and cough etiquette (3 questions) such as respiratory hygiene and cough etiquette technique, safe disposal of used tissue
7. Environmental cleaning and spills-management (2 questions) such as safe blood and body fluid spill management and the concentrations of chlorine solution used in bloody spill.
8. Safe waste management (2 questions) such as, benefits of proper waste disposal and stages of medical waste disposal.

Scoring system:

Each nurse was asked to respond to each item. Three marks were given to 'correct and complete' answer, two marks were given to "correct but incomplete" and one mark was given to 'incorrect answer'. Ranged from (32: 96) Nurses' knowledge was ranked as poor, fair and good knowledge according to their total score; the highest score in this system conveys better knowledge.

Score	Nurses' knowledge
< 50%(33-54)	Poor Knowledge
50% < 75%(55-76)	Fair Knowledge
≥ 75%(77-99)	Good Knowledge

Tool II: Nurses' Compliance with Infection Prevention and Control Practices (IPC) in Family Planning Clinics Observation Checklist:

The tool was developed by the researcher after reviewing the recent literature (WHO, 2018 & Russell et al., 2018) to assess compliance of nurses with seven components of standard precautions of IPC practices (IPC) in their daily activities in fixed / mobile family planning clinics. Comprised of (47) items regarding seven components of IPC practices, which were

1. Hand hygiene (11 items) such as steps of hand washing according to infection control guideline, duration of routine hand washing for 40-60 sec, dry hand thoroughly by using(clean, sterile) towel.
2. Personal protective equipment (PPE) (8 items) such as when use or change gloves, when use apron and face mask, wear gloves before invasive procedure done to patient.
3. Safe management of patient care equipment and soiled linen (14 items) such as the first step in reprocessing equipment, wearing PPE when handling contaminated equipment, the degree of sterilization.
4. Prevention of needle stick\ sharp injury (6 items) such as dispose needles and other sharp objects immediately after use, avoid recap used needles by hand, close the sharp box when (3\4) full.
5. Respiratory hygiene and cough etiquette (2items) such as cover mouth and nose when coughing or sneezing, when wearing masks.
6. Environmental cleaning and spills management (4 items) such as wear gloves and apron before management of blood\ body fluid spills, wipe up the spill using towels or absorbent material, cover the spill with disinfectant solution.
7. Safe management of waste (2 items) such as dispose contaminated items into the designated disposal container, close the bag securely when (3\4) full.

Scoring system: The observed practices were recorded by the researcher according to the extent of compliance. A score 2 was given for right and completely done, and 0 for not done or wrong practice. The total score calculated and ranged from (0:94) and converted into percentage score. The levels of compliance were classified into:

Score	Nurses' Compliance
< 50% (0 to less than 47)	Non compliance
≥ 50% (47- 94)	Compliance

Method

The study was implemented according to the following steps:

Administrative process:

- Official permission was obtained from Faculty of Nursing, Damanhour University directed to The Minister of Health and Population office (MOHP), the head of the Family Planning Sector at (MOHP), the Ministry's Research and Development Committee.
- Official permission was obtained from the Undersecretary of the Ministry of Health and Population in El Beheira governorate, the director of family planning department to obtain their support to carry out the study at selected health directorate.
- The researcher met the manager of 16 health directorate; clarify the purpose of the study as well as to gain their cooperation and support during data collection from the selected family planning clinics.

Development of the Study Tools:

- Tool I, Tool II, were developed by the researcher after reviewing the relevant literatures, and translated into Arabic.
- Content validity of Tool I (part II) and Tool II was examined by a jury composed of five experts in the field of community health nursing; obstetric and gynecological nursing. Their opinions & suggestions were taken into considerations and recommended modifications were done accordingly.
- Reliability of Tool I (part II) and Tool II was tested by using cronbach's alpha coefficient test; it showed acceptable level of reliability (0.820, 0.830) respectively.

Pilot study

The pilot study was carried out on 41 family planning nurses (10%) who were chosen randomly and not included in the study sample to test the feasibility and applicability of the tools and to identify obstacles that might interfere with the process of data collection. The necessary modifications were done accordingly.

Collection of Data:

- At the beginning, the researcher was introduced herself, establishment of relationship with nurses before data collection

- Each nurse was asked for oral consent for participation in the study a brief explanation of the purpose and nature of the research. Without mention of their name to ensure their cooperation and gaining their confidence.
- The researcher distributed questionnaires Tool I to collect family planning clinics nurses' socio demographic characteristics, and nurses' knowledge about infection prevention and control practices (IPC) with giving a necessary instructions about how to fill it. Took approximately from 15-20 minutes.

The researcher observe the family planning clinic nurses by tool II, at the morning shift from 9 am to 1 pm , four day \week over a period of 4 months (from May to August 2021).

Statistical analysis:

After data collection, the collected data was coded and transferred into especially designed format to be suitable for computer feeding.

- Data was entered into and analyzed using statistical package of social science (SPSS) version 20
- After data entry, data was checked and revised through frequency analysis, cross tabulation, and manual revision to discover any error during data entry.
- Variables were analyzed using the descriptive statistics which included:
 - Percentages, frequencies, range (minimum and maximum), arithmetic mean, and standard deviation (SD) they are used as measures of central tendency as dispensing respectively for normally distributed quantitative data.
 - Chi square test (χ^2) was used to test the significance of the results and to test the association between two quantitative variables or to compare between two study groups.
 - Graphs were done for data visualization by using Microsoft Excel Program.

