Knowledge and Compliance of Nursing Students regarding Infection Control Standard Precautions during their Clinical Training

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Background: Infection is one of the most important problems in health care services worldwide; also, it constitutes one of the most important causes of morbidity and mortality associated with clinical, diagnostic and therapeutic procedures. Nursing students are more exposed to infections duringtheir clinical training, so they need to improve their performance related to infection control measures. Standard precautions are set of measures formulated to prevent transmission of blood borne pathogens when providing health care. **Aim of the study:** Assess knowledge and compliance of nursing students regarding infection control standard precautions during their clinical training. **Study design:** An analytic comparative cross-sectional study was used for this study**. Subjects and method**: The study was conducted on 450 nursing studentsof second, third and fourth academic yearsat the Faculty of Nursing Tanta University. **Toolsof data collection: Tool I**: Structured questionnaire sheet which consisted of two parts. **Part 1: -** Socio-demographiccharacteristics of the nursing students. **Part 2: -**Standard precautions knowledge. **Tool II: Part 1:** Used for measuringcompliance with standard precautions. **Part 2:** measuring factors affecting the compliance with standard precautions. **Results**: The mean of ages of the studied students were 20.21±0.619, 21.67±1.047, and 21.74±0.65 years for second, third and fourth academic years respectively. The total mean scores of knowledge were (13.04±3.072, 13.55±1.144, and 12.24±2.579) respectively. The total compliance score in the studied group were 30.91±5.844, 30.75±3.183 and 29.67±5.142 in the second, third and fourth years of students respectively. Also majority (89.3%, 94.7 % and 82.7% respectively) of the studied groups (second, third and fourth years) had good practice score of compliance, also there werea statistical significance difference between the levels of knowledge scores and also between the levels of compliance scores $P< 0.05$. **Conclusion and recommendations**: This study showed that there was statistically significance difference in relation to total score of knowledge and compliance score in the three studied years. However, the periodic refresher in-service training courses and regular lectures should be provided to nursing students in order to keep them of updating knowledge and practice regarding standard precaution measures.

Key words**:** *Infection Control, Knowledge, Clinical training, Compliance, Standard Precautions*

Introduction:

Nosocomial infection (NI), or hospital-acquired infection or Health-Care-Associated Infection (HCAI) refers to infection that is acquired during the process of care providing and not manifested at the time of hospital admission or other health-care facility [1-3]. About 5% –10% of patients admitted to acute care hospitals in developed countries acquire HCAI at any given time, and the risk of acquiring infection is 2 – 20 times higher in developing countries [4]. It constitutes a global health problem, and is considered as one of the leading causes of increased morbidity and mortality such as,prolonged hospitalization /Intensive Care Unit (ICU) stay; increased severity of the underlying illness; increased utilization of devices for monitoring and treatment; increased cost of treatment in both developed and developing countries; and impairment of the quality of patient's and family's life [5-7].Health care professionals are constantly exposed to blood and other body fluids in the course of their work specially at delivery room and operating room. Hence, they are at a higher risk of acquiring infections such as human immune virus (HIV), Hepatitis B, and Hepatitis C etc. Occupational exposure to blood can result from percutaneous injury (needle stick or other sharps injury), mucocutaneous injury (splash of blood or other body fluids into the eyes, nose or mouth), or contact with non-intact skin. According to the WHO, out of 35 million health workers worldwide, about 3 million receive percutaneous exposures to blood borne pathogens each year; two million of those to HBV, 0.9 million to hepatitis C virus (HCV) and 170 000 to HIV. These injuries may result in 15 000 (HCV), 70 000 hepatitis B virus (HBV) and 500 HIV infections. More than 90% of these infections occur in developing countries. Nursing students are also at risk of such infections and injuries due to accidental contamination during their practical occupational exposure [7 -10].

Exposure to infectious material can be minimized by adherence to standard precautions which are designed to reduce the risk of acquiring occupational infection from both known and unexpected sources in the healthcare setting[8,9]. Standard precautions are set of measures formulated to prevent transmission of any type of pathogens when providing health care. Since identification of patients infected with these pathogens cannot be reliably made by medical history and physical examination, in 1996, the Centers for Disease Control (CDC) included the universal precautions in a new prevention concept the so-called "standard precautions", which are devised to be used for providing care of all patients in

hospitals regardless of their diagnosis or presumed infection status, now replace the "universal precautions." The fact that "standard precautions" are recommended for the care delivery to all patients, regardless of their presumed infection state, it is important when handling equipment and devices that are contaminated or suspected of contamination with blood, body fluids, secretions and excretions except sweat, Standard precautions include hand washing; use of barriers (e.g., gloves, gown, cap, mask); care with devices such as fetal external and internalfetal monitoring, insertion of intrauterine device (IUD's), insertion of cannula and injections, equipment and clothing used during care; environmental control (e.g., surface processing protocols, health service waste handling); adequate discarding of sharp instruments including needles [(11-13)].

