Nurses' knowledge and adherence perception to standard infection control practices; Single Centre Experience

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ABSTRACT

Background: Nurses' knowledge and implementation of infection prevention and control (IPC) protocols play a vital role in ensuring the efficacy of IPC measures. Adherence to IPC procedures has significant ramifications for the safety of healthcare workers (HCWs) and the protection of patients. **Objective:** To test nurses' knowledge about standard precautions and their perception of adherence to infection control practices. **Methodology:** Cross-sectional research was done at the National Cancer Institute (NCI), Cairo University (CU). The study included 213 nurses. The nurses completed a self-administered questionnaire as part of the study. **Results:** Participants' age, professional title, years of experience, and the receipt of the hepatitis B virus vaccine were statistically significant when associated with adherence perception regarding standard precautions. The level of knowledge was not associated with any of these factors except for the department where these nurses work. A multivariate analysis of knowledge score revealed that nurses working at outpatient clinics had better knowledge than those working in Medical Oncology, Surgical Oncology, and Pediatric Oncology Wards, in addition to those working in the operating room, intensive care units, and endoscopy unit. Regarding the adherence perception score, we found that having fewer years of experience and being vaccinated against Hepatitis B were associated with a higher adherence perception. **Conclusion & Recommendations:** Most nurses needed more knowledge, and almost half needed an adequate adherence perception regarding standard precaution practices. Having written policies and communicating them to all nurses, intensified training, and regular supervision is recommended.

Keywords: Adherence perception, Infection control, Knowledge, Nurses, Standard precaution

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Background and Rationale

The issue of infection control has emerged as a significant focal point within the healthcare sector, with healthcare professionals, notably nurses, particularly vulnerable to the danger of contracting infections.[1] Implementing infection prevention and control (IPC) measures has significant importance in the context of clinical education, particularly within the nursing field.[2]

Standard precautions (SP) are defined as "a group of infection prevention practices that apply to all patients, regardless of suspected or confirmed diagnosis or presumed infection status".[3] The term encompasses all protocols, methodologies, and endeavors created to mitigate or reduce the likelihood of transmission of contagious illnesses within healthcare environments.[4]

The primary obstacles to the implementation of SP initiatives were insufficient availability of resources and inadequate