Ethical considerations

- Written informed consent was obtained from the director of each health directorate which included in the study after explanation of the aim of the study and assures them that collected data will be used only for the study purpose.
- Confidentiality and anonymity of family planning clinic nurses response was guaranteed by using a code numbers as an alternative of name.

Results

Table (1): Distribution of the Studied Nurses Working in Fixed versus Mobile Family Planning Clinics according to their personal characteristics

Nurses' Personal Characteristics	Types of Family Planning Clinics			
	Fixed (n = 382)		Mobile (n = 27)	
	No.	%	No.	%
Age(year)				
• <30	26	6.8	0	0.0
• 30<40	97	25.4	7	25.9
• 40<50	163	42.7	15	55.6
• ≥50	96	25.1	5	18.5
Min. – Max.	20.00 – 62.00		33.0 – 54.0	
Mean ± SD.	43.35 ± 8.81		43.52 ± 5.70	
Level of education				
• Nursing diploma	283	74.1	25	92.6
• Health technical institute	99	25.9	2	7.4
Marital status				
• Single	8	2.1	1	3.7
• Married	306	80.1	25	92.6
• Divorced	15	3.9	0	0.0
• Widow	53	13.9	1	3.7
Working experience				
• 6 months – less than 1 year	8	2.1	0	0.0
• 1- less than 5 years	16	4.2	0	0.0
• 5- less than 10 years	14	3.7	0	0.0
• 10- less than 20 years	122	31.9	8	29.6
• More than 20 years	222	58.1	19	70.4

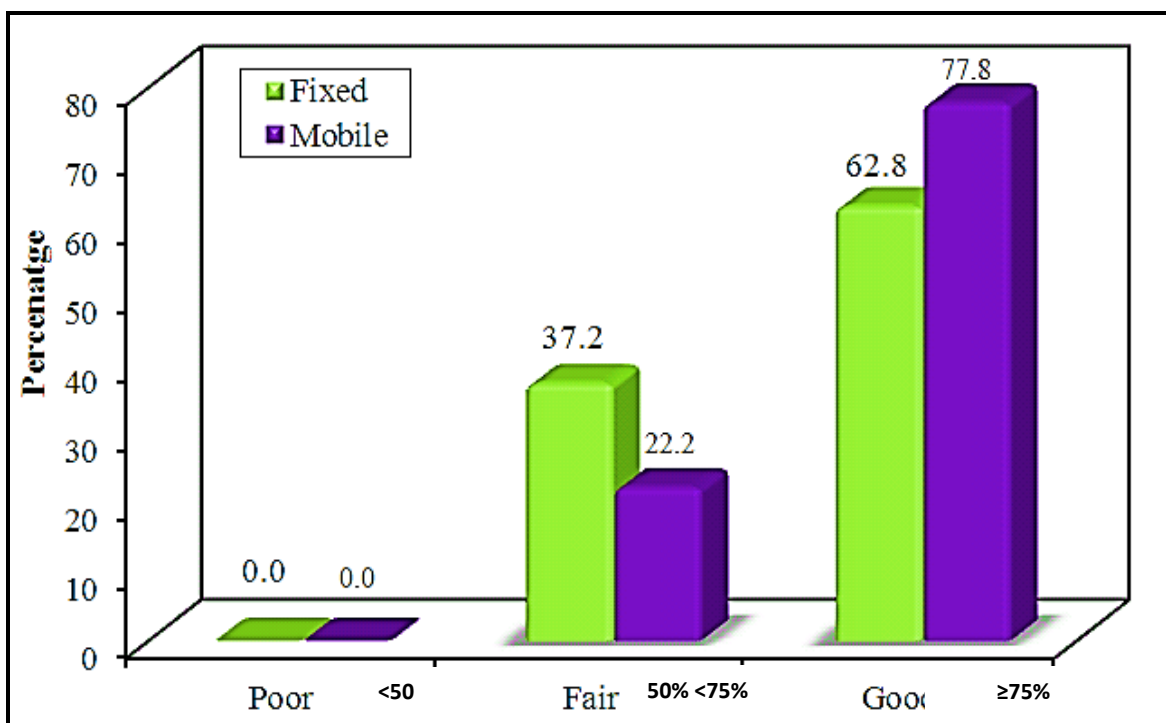
Table (2): Distribution of the Studied Nurses Working in Fixed versus Mobile Family Planning Clinics according to their Total Score of knowledge about Seven Components of Standard Precautions of IPC Practices

Nurses' Total Score of Knowledge about Seven Components of Standard Precautions of IPC Practices	Types of Family Planning Clinics				χ^2	P
	Fixed (n = 382)		Mobile (n = 27)			
	No.	%	No.	%		
1. Hand Hygiene[#]					9.334*	0.002*
• Poor	0	0.0	0	0.0		
• Fair	228	59.7	8	29.6		
• Good	154	40.3	19	70.4		
2. Personal Protective Equipment[#]					4.452	0.108
• Poor	8	2.1	0	0.0		
• Fair	139	36.4	5	18.5		
• Good	235	61.5	22	81.5		
3. Safe Management of Patient Care Equipment and Soiled Linen[#]					1.520	0.468
• Poor	8	2.1	0	0.0		
• Fair	106	27.7	10	37.0		
• Good	268	70.2	17	63.0		