All standards of care provide a guide to the knowledge, skills, judgment and attitudes that are needed to practice safely. They describe what each nurse is accountable and responsible for practice. The aim of standard of Infection Control (IC) precautions is to prevent HCAI [(14).] Infection control standards become an integral part of the accreditation program for all medical settings in Egypt, where the National Guidelines for Infection Control" (NGIC) are produced and established by the infection control team at the Ministry of Health & Population (MOHAP) since the year 2003 [(15-17)] .Therefore, adequate nursing staff is necessary because a higher patient-to nurse ratio increases the risk of nosocomial infection [(18)].

Compliance is the extent to which certain behavior such as; following physician's orders or implementing healthier lifestylescan be influenced or controlled by a variety of factors like culture, economic and social factors and self-efficacy. Guidelines that guide an individual's behavior exist in a variety of settings including health care settings, but people do not always comply with them [(19-21)]. Studies have shown that compliance with precautions among nurses in order to avoid exposure to microorganisms is low. More specifically, compliance was found inadequate concerning regarding hand hygiene guidelines, use of gloves when exposure to body fluids was anticipated, eye protection, mouth and nose protection (mask use), wearing a gown when required , avoid recapping the needle after it was used for a patient, and provision of care considering all patients as potentially infectious[(22-25)].

Several factors ranging from personal to organizational causes were contributed to

non-compliance with Standard Precautions among health care providers due to lack of knowledge, lack of time, forgetfulness, lack of means , negative influence of the equipment on nursing skills, uncomfortable equipment, skin irritation, lack of training , conflict between the need to provide care and self-protection and distance to necessary equipment or facility[26-30].The costs of infection control and staffing are less when compared to that of HCAI. Therefore, nurses and student nurses should have professional and ethical responsibilities to make sure that their knowledge and skills regarding infection control standard precautions are up-to-date and they always practice safely and competently [31]. Thus, education about infection prevention and control was targeted as one of the main objectives of the infection control programs especially where nurses represent the largest group of workers within the healthcare system [32,33]. Nursing student should be able to provide carefor patients after learning the principles of standard precautions, effective training is essential to ensure that these concepts about standard precautions are understood and put into practice wherever health care is provided [34]. Nurses are expected to perform all functions necessary for the total patients care. They must know how to protect others from contacting infection, and she is responsible for disseminating prevention and control information to personnel, patients, their community members [35].Nursing students play a critical role in the prevention efforts so, they are an important population needed to study their level of knowledge, attitudes, and behavior regarding infection control measures, and obtaining this information are useful for developing programs to improve their performance [36,37]. Studies on standard precautions are increasing over the world [7, 8, 11, 14], however there has been limited attention paid to investigate nursing students' understanding and compliance regarding standard precautions within certain localities. Therefore, the purpose of the present study was to assessthe knowledge and compliance of nursing students regarding infection control standard precautions during their clinical training.

Aim of the study:

The aim of the present study was to assessknowledge and compliance of nursing students regarding infection control standard precautions during their clinical training.

Research questions:

-What are the nursing students' knowledge and compliance about standard precautions?

-What are the factors affecting nursing students' knowledge and compliance with infection control standard precautions?

Subjects and method:

Study Design: -

An analytic comparative study was used to conduct this study.

Study settings: -

The study was conducted during students clinical training at medical surgical, obstetric and gynecological departments in Faculty of Nursing and Tanta university hospital as well as maternal and child health care centers (MCH).

Study subjects: -

Data were collected over a period of three months from the beginning of March to the end of May during the second semester of the academic year 2018-2019. A proportion simple random sample of 25% of the total faculty studentswhich constituted 450students were enrolled and willing to participate in the study.

Tools of the study: -

Two tools were used in this study.

Tool (I): Structured questionnaire sheet. It was divided into twoparts: -

Part (1) Socio-demographic characteristics which included age, sex, residence, academic year, working beside the study and source of information.

Part (2): Knowledge of students about standard precautions: -

To gather data, the researchers adopted the questionnaires developed by Tavolacci etal., (2008)[38].Standard precautions knowledge questions included the basic concepts, content, and activity requirements of the standard precautions, which covering 18 items, with possible responses of 'yes', 'no', or 'unknown'. 'Yes' is given a value of 1 point(if Yes is correct answer); and 'No' or 'Unknown' 0 points in some items and 'No' is given a value of 1 point, and 'Yes ' 0 points in some items(if No is correct answer); the maximum possible score is 18. The total score ranged from zero to 18. The higher the score, the greater assumed knowledge about standard precautions the participant studentshave. Result of test was interpreted as follows; equal or more than (13.5)constituted "good knowledge" which is (≥ 75%), from 11.7- 13.5constituted "fair knowledge" which is (65% to < 75%) and fromzero to less than11.7 constituted "poor knowledge which is(<65%). The higher participants score means greaterknowledge about standard precautions of infection control.