Nurses' Total Score of Knowledge about Seven Components of Standard Precautions of IPC Practices	Types of Family Planning Clinics				χ^2	P
	Fixed (n = 382)		Mobile (n = 27)			
	No.	%	No.	%		
4. Prevention of Needle Stick/Sharp Injuries[#]						
• Poor	2	0.5	0	0.0	3.566	MC P=0.217
• Fair	62	16.2	1	3.7		
• Good	318	83.2	26	96.3		
5. Respiratory Hygiene and Cough Etiquette[#]						
• Poor	0	0.0	0	0.0	6.770*	0.009*
• Fair	198	51.8	7	25.9		
• Good	184	48.2	20	74.1		
6. Environmental Cleaning and Spills Management[#]						
• Poor	0	0.0	0	0.0	0.532	FE P=0.434
• Fair	64	16.8	6	22.2		
• Good	318	83.2	21	77.8		
7. Safe Waste Management[#]						
• Poor	0	0.0	0	0.0	2.146	0.143
• Fair	106	27.7	4	14.8		
• Good	276	72.3	23	85.2		

[#] Total Score of Knowledge about Seven Components of Standard Precautions of IPC Practices as follows: Poor < 50%, Fair 50% < 75%, Good ≥ 75%

χ^2 : Chi square test MC: Monte Carlo FE: Fisher Exact *: Statistically significant at p ≤ 0.05



Overall Score of Knowledge about Seven Components of Standard Precautions of IPC practices
 $\chi^2 = 2.441$ p = 0.118

Figure (1): Distribution of the Studied Nurses Working in Fixed versus Mobile Family Planning Clinics according to their overall Score of Knowledge about Seven components of Standard Precautions of IPC Practices

Table (3): Distribution of the Studied Nurses Working in Fixed versus Mobile Family Planning Clinics according to their Total Score of Compliance' Level with Seven Components of Standard Precautions of IPC Practices

Nurses' Total Score of Compliance' Level with Seven Components of standard precautions of IPC practice	Types of Family Planning Clinics				χ^2	p
	Fixed (n = 382)		Mobile (n = 27)			
	No.	%	No.	%		
1. Hand Hygiene[#]						
• Non compliance	118	30.9	14	51.9	5.069*	0.024*
• Compliance	264	69.1	13	48.1		
2. Personal Protective Equipment(PPE)[#]						
• Non compliance	140	36.6	9	33.3	0.120	0.729
• Compliant	242	63.4	18	66.7		
3. Safe Management of Patient Care Equipment and Soiled Linen[#]						
• Non compliance	23	6.0	8	29.6	20.065*	FE p= <0.001*
• Compliance	359	94.0	19	70.4		
4. Prevention of Needle Stick/Sharp Injuries[#]						
• Non compliance	30	7.9	0	.0	2.288	FE p= 0.245
• Compliance	352	92.1	27	100.0		
5. Respiratory Hygiene and Cough Etiquette[#]						
• Non compliance	35	9.2	1	3.7	0.936	FE p= 0.494
• Compliance	347	90.8	26	96.3		
6. Environmental Cleaning and Spills Management[#]						
• Non compliance	197	51.6	9	33.3	3.355	0.067
• Compliance	185	48.4	18	66.7		
7. Safe Waste Management[#]						
• Non compliance	96	25.1	11	40.7	3.181	0.075
• Compliance	286	74.9	16	59.3		

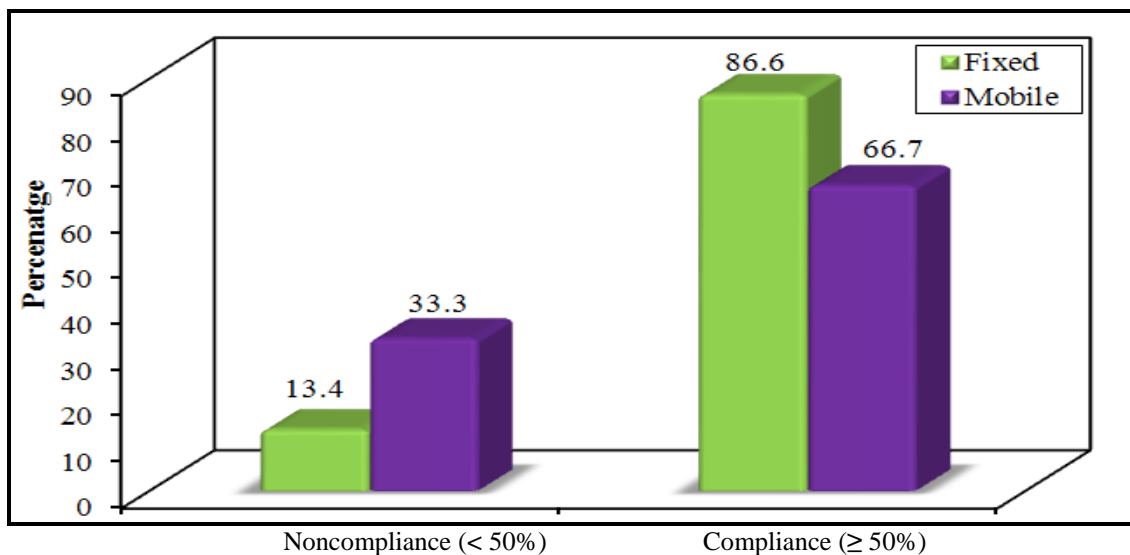
[#] Total Score of Compliance' Level with Seven Components of Standard Precautions of IPC Practices as follows: Compliance ≥ 50%, Noncompliance < 50%

χ^2 : Chi square test

FE: Fisher Exact

p: p value for comparing between the studied groups

*: Statistically significant at p ≤ 0.05



Overall Score of Compliance' Level about Seven Components of Standard Precautions of IPC Practices.

$\chi^2 = 8.044^*$, $p^{FE} = 0.009^*$ Statistically significant at p ≤ 0.05

Figure (2): Distribution of the studied nurses working in fixed versus mobile family planning clinics according to overall Score of compliance' level with IPC practices

Table (4): Correlation between the Studied Nurses' Knowledge and their Level of Compliance with Seven Components of Standard Precautions of IPC Practices in Fixed Family Planning Clinics

Level of compliance with seven components of IPC practices		Nurses' knowledge about seven components of IPC practices						
		Hand hygiene	Personal protective equipment's	Safe management of patient care equipment and soiled linen	Prevention of needle stick/sharp injuries	Respiratory hygiene and cough etiquette	Environmental cleaning and spills management	Waste management
Hand hygiene	r	0.175*	–	–	–	–	–	–
	p	0.001*	–	–	–	–	–	–
Personal protective equipment's (PPE)	r	–	0.104*	–	–	–	–	–
	p	–	0.042*	–	–	–	–	–
Safe management of patient care equipment and soiled linen	r	–	–	0.234*	–	–	–	–
	p	–	–	<0.001*	–	–	–	–
Prevention of needle stick/sharp injuries	r	–	–	–	0.272*	–	–	–
	p	–	–	–	<0.001*	–	–	–
Respiratory hygiene and cough etiquette	r	–	–	–	–	0.030	–	–
	p	–	–	–	–	0.558	–	–
Environmental cleaning and spills management	r	–	–	–	–	–	0.040	–
	p	–	–	–	–	–	0.435	–
Safe waste management	r	–	–	–	–	–	–	0.121*
	p	–	–	–	–	–	–	0.018*

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$ **Table (5): Correlation between the Studied Nurses' Knowledge and their Level of Compliance with Seven Components of Standard Precautions of IPC Practices in Mobile Family Planning Clinics**

Level of compliance with seven components IPC practices		Nurses' knowledge about seven components IPC Practices						
		Hand hygiene	Personal protective equipment	Safe management of patient care equipment and soiled linen	Prevention of needle stick/sharp injuries	Respiratory hygiene and cough etiquette	Environmental cleaning and spills management	Waste management
Hand hygiene	r	-0.283	–	–	–	–	–	–
	p	0.152	–	–	–	–	–	–
Personal protective equipment(PPE)	r	–	0.343	–	–	–	–	–
	p	–	0.080	–	–	–	–	–
Safe management of patient care equipment and soiled Linen	r	–	–	0.220	–	–	–	–
	p	–	–	0.270	–	–	–	–
Prevention of needle stick/sharp injuries	r	–	–	–	-0.139	–	–	–
	p	–	–	–	0.489	–	–	–
Respiratory hygiene and cough etiquette	r	–	–	–	–	-0.205	–	–
	p	–	–	–	–	0.305	–	–
Environmental cleaning and spills-management	r	–	–	–	–	–	-0.067	–
	p	–	–	–	–	–	0.739	–
Waste management	r	–	–	–	–	–	–	-0.043
	p	–	–	–	–	–	–	0.830

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

Table (1): Displays the Distribution of the Studied Nurses Working in Fixed \ Mobile Family Planning Clinics according to their Socio-Demographic Characteristics.

Concerning to nurses' ages, the table shows that more than one half (55.6%) of the studied nurses who working in mobile family planning clinics, and more than two fifths (42.7%) of nurses in fixed family planning clinics were aged from 40 to less than 50 years With a mean of 43.52 ± 5.70 , $.35 \pm 8.81$ in mobile and fixed family planning clinics respectively. As regard to **level of education**, the majority and less than three quarters (92.6%, 74.1%) of the studied nurses who work in both settings had nursing diploma. In relation to **marital status**, the highest percent (92.6%, 80.1%) of the studied nurses in both settings were married respectively.

Concerning to **years of working experiences**, less than three quarters (70.4%, 58.1%) of the studied nurses who work in mobile and fixed family planning clinics had more than 20 years of working experiences respectively.

Table (2): Clarify the Distribution of the Studied Nurses Working in Fixed versus Mobile Family Planning Clinics according to their Total Score of knowledge about Seven Components of Standard Precautions of IPC Practices.

Concerning to total score of nurses' knowledge about **hand hygiene**, it was observed from the table that less than three quarters (70.4%) of the studied nurses in mobile family planning clinics had good level of knowledge about hand hygiene, while nearly two fifths (40.3%) of nurses in fixed family planning clinics had good level of knowledge. There was statistically significant differences between both settings ($p= 0.002^*$).

In relation to total score of nurses' level of knowledge about **Personal Protective Equipment (PPE)**, less than two thirds (61.5%) of the studied nurses in fixed family planning clinics had good level of knowledge about PPE, and only 2.1% of them had poor level of knowledge. While more than three quarters (81.5%) of the studied nurses in mobile family planning clinics had good level of knowledge about PPE. There was no statistically significant differences between both settings ($p=0.108$).

Regarding to total score of nurses' level of knowledge about **safe management of patient care equipment and soiled linen**, less than three quarters (70.2%) and less than two thirds (63.0%) of the studied nurses in fixed and mobile family planning clinics had good level of knowledge respectively. With no statistically significant difference between both settings ($p= 0.468$).

Pertaining to total score of nurses' level of knowledge about **prevention of needle stick/sharp injuries**, the

highest percent (96.3%, 83.2%) of the studied nurses in mobile and fixed family planning clinics had good level of knowledge. With no statistically significant difference between both settings ($^{MC}p= 0.217$).

Regarding to total score of nurses' level of knowledge about **Respiratory hygiene and cough etiquette**, nearly three quarters (74.1%) of the studied nurses in mobile family planning clinics had good level of knowledge, compared to nearly one half (48.2%) of the studied nurses in fixed family planning clinics. There was statistically significant difference between both settings ($p= 0.009^*$).