Tool II: Compliance with standard precautions of infection control: -It included two parts.

Part (1): Compliance with standard precautions was measured by adapted the standard precautions questionnaires

developed by **Luo et al., (2010)**[39].One item on compliance questionnaire was removed, since students are not yet allowed to perform venous puncture. The Arabic translated version of compliance questionnaire was validated for its reliability resulting in statistical value of 0.78 (Cronbach's alpha). There are 17 compliance items with a scale of 0–2 points: 0 = never, 1= sometimes and 2 = always, giving a score range of 0–34. In determining the level of compliance, the following scaling was used; for good compliance more than 25.5 which equal ≥ 75%, satisfactory compliance more than 25.5 to less than 22.1 which equal from 65% to < 75%, poorcompliance less than 22.1 which equal< 65%. The higher the mean score, the better that student carries out the standard precautions.

Part (2): Factors affecting the compliance with standard precautions [40, 41]**: -**

Factors affecting the compliance with standard precautions were measured by the tool developed by the researchers according to literature review. This part covered two factors affecting the compliance with standard precautions: patient's type covered by four standard items as (children, foreigners irrespective of age, patient's personal characteristics irrespective of age and adults) as well as activity's type (situation) covered by sixteen standard items as (physician way of working/ demand, wrong routine practice at workplace, patient discomfort, embarrassment, reminding for using precautions, lack of time, time consuming, negative impact on nurse, equipment not immediately available, emergency situations, colleagues with more experience, previous exposure, protection offered by precautions, cost from being infected, fear and death) .There were 20 items with a scale of 1–3 points: 1 = less effect, 2= moderate effect and 3 = more effect, itwas giving a score ranged of 20–60. Total score of patient' type was categorized as follows: less than 9 refers to less effect, 9 moderate effect, and 10 and above more effect, while total score of activity' type (situation) categorized less than 37 less effect, 37-39 moderate effect, and 40 and above more effect.

Methods:

1- Before conducting the study, an official permission to carry out the study was secured through an official letter to deans of the Faculty of Nursing Tanta University explaining the purpose of the research to get the permission for data collection.
2- Ethical considerations: - Students' oral consent was obtained, rights, anonymity and confidentiality of the

respondents were respected in all phases of the study and all students were informed about the purpose and the benefits from this study.

3- The structured questionnaire sheet was developed based on literature review and was translated into Arabic version by the researchers.

4- Before embarking on actual study, the knowledge questionnaire and the compliance were used in a pilot test student on fifty students before being distributed to the students enrolled in this research and those students were excluded from the study. Refinement and modifications were done on the basis of pilot study results.

5- The researcher asked the students regarding compliance items during their clinical training (at medical and surgical units, obstetric and gynecological units including antenatal, labor and delivery unit as well as postpartum unit and operation room in cesarean section also in maternal and child health care centers (MCH).

6- The researcher asked the students on application of infection control standard precautions which are the minimum infection prevention practices that applied to all patient care, regardless of suspected or confirmed infection status of the patient including (hand hygiene, use of personal protective equipment's, (e.g., gloves, mask, eye wear), respiratory hygiene/ cough etiquette, safe injection practices(i.e., aseptic technique for parenteral medications), sterile instruments and devices as well as clean disinfected environmental surfaces) .

7-**Validity test**: The tool of data collection was distributed to a jury of 5 academic professors in Community Health Nursing Department, Maternity and Gynecological Nursing Department, and Medical and Surgical Nursing Department to test its face and content validity. Accordingly, corrections and modifications were done. The validity of the expertise judgments of the questions of the Arabic translated version of standard precautions knowledge was 0.98.

8-The reliability of the translated Arabic tool was done by using Cronbach's Alpha which was0.87.

9- Statistical analysis

The data were coded, entered and analyzed using SPSS (version 20). Descriptive statistics (frequency numbers Percentages and X^2) identified demographic characteristics and students' responses to the questionnaire. Paired t / F tests were used to analyze the relationships;

statistically significant was set at P value < 0.05%. Spearman correlation was used to examine the correlations between Knowledge and reported compliance total scores.

Results:

Table (1): Represents distribution of the studied subjects according to their socio-demographic data. This table shows that the means of ages of the studied students were 20.21±0.619, 21.67±1.047, and 21.74±0.65 years for second, third and fourth academic years respectively. More than three quarters (76.7%) and two thirds (64.0%) of students in the second and fourth year of students respectively were female, while more than half (50.7%) of students in third year were male. In relation to residence more than half (56.7 %), majority of students (84.7%) and more than three thirds (67.3%) of students in the second, third and fourth year respectively were lived in rural. In relation to working beside the study (91.3%, 60% and 78.7 %) of students in the second, third and fourth years were not working beside the study.