Concerning to total score of nurses' level of knowledge about **environmental cleaning and spills management**, more than three quarters (83.2%, 77.8%) of the studied nurses in fixed and mobile family planning clinics had good level of knowledge respectively. There was no statistically significant difference between both settings ($^{FE}p= 0.434$).

Pertaining to total score of nurses' level of knowledge about **safe waste management**, the table clears that the percent of the studied nurses who had good level of knowledge about safe waste management was 85.2%, 72.3% in mobile and fixed family planning clinics respectively. There was no statistically significant difference between both settings ($p= 0.143$).

Figure (1): shows the distribution of the Studied Nurses Working in Fixed versus Mobile Family Planning Clinics according to their overall Score of Knowledge about Seven components of Standard Precautions of IPC Practices.

It is surprising that total percent of the studied nurses ranged from good and fair level of knowledge. The figure illustrate that more than three quarters (77.8%) of the studied nurses who working in mobile family planning clinics compared to less than two thirds (62.8%) of the studied nurses who working in fixed family planning clinics had good level of knowledge about standard precaution of IPC practices. While more than one third (37.2%) of the studied nurses who working in fixed family planning clinics compared to more than one fifth (22.2%) of the studied nurses who working in mobile family planning clinics had fair level of knowledge about standard precaution of IPC practices. there was no statistically significant difference between both settings ($p=0.118$).

Table (3): Show the distribution of the Studied Nurses Working in Fixed versus Mobile Family Planning Clinics according to their Total Score of Compliance' Level with Seven Components of Standard Precautions of IPC Practices

Concerning to nurses' compliance with hand hygiene practices, the percent of nurses who were compliance

was (69.1%,48.1%) in both setting. a statistically significant difference was found ($p=0.024^*$). As regard to use of PPE, nearly two thirds (66.7%, 63.4%) of them in both settings were compliance with use of PPE. No a statistically significant difference was found. ($p=0.729$).

Additionally, the majority (94.0%) of the studied nurses in fixed family planning clinics were compliance with safe management of patient care equipment and solid linen, compared to 70.4% of them in mobile family planning clinics. there was statistically significant difference ($^{FE}p < 0.001^*$).

Concerning to prevention of needles stick/sharp injuries, it is clear from the table that 100% and 92.1% of the studied nurses in mobile and fixed family planning clinics were compliance, with no a statistically significant difference was found ($^{FE}p=0.245$). Regarding to respiratory hygiene and cough etiquette, the majority (96.3%, 90.8%) of the studied nurses in both settings were compliance respectively. No a statistically significant difference was found ($^{FE}p=0.494$).

In relation to environmental cleaning and spills-management, 66.7% of the studied nurses in mobile family planning clinics, compared to 48.4% of nurses in fixed family planning clinics were compliance. With No a statistically significant difference ($p=0.067$). Regarding to safe waste management, nearly three quarters of the studied nurses 74.9% in fixed family planning clinics compared to less than two third (59.3%) in mobile family planning clinics were compliance. There was no a statistically significant difference. ($p=0.075$).

Figure (2): Shows the distribution of the studied nurses working in fixed versus mobile family planning clinics according to overall Score of compliance' level with IPC practices

It can be observed from this figure that the percent of nurses who were compliance with IPC practices was 89.6%, 66.7% in fixed and mobile family planning clinics respectively. There was statistically significant difference ($^{FE}p=0.009^*$).

Table (4): Shows the correlation between the studied nurses' knowledge and their level of compliance with standard precaution of IPC practices in fixed family planning clinics. It appears from this table that, there was a statistically significant positive correlation between nurses' knowledge about IPC practices and their level of compliance as hand hygiene ($r=0.175^*$, $P=0.001^*$) personal protective equipment ($r=0.104^*$, $P=0.042^*$), safe handling of patient care equipment and soiled linen ($r=0.234^*$, $P=0.001^*$), prevention of needle stick/sharp injuries ($r=0.272^*$, $P=0.001^*$) waste management ($r=0.121^*$, $P=0.018^*$). On the other hand, there was no statistically

significant positive correlation between nurses knowledge and their level of compliance regarding respiratory hygiene and cough etiquette ($r=0.030$, $P=0.558$) and environmental cleaning and spills management ($r=0.040$, $P=0.435$).

Table (5): Displays the correlation between the studied nurses' knowledge and their level of compliance with standard precautions of IPC practices in mobile family planning clinics. It appears from this table that, there was no statistically significant negative correlation between nurses' knowledge about IPC practices and their level of compliance as hand hygiene ($r=-0.283$, $P=0.152$), prevention of needle stick/sharp injuries ($r=-0.139$, $P=0.489$), respiratory hygiene and cough etiquette ($r=-0.205$, $p=0.305$), environmental cleaning and spills management ($r=-0.067$, $p=0.739$), waste management ($r=-0.043$, $p=0.830$). On the other hand, there was no statistically significant positive correlation between nurses' knowledge about IPC practices and their level of compliance regarding personal protective equipment ($r=0.343$, $P=0.080$) and safe handling of patient care equipment and soiled linen ($r=0.220$, $P=0.270$).

Discussion

Nurses' compliance with IPC practices is a key role in prevent occurrence of healthcare - associated infection in family planning clinics by using their knowledge and practice to protect themselves and patients from exposure to potentially infection. Family planning nurses perform a wide range of activities that can put their health and well-being at risk of harm. So they should follow the standard precautions of IPC practices to ensure patients and nurses safety. Thus, assessing nurses' compliance with IPC practices is very important to reduce healthcare- associated infection in family planning clinics. (Rube et al., 2019).

Regarding to nurses' level of knowledge about standard precautions of IPC practices, the present study showed that more than three quarters of the studied nurses in mobile family planning clinics had good level of knowledge about IPC practices than those who working in fixed family planning clinics, with no statistically significant differences between the studied nurses in both settings.

These findings are consistent with Abdul Hussein et al., (2022) in the study of nurses knowledge about infection control at primary health care centers, reported that 83.6% of the studied nurses who working in **fixed family planning clinics** had good level of knowledge about IPC practices, and contradicted with Mhana et al., (2022) in the study of nurses' performance regarding infection control precautions in primary health care centers, reported

that only 26.4% of the studied nurses had good level of knowledge about IPC practices. While in **mobile family planning clinics**, the findings are contradicted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units, reported that 30.5% of the studied nurses had good level of knowledge regarding standard precautions of IPC practices. This difference could be due to the variety of socio demographic factors and geographic areas between studies settings. The current study revealed that less than three quarters of the studied nurses who working in mobile family planning clinics had good level of knowledge about **hand hygiene** compared to nearly two fifths of the studied nurses in fixed family planning clinics. And there was statistically significant difference between nurses in both settings. The findings of the present study in **fixed family planning clinics** are in line with **Shehab El-Din et al., (2022)** in their study, effect of educational program on nurses' performance regarding infection control in labor and delivery care units, they found that 33.5% of the studied nurses had good level of knowledge regarding hand hygiene, and contradicted with **Abu Salam et al., (2022)** in the study of infection control awareness among healthcare providers in family health settings, who found that about 96.5% of the studied nurses had good level of knowledge. While in **mobile family planning clinics** these findings are not compatible with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who reported that 31% of the studied nurses had good level of knowledge about hand hygiene practices. This discrepancy may be related to variations in socio demographic characteristics regarding age and years of work experiences.

Use of **Personal Protective Equipment (PPE)** is vital in implementing IPC practices. The current study revealed that more than three quarters of the studied nurses in mobile family planning clinics had good level of knowledge about PPE than those in fixed family planning clinics that was less than two thirds, but there was no statistically significant difference between nurses in both settings.

These findings in **fixed family planning clinics** are in agreement with **Abed Alah et al., (2022)** in their study, occupational prevention of COVID-19 among healthcare workers in primary healthcare settings who found that 88% of the studied subjects had good level of knowledge regarding use of PPE, while contradicted with **Ijachi et al., (2020)** in the study of knowledge, attitude and practice of injection safety among Benue State University Teaching Hospital Healthcare Professionals, who reported that 40.4% of the studied nurses had good level of knowledge about

PPE. On the other hand, in **mobile family planning clinics** these findings are contradicted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who reported that 33.5% of the studied nurses had good level of knowledge about use of PPE. This variation could be explained by in the current study there were continuously effective training program about IPC practices for family planning nurses about IPC practices.

Regarding to **patient care equipment and soiled linen**, the findings of the current study demonstrated that nearly three quarters of the studied nurses in both settings had good level of knowledge, and there was no statistically significant difference. In **fixed family planning clinics**, these findings are consistent with the study which done by **Abdul Hussein et al., (2022)** in their study, nurses knowledge about infection control at primary health care centers, stated that 88.6% of the studied nurses had good level of knowledge about safe management of patient care equipment and soiled linen, Incompatible, the study done by **Rawajfah et al., (2018)** in the study of compliance of Jordanian registered nurses with infection control guidelines, who stated that 36.5% of the participating nurses had good level of knowledge. On the other hand, in **mobile family planning clinics** the findings of the current study are consistent with **El Hakiem et al., (2020)** in their study of universal precautions for infection control in health care in shoubra el kheimah, who stated that 62.1% of the studied nurses had good level of knowledge about safe management of patient care equipment and soiled linen, while contradicted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who reported that 24.8% of the studied nurses had good level of knowledge about safe management of patient care equipment and soiled linen. This variation may be due to in these work places which studies were conducted there were no enough advertised posters about management of patient care equipment and solid linen with no enough educational programs to improve nurses' knowledge about IPC practices, where only 27% of nurses had IPC training in these studies.

The current study revealed that the majority of the studied nurses in both settings had good level of knowledge about **prevention of needle stick/sharp injuries (NSI)**, and there was no statistically significant difference between nurses in both settings. These results in **fixed family planning clinics** approved with the study conducted by **Al Qadire et al., (2021)** in their study student nurses' knowledge and practices of needle stick injuries during clinical training, who showed that 92% of the studied nurses

had good level of knowledge regarding to prevention of needle stick/sharp injuries, while contradicted with **Rizk et al., (2021)** in their study assessment of infection control measures at primary health care facilities, who stated that 43.4% had good level of knowledge. While in **mobile family planning clinics** these findings are contrasted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who reported that 34% of the studied nurses had good level of knowledge about prevention of needle stick/sharp injuries. This variation can be justified by in the current study the highest percent of nurses had more than 20 years of work experiences, so they had more knowledge about IPC practices.

Regarding to **respiratory hygiene and cough etiquette**, the current study revealed that nearly three quarters and nearly one half of the studied nurses in mobile and fixed family planning clinics had good level of knowledge. There was statistically significant difference between nurses in both settings. These findings in **fixed family planning clinics** are consistent with **Alzahrani et al., (2019)** in their study assessment of the knowledge and practices of infection control standard among health care workers at primary healthcare level, who found that 90% of the studied nurses had good level of knowledge, and contradicted with **Turnberg et al., (2016)** in their study appraisal of recommended respiratory infection control practices in primary care and emergency department settings who reported that 20% of the studied nurses had good level of knowledge regarding respiratory hygiene and cough etiquette. While in **mobile family planning clinics** the findings of the present study are not consistent with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who reported that 30.5% of the studied nurses had good level of knowledge about respiratory hygiene and cough etiquette. This variation may be due to frequent outbreak of respiratory diseases in the last years, so nurses have more attention and more knowledge to protect them self against respiratory diseases as COVID19.