Table (2): Shows distribution of the studied subjects according to their source of knowledge. The table reveals that high percent of students their source of knowledge were lectures (61.3%, 76 % and 73.3% respectively) in the second, third- and fourth-years students and there were statistical significance difference P< 0.05. While low percent of students their sources of knowledge were hospital guidelines (8.7 %, 10 % and 29.3 % respectively) in the second, third- and fourth-year students, meanwhile there was statistical significance difference.

Table (3): Represents the mean scores of knowledge domains about infection control among studied subjects. The table shows that there was statistical significance difference between the three years students in relation to all knowledge domains about infection control standard precautions except for body fluid P< 0.05. The total mean scores of knowledge were (13.04±3.072, 13.55±1.144, and 12.24±2.579) respectively.

Table (4): Represents the mean scores of domains of compliance with slandered precaution about infection control among studied groups. The table shows that there were statistically significant differences in relation to syringe and sharp disposal P< 0.05 and the total mean score in the studied group were 30.91±5.844, 30.75±3.183 and 29.67±5.142 for the second, third and fourth years of students respectively.

Table (5): Represents the studied groups according to patient's type factors affecting the compliance with standard precaution. There was statistical significance difference between the three studied

groups in relation to patient's type factors (children, foreigners, patient's personal characteristics and adults) affecting the compliance with standard precaution P< 0.05.

Table (6): Represents distribution of the studied subjects according to activity's type (situation) factors affecting the compliance with standard precautions. This table showed that there was statistical significance difference between the three studied subjects of students in relation to activity's type (situation) factor affecting the compliance with standard precautions P< 0.05.

Table (7): Represents distribution of the studied subjects according to their levels of knowledge and compliance. This table shows that high percent of students had good level of knowledge 64.7 %, 75.3% and 39.3% in the second, third and fourth years respectively. Also majority (89.3%, 94.7 % and 82.7% respectively) of the studied groups (second, third and fourth years) had good practice score of compliance, also there was statistical significance difference between levels of scores of knowledge and also between levels of scores of compliance P< 0.05.

Table (8) and figure (1): Show the comparison between the studied groups according to total score of patient's type and activity's factors affecting the compliance with standard precautions. In relation to total score of patient's type there were high percent of students in the second and fourth years had more effect 50.7 % and 43.3 % respectively. Also, in relation to total score of activity's factors high percent 51.3% and 68% in the second and fourth year of students respectively had less effect. There was statistical significance difference in the three studied groups.

This table (9): Shows comparison between level of knowledge and compliance among the studied subjects. The table shows that there was statistically significance difference in relation to total score of knowledge and compliance score in the three studied years. The majority (97.9 %, 96.5 % and 94.9%) of students with good compliance score had good knowledge score respectively.

Table (1): Distribution of the studied subjects according to their socio-demographic data

Socio-demographic data		2nd Year(n=150)		3rdYear(n=150)		4th Year (n=150)	
		N	%	N	%	N	%
Age (years)	=< 21	148	98.7	73	48.7	55	36.7
	> 21	2	1.3	77	51.3	95	63.3
	Range Mean ± SD	22-19 20.21±0.619		23-20 21.67±1.047		24-21 21.74±0.65	
Sex	Male	35	23.3	76	50.7	54	36.0
	Female	115	76.7	74	49.3	96	64.0
Residence	Rural	85	56.7	127	84.7	101	67.3
	Urban	65	43.3	23	15.3	49	32.7
Working beside study	No work	137	91.3	90	60.0	118	78.7
	private hospital	13	8.7	60	40.0	32	21.3

*** Significant at level P< 0.05**

Table (2): Distribution of the studied subjects according to their source of knowledge

Source of knowledge		2nd Year (n=150)		3rd Year (n=150)		4th Year (n=150)		χ^2 P
		N	%	N	%	N	%	
1. Lectures	no	58	38.7	36	24.0	40	26.7	**8.757 0.013***
	yes	92	61.3	114	76.0	110	73.3	
2. Self-learning	no	92	61.3	116	77.3	87	58.0	**14.191 0.001***
	yes	58	38.7	34	22.7	63	42.0	
3. Clinical practices	no	102	68.0	82	54.7	89	59.3	5.755 0.056
	yes	48	32.0	68	45.3	61	40.7	
4. Work shops	no	136	90.7	122	81.3	128	85.3	5.392 0.067
	yes	14	9.3	28	18.7	22	14.7	
5. Hospital guidelines	no	137	91.3	135	90.0	106	70.7	**29.861 0.00***
	yes	13	8.7	15	10.0	44	29.3	

Table (3): Mean scores of knowledge domains about infection control standard among studied subjects

Knowledge domains	2nd Year(n=150)	3rd Year(n=150)	4th Year (n=150)	F P
	Mean±SD	Mean±SD	Mean±SD	
1. Hospital environment and health workers	4.19±1.325	4.77±0.607	4.20±1.253	**13.199 0.00***
2. Hand washing	1.89±0.550	2.02±0.357	1.81±0.621	**6.415 0.002***
3. Protective clothes	3.24±1.294	2.93±0.493	2.65±1.069	**12.960 0.00***
4. Body fluids	3.72±0.963	3.84±0.676	3.59±1.177	2.609 0.075
Total knowledge score	**13.04±3.072**	**13.55±1.144**	**12.24±2.579**	**11.331 0.00***