Regarding to **environmental cleaning and spills management**, the present study showed that nurses in both settings had good level of knowledge, and there was no statistically significant difference between the studied nurses in both settings. The findings of the current study in **fixed family planning clinics** are in vein with **Abu Salam., (2022)** in the study of infection control awareness among healthcare providers in family health settings who reported that 97.9% of the studied nurses had good level of knowledge about environmental cleaning and spill management. While in **mobile family planning**

clinics the study findings are in line with **El Hakiem et al., (2020)** in their study, universal precautions for infection control in health care, who stated that 54.3% of the studied nurses had good level of knowledge about environmental cleaning and spill management. Concerning to **safe waste management**, the present study revealed that the highest percent of the studied nurses in fixed and mobile family planning clinics had good level of knowledge, and there was no statistically significant difference between nurses in both settings. The findings of the present study in **fixed family planning clinics** are compatible with **Abdul Hussein et al., (2022)** in their study, nurses knowledge about infection control at primary health care centers, reported that 82.6% of the studied nurses had good level of knowledge regarding waste management, while these findings are contrasted with the study which done by **Gupta et al., (2016)** in their study of knowledge, attitude and practices of biomedical waste management among health care personnel in selected primary health care centers, who reported that 35% of the studied nurses had good level of knowledge.

On the other hand, the findings of the present study in **mobile family planning clinics** are contradicted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who reported that 30.5% of the studied nurses had good level of knowledge about standard precautions. This variation may be due to continues training about IPC program in primary health care facilities and availability of IPC guideline and close observation from infection control committee.

Concerning to nurses' compliance regarding IPC practices, compliance is a complex behavioral process which is strongly influenced by personal, psychological, environmental and by health care work related factors. In the current study level of nurses' compliance in fixed family planning clinics was high than those in mobile family planning clinics, and there was a statistically significant difference between the studied nurses in both settings.

In **fixed family planning clinics** these findings are consistent with **Bayoumy .,(2017)** in the study of client's satisfaction regarding nurses' performance in family planning centers in a rural community, who reported that most of nurses were compliance with IPC practices, while contradicted with **Mhana et al., (2022)** in their study nurses' performance regarding infection control precautions in primary health care centers, who observed that 41.4% of the studied nurses were compliance with IPC practices, while these findings in **mobile family planning clinics** are agreement with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection

control in ambulatory care units, who observed that 53.8% of the studied nurses had correct performance toward infection control.

When discuss the nurses' level of compliance regarding to the components of IPC practices, the current study showed that nurses' compliance with hand hygiene practices was high in fixed family planning clinics than those in mobile family planning clinics, a statistically significant difference was found. In **fixed family planning clinics** these findings agreement with **Abo El-Enen et al., (2019)** in their study of nurses' performance at the family planning clinics in Alexandria, who observed that nearly 60% of the studied nurses were compliance with hand hygiene practices, while contradicted with **Rizk et al., (2021)** in their study assessment of infection control measures at primary health care facilities who found that 10% of the studied nurses were compliance with hand hygiene practices. On the other hand, in **mobile family planning clinics** these findings consistent with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units, who found that 54.1% of the studied nurses were compliance with hand hygiene practices. This variation may be justified by in the current study hand hygiene supplies were not enough or not available in mobile family planning clinics, such as soap, towels and source of water.

Concerning to use of personal protective equipment the present study revealed that nearly two thirds of the studied nurses in mobile and fixed family planning clinics were compliance with use of PPE. No a statistically significant difference was found. These findings in **fixed family planning clinics** are in line with **Abed Alah et al., (2022)** in their study, occupational prevention of COVID-19 among healthcare workers in primary healthcare settings, who observed that 76.3% of the studied nurses were compliance with use of PPE. While in **mobile family planning clinics** the findings are contradicted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units, who found that 43.6% of the studied nurses were compliance with uses of PPE. Variability between these studies results could be related to availability of PPE in the different study settings.

Regarding to nurses' compliance with **safe management of patient care equipment and solid linen**, the present study revealed that the majority of the studied nurses in fixed family planning clinics were compliance with safe management of patient care equipment and solid linen, compared to less than three quarters of them in mobile family planning clinics. There was statistically significant difference.

These findings in **fixed family planning clinics** are in line with study done by **Abo El-Enen et al., (2019)** in their study of nurses' performance at the family planning clinics in Alexandria who found that 80% of nurses followed recommendation of cleansing and disinfection of equipment correct and complete, and contradicted with **Esmail et al., (2019)** in their study of factors influencing nurses' compliance with standard precautions regarding occupational exposures to blood and body fluids, who reported that only 44.2% of the studied nurses had satisfactory practice regarding cleaning instruments and linen. While in **mobile family planning clinics** these finding are contradicted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who found that 19.4% were compliance with linen management practices. This variation could be explained by availability of suitable place for managing of patient care equipment and solid linen in different settings.

The present study revealed that nurses' compliance with **prevention of needle stick\ sharp injuries** in both settings was high; there was no statistically significant difference between nurses in both settings. The findings of the present study in **fixed family planning clinics** are concordance with **Bahegwa et al., (2022)** in their study of factors affecting compliance with infection prevention and control standard precautions among healthcare workers in Songwe region, who reported that 94% of the studied nurses taken safety precaution during injection correct and complete, while contrasted with **Alzahrani et al., (2019)** in their study assessment of the knowledge and practices of infection control standard among health care workers at primary healthcare level, who found that 40% of the studied nurses were compliance with prevention of needle stick injury. While in **mobile family planning clinics Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units reported that 53.2% of the studied nurses were compliance with prevention of needle stick\ sharp injuries. This variation may be due to availability of infection control guideline and posters of safe injection practices in all health care facilities in addition to continuous training and close observation on nurses' practices from infection control committee personnel.

Regarding to **respiratory hygiene and cough etiquette**, the present study revealed that the majority of the studied nurses in mobile and fixed family planning clinics were compliance respectively. There was no statistically significant difference between nurses in both settings. These findings in **fixed family planning clinics** are in line with **Donati et al., (2020)** in their study effectiveness of implementing link

nurses and audits and feedback to improve nurses' compliance with standard precautions, who found that 85% of nurses were competent related to respiratory precautions. While contradicted with **Alzahrani et al., (2019)** in their study assessment of the knowledge and practices of infection control standard among health care workers at primary healthcare level, who reported that 30.0% of studied nurses were compliance with respiratory hygiene and cough etiquette. This variation explained by spread of respiratory infection (COVID19) at the time of collecting study data, thus nurses protect their selves by follow respiratory hygiene and cough etiquette.

Regarding to nurses compliance with **environmental cleaning and spills management**, the present study revealed that two thirds of the studied nurses in mobile family planning clinics, compared to nearly on half of nurses in fixed family planning clinics were compliance. There was no a statistically significant difference between nurses in both settings.

The findings of the current study in **fixed family planning clinics** are in line with **Rizk et al., (2021)** in their study assessment of infection control measures at primary health care facilities, who reported that 57.9% of the studied nurses were compliance with environmental cleaning and spills management. While contradicted with **Bahewa et al., (2022)** in their study of factors affecting compliance with infection prevention and control standard precautions among healthcare workers, who reported that only 8% of the studied nurses were handling correctly spills of blood/body fluid on surfaces. On the other hand, in **mobile family planning clinics** the study findings are agreement with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units, who observed that 41.7% of the studied nurses were compliance with environmental cleaning and spill management. These differences may be explained by availability of places and equipment needed for cleaning equipment in these studies settings.

Regarding to **safe waste management**, nearly three quarters of the studied nurses in fixed family planning clinics compared to less than two third in mobile family planning clinics were compliance with safe waste management. There was no a statistically significant difference between nurses in both settings. The current study findings in **fixed family planning clinics** were supported by **Gonibeedu et al., (2020)** in outcome of biomedical waste management training among staff nurses of primary health centers, who observed that 54% of the studied nurses were compliance with waste management. While contradicted with **Tabash & Ashraf., (2018)** in their study of compliance of healthcare staff towards infection control precautions, who concluded that

nurses' compliance with waste disposal was low. On the other hand, the study findings in **mobile family planning clinics** are consistent with the study done by **Soliman et al., (2018)** in their study of improving nurses' performance toward infection control in ambulatory care units, who found that 58.8% of the studied nurses were compliance with waste management.

Regarding to the correlation between nurses' knowledge and practice about IPC practices in fixed family planning clinics, the present study revealed that there was a statistically significant positive correlation between nurses' knowledge about IPC practices and their level of compliance. These results supported by the results of the following studies which done by **Assefa et al., (2020)** in their study of infection prevention knowledge, practice, and its associated factors among healthcare providers in primary healthcare unit, and **Rensburg et al., (2018)** in their study of infection prevention knowledge, attitudes, and practices of primary health care nurses, they stated that there was a statistically significant positive correlation between nurses' level of knowledge and their level of compliance with IPC practice.

On the other hand, these findings are contradicted with the study done by **Sarani et al., (2016)** in their study of knowledge, attitude and practices of nurses about standard precaution for hospital acquired infection, who reported that no statistically significant positive correlation was found between nurses' level of knowledge and their level of compliance with IPC practice. This finding reflects that nurses' performance is based on their knowledge .

On the other hand, no statistically significant negative correlation between nurses' knowledge about IPC practices and their level of compliance in mobile family planning clinics, these results in line with **El-Hebshi et al., (2018)** in the study of nurses' knowledge and practice about infection control in outpatient clinics, who reported that there was no statistically significant negative correlation between total score of nurses' performances and their knowledge. While these findings are contradicted with **Soliman et al., (2018)** in the study of improving nurses' performance toward infection control in ambulatory care units who reported that there was a positive correlation between nurses' knowledge and their level of compliance with IPC practices.

Conclusion

Based on the findings of the present study, it can be concluded that, level of nurses' compliance in fixed family planning clinics was high than those in mobile family planning clinics, and there was a statistically significant difference between the studied nurses in

both settings. On the other hand, nurses' knowledge in mobile family planning clinics was high than those in fixed family planning clinics, there was no statistically significant difference between the studied nurses in both settings.

Recommendations

Based on the current study findings the following recommendations are suggested:

- Monitoring and supervision from infection control nurses to family planning nurses to ensure the application of IPC program in fixed and mobile family planning clinics.
- Motivating the staff nurses in primary healthcare facilities through the application of specific rewards schemes for IPC practices
- Follow up and evaluate nurses' compliance with IPC practices at family planning clinics by infection control nurses.
- Implementing educational programs for family planning nurses in primary health care facilities to improve nurses' knowledge and compliance with IPC practices.

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