*** Significant at level P< 0.05**

Table (4): Mean scores of domains ofcompliance with standard precaution about infection control among studied subjects

Domains of compliance with standard precaution	2nd Year(n=150)	3rd Year(n=150)	4thYear(n=150)	F P
	Mean±SD	Mean±SD	Mean±SD	
1. Hand washing	5.39±1.098	5.54±0.701	5.39±1.016	1.182 0.308
2. Wearing gloves	16.61±3.258	16.19±2.002	15.94±2.745	2.30 0.101
3. Protective clothes (mask, eye, gown)	5.33±1.408	5.49±0.903	5.15±1.271	2.965 0.053
4. Syringe and sharp disposal	3.57±0.870	3.53±0.841	3.19±1.039	**8.003 0.00***
Total compliant score	**30.91±5.844**	**30.75±3.183**	**29.67±5.142**	2.908 0.056

*** Significant at level P< 0.05**

Table (5): Distribution of the studied subjects according to patient's type factor affecting the compliance with standard precautions

Patient's type		2nd Year (n=150)		3rd Year (n=150)		4th Year (n=150)		χ^2 P
		N	%	N	%	N	%	
1. Children	Less effect	26	17.3	27	18.0	33	22.0	192.5 0.00*
	Moderate effect	22	14.7	123	82.0	38	25.3	
	More effect	102	68.0	-	-	79	52.7	
2. Foreigners (irrespective of age)	Less effect	23	15.3	4	2.7	22	14.7	98.931 0.00*
	Moderate effect	73	48.7	146	97.3	79	52.7	
	More effect	54	36.0	-	-	49	32.7	
3. Patient's personal characteristics (irrespective of age)	Less effect	42	28.0	32	21.3	27	18.0	62.535 0.00*
	Moderate effect	69	46.0	118	78.7	77	51.3	
	More effect	39	26.0	-	-	46	30.7	
4. Adults	Less effect	23	15.3	33	22.0	30	20.0	143.1 0.00*
	Moderate effect	35	23.3	117	78.0	51	34.0	
	More effect	92	61.3	-	-	69	46.0	

*** Significant at level P< 0.**

Table (6): Distribution of the studied subjects according to activity's type (situation) factors affecting the compliance with standard precautions

Situation		2nd Year (n=150)		3rd Year (n=150)		4th Year (n=150)		χ^2 P
		N	%	N	%	N	%	
1. Physicians' way of working/demands	Less effect	36	24.0	61	40.7	40	26.7	**133.3 0.00***
	Moderate effect	23	15.3	89	59.3	53	35.3	
	More effect	91	60.7	-	-	57	38.0	
2. Wrong routine practice at workplace	Less effect	28	18.7	36	24.0	38	25.3	**131.0 0.00***
	Moderate effect	35	23.3	114	76.0	63	42.0	
	More effect	87	58.0	-	-	49	32.7	
3. Patient discomfort	Less effect	57	38.0	20	13.3	55	36.7	**99.117 0.00***
	Moderate effect	57	38.0	130	86.7	58	38.7	
	More effect	36	24.0	-	-	37	24.7	
4. Embarrassment	Less effect	40	26.7	34	22.7	40	26.7	**51.992 0.00***
	Moderate effect	69	46.0	116	77.3	83	55.3	
	More effect	41	27.3	-	-	27	18.0	
5. Reminding for using precautions	Less effect	51	34.0	34	22.7	45	30.0	**81.454 0.00***
	Moderate effect	48	32.0	116	77.3	72	48.0	
	More effect	51	34.0	-	-	33	22.0	
6. Lack of time	Less effect	40	26.7	19	12.7	41	27.3	**106.3 0.00***
	Moderate effect	51	34.0	131	87.3	69	46.0	

	More effect	59	39.3	-	-	40	26.7	
7. Time consuming	**Less effect**	35	23.3	23	15.3	35	23.3	**118.4 0.00***
	Moderate effect	45	30.0	127	84.7	59	39.3	
	More effect	70	46.7	-	-	56	37.3	
8. Negative impact on nurse	**Less effect**	40	26.7	32	21.3	47	31.3	**119.3 0.00***
	Moderate effect	39	26.0	118	78.7	73	48.7	
	More effect	71	47.3	-	-	30	20.0	
9. Equipment not immediately available	**Less effect**	32	21.3	49	32.7	37	24.7	**122.6 0.00***
	Moderate effect	33	22.0	101	67.3	70	46.7	
	More effect	85	56.7	-	-	43	28.7	
10. Emergency situation	**Less effect**	43	28.7	39	26.0	32	21.3	**144.7 0.00***
	Moderate effect	21	14.0	111	74.0	68	45.3	
	More effect	86	57.3	-	-	50	33.3	
11. Colleagues with more experience	**Less effect**	49	32.7	37	24.7	46	30.7	**99.555 0.00***
	Moderate effect	40	26.7	113	75.3	58	38.7	
	More effect	61	40.7	-	-	46	30.7	
12. Previous exposure	**Less effect**	45	30.0	38	25.3	39	26.0	**103.2 0.00***
	Moderate effect	38	25.3	112	74.7	62	41.3	
	More effect	67	44.7	-	-	49	32.7	
13. Protection offered by precautions	**Less effect**	41	27.3	34	22.7	44	29.3	**82.080 0.00***
	Moderate effect	55	36.7	116	77.3	60	40.0	
	More effect	54	36.0	-	-	46	30.7	
14. Cost from being infected	**Less effect**	42	28.0	28	18.7	32	21.3	**103.3 0.00***
	Moderate effect	43	28.7	122	81.3	75	50.0	
	More effect	65	43.3	-	-	43	28.7	
15. Fear	**Less effect**	24	16.0	38	25.3	31	20.7	**109.8 0.00***
	Moderate effect	46	30.7	112	74.7	62	41.3	
	More effect	80	53.3	-	-	57	38.0	
16. Death	**Less effect**	36	24.0	53	35.3	35	23.3	**85.226 0.00***
	Moderate effect	49	32.7	97	64.7	59	39.3	
	More effect	65	43.3	-	-	56	37.3	

*** Significant at level P< 0.05**

Table (7): Distribution of the studied subjects according to their levelsof knowledge and compliance

Levels of knowledge and compliance		**2nd Year (n=150)**		**3rd Year (n=150)**		**4th Year (n=150)**		**χ^2 P**
		N	%	N	%	N	%	
Total knowledge score	**Poor**	31	20.7	17	11.3	42	28.0	**44.923 0.00***
	Fair	22	14.7	20	13.3	49	32.7	
	Good	97	64.7	113	75.3	59	39.3	
Total compliance score	**Poor compliance**	12	8.0	2	1.3	18	12.0	**14.803 0.005***
	Satisfactory compliance	4	2.7	6	4.0	8	5.3	
	Good compliance	134	89.3	142	94.7	124	82.7	

*** Significant at level P< 0.05**

Table (8): Comparison between the studied subjects according to total score of patient's type and total activity's factor affecting their compliance with standard precautions

Total score of patient's type and total activity's factors		2nd Year (n=150)		3rd Year (n=150)		4th Year (n=150)		χ^2 P
		N	%	N	%	N	%	
1. Total score of patient's type	Less effect	58	38.7	150	100	60	40.0	157.1 0.00*
	Moderate effect	16	10.7	-	-	25	16.7	
	More effect	76	50.7	-	-	65	43.3	
2. Total score of activity' s factors	Less effect	77	51.3	150	100	102	68.0	103.8 0.00*
	Moderate effect	19	12.7	-	-	24	16.0	
	More effect	54	36.0	-	-	24	16.0	

*** Significant at level P< 0.05.**

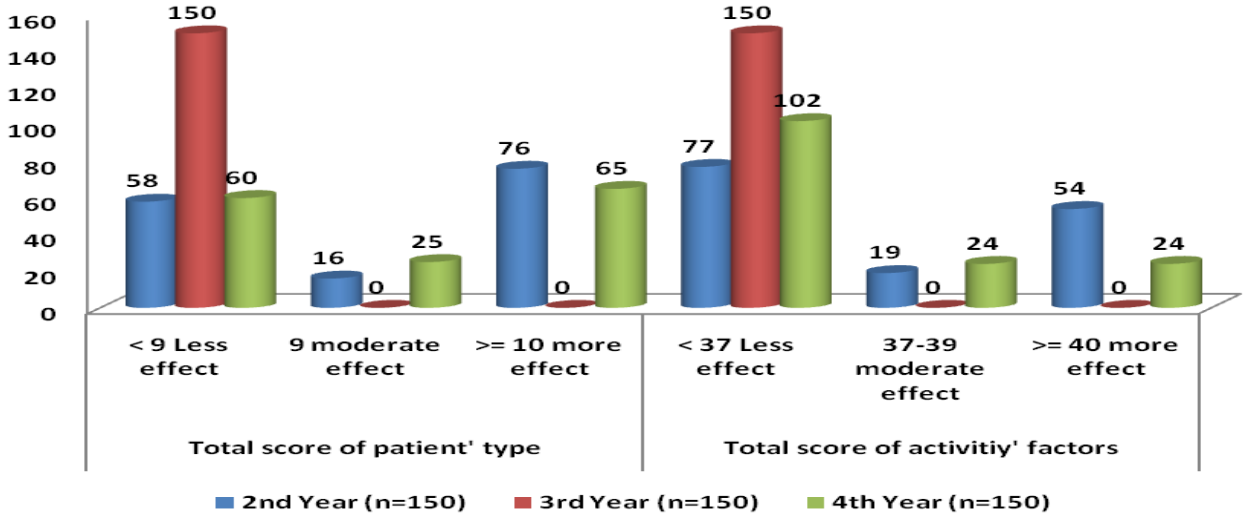

Figure (1): Comparison between the studied subjects according to total score of patient's type and activity's factor affecting the compliance with standard precautions

Table (9): Comparison between level of knowledge and compliance among the studied subjects

Total compliance Score		Total knowledge score						Total		χ^2 P
		Poor		Fair		Good				
		N	%	N	%	N	%	N	%	
2nd year	Poor compliance	12	38.7	-	-	-	-	12	8.0	53.663 0.00*
	Satisfactory compliance	2	6.5	-	-	2	2.1	4	2.7	
	Good compliance	17	54.8	22	100	95	97.9	134	98.3	
Total		31	100	22	100	97	100	150	100	
3rd year	Poor compliance	-	-	-	-	2	1.8	2	1.3	19.762 0.001*
	Satisfactory compliance	4	23.5	-	-	2	1.8	6	4.0	
	Good compliance	13	76.5	20	100	109	96.5	142	94.7	
Total		17	100	20	100	113	100	150	100	
4th year	Poor compliance	16	38.1	1	2.0	1	1.7	18	12.0	40.334 0.00*
	Satisfactory compliance	1	2.4	5	10.2	2	3.4	8	5.3	
	Good compliance	25	59.5	43	87.8	56	94.9	124	82.7	
Total		42	100	49	100	59	100	150	100	

Significant at level P< 0.05

Discussion:

Hospital acquired infection is a common problem all over the world. Therefore, up to date knowledge and refined practical nursing skills can play an important role in preventing infection. Infection Control (IC) is evidence-based practices and procedures that, when applied consistently in healthcare settings which can prevent or reduce the risk of microorganism's transmission to the healthcare providers, other patients and visitors. Nursing student should have the opportunity to practice infection control on a day-to-day basis as an integral part of patient care [2-6]. So, this study was carried to assess knowledge and compliance of nursing students regarding infection control standard precautions during their clinical training.

The findings of the current study revealed that, the studied sample age ranged from 19 to 24 years old. This finding was in accordance with **Sreedharan et al., (2011)**[40]**,**who studied knowledge about standard precautions among university hospital nurses in the United Arab Emirates. On the other hand, **Labrague et al., (2012)** [9], found in their study about knowledge and compliance with standards precautions that the mean age was slightly lesser than the current study. From the researcher point of view the younger age of the studied sample increases their ability to acquire up to date knowledge which in turn change their behaviors. In this regards **Alwutaib et al., (2012)**[41], revealed that the older age is an important determinant of lower knowledge levels. Concerning gender, the current study demonstrated that more than three quarters and two third of students in the second and fourth academicyear respectively were female which show the dominance of females than males. This finding is in agreement with **Labrague et al., (2012)** [9], **Vaz et al., (2010)**[7], who revealed the dominance of females than male in their studied samples.

In relation to residence the findings of the present study clarify that more than half, nearly three quarters of students and more than two third of students in the second, third and fourth year respectively lived in rural area. This finding is in accordance with that of **Johnson et al., (2013)** [42], and **Janjua et al., (2007)** [43], who declared that most of the studied sample were from rural residence. As regarding to working beside the study, the findings of this study illustrated that the majority of students in the second, third and fourth years were not working beside the study. **Reda et al., (2010)** [44]**,** also stated that most of the studied sample not working beside their study which emphasizing the need to protect this group in the prime of their life from hospital acquired infections.

In relation to students' sources of knowledge, the findings of the present

study demonstrated that nearly three quarters of students in the third and fourth year, their source of knowledge were lectures. This was consistent with **Reda et al., (2010)** [44], who found that most students agreed that current curriculum provides them with enough information on IC and SPs. Also agreed about the role of their tutors and faculty in providing them with necessary information on how to avoid health facilities related infections before their entrance into hospital clinical training. Furthermore, according to **Tavolacci et al., (2008)** [38], who announced that nurse educators may need to provide an environment that models and promotes standard precaution practices by positive role modeling.

Concerning levels of students' knowledge regarding infection control, the findings of the present study showed that high percent of students had good level of knowledge in the second, third and fourth years respectively. On the same line with this finding was **Ibrahim et al., (2011)** [15], who found the majority of the studied group was aware with, what infection is, and how it is transmitted. In this regards **Perry and Potter (2002)** [45] revealed that by understanding how infection is transmitted or spread, the nurse can intervene to prevent infections from developing. On the other hand, **Qayyum et al., (2016)** [2] who found poor knowledge about nosocomial infections and their routes of spread among the studied sample. Concerning the group who obtained high knowledge scores in the current study, they were acquainted with sharp devices and needle stick injuries; personal protective equipment; hand hygiene; standard precaution and methods used to prevent infection. This of special concern especially where approximately one third of the studied sample attended training courses about infection control.

Concerning student's compliance regarding infection control standard precautions, it was found that majority of the studied groups (second, third and fourth years) stated that they had good practice score of compliance. This agreed with **Talaat et al., (2006)** [46]. From the researcher point of view this findings could be related to that compliance assessed from students perspectives and a further study need to be done to study compliance from the teacher perspectives as what nursing students do (application of infection control standard precautions) in the current study could be based on what explained by their lecturer (theoretical curriculum). In addition, the findings of the present study reflect the lecturer emphasis on following infection control precautions during clinical hospital training and constructive

supervision by their demonstrators. In this regards **Gijare, (2012)** [47], revealed that providing feedback is necessary to improve knowledge, attitude, practices and so compliance to infection control standard precautions.

On the other hand, **Ibrahim et al., (2011)**[15], who assessed infection control practices in a neonatal intensive care unit and emphasized the importance of compliance to infection control standards to reduce in-hospital neonatal morbidity and mortality. The same authors attributed that lack of compliance to infection control standards precaution due to lack of knowledge about standard procedures of infection control; poor design of the intensive care unit; high work load; lack of sustainable resources and arrangements; time of contacts (daytime or night shift), and lack of training and constructive supervision. Therefore, efforts are needed to correct unacceptable nurses' performance, especially where certain mismatching was noticed between what nurses know and what they do in the current study.

Regarding patient's type factors affecting the compliance with standard precaution. There was statistical significance difference between the three studied groups in relation to patient's type factors (children, foreigners, patient's personal characteristics and adults) affecting the compliance with standard precaution P< 0.05. The findings of this study were in line with **Bouchoucha et al., (2019)** [48] who illustrated that identifying the factors that influence compliance with infection prevention and control practices (IPC) provides a foundation for developing adherence strategies. This study reinforces that nurses need to have more responsibility to enhance their compliance. Management support in hospitals to ensure enough staffing is necessary, in addition to having personal protective equipment readily available when needed. Nursing managers and IPC departments should monitor nurses in the performance of IPC practices and provide periodic feedback to encourage nurses' compliance.

In relation to activity's type (situation) factors affecting the compliance with standard precautions. It was found that there was statistical significance difference between the three studied subjects of students in relation to activity's type (situation) factor affecting the compliance with standard precautions P< 0.05. The findings of the present study was consistent with **Zebet al., (2019)** [49] who demonstrated that factors affecting nurses compliance to SPs highlighted by participants in current study include, unavailability of resources like

personalprotective equipment (PPEs) by 73.6%, 55.7%. Participants highlighted workload due to shortage of staff 75.8% elaborated unavailability and dissemination of infection control policies. Another study conducted by **Efstathiouet al., (2011)** [25] shows that workload, unavailability of equipment and patient's discomfort are the factors affecting Nurses compliance to SPs. Also Lack of facilities provision and maintenance, heavy workload andlack of good role models were factors determined by **Hedayati et al., (2014)** [50], at a dental Schoolin Iran.

A statistically significant positive correlation was found between knowledge and compliance in the current study. This finding reflects that nursing students'compliance is based on their knowledge. In agreement with the current study finding was that of **Gijare, (2012)** [47], **Hamid et al. (2010)** [51], and **NdikomandOnibokun (2007)** [52],who revealed statistically significant positive correlation between knowledge and practice of universal precautions.

In contrast with the present study, **Askarian et al. (2007)** [53], found no correlation between knowledge and practice regarding infection control. Also, **Najeeb et al., (2008)** [54]**,** reported a weak, negative relationship between knowledge and practice regarding infection control among nurses and doctors. This reflects the need for enhancing knowledge of all nursing qualification categories, which emphasize the need for continuous training programs about infection control to facilitate adherence to infection control measures. In this regards**Royal College of Nursing (RCN),(2012)**[31]**,**emphasized that workplaces should have written policies about methods of utilizing infection control standard precautions to provide guidance on all aspects of critically ill patients' care. As well, continuing education regardless of age can significantly improve infection control practices and reduces rates of infection.

Conclusion and Recommendations:

This study showed that there was statistically significance difference in relation to total score of knowledge and compliance score in the three studied years. However, teaching must be strengthened, particularly with respect to the concepts of hand hygiene and protective clothes where students scored less. Also,the periodic refresher training courses and regular lectures should be provided to nursing students in order to keep them of updating knowledge and practice regarding standard precaution measures. Future educational strategies to make changes in their behaviors maybe enhanced through intensive return

demonstration of effective use of protective equipment such as masks and eye goggles, requiring students to submit written journal, nursing care plans (NCP's) and anecdotal record of demonstration and integration of standard precaution practices during clinical exposure.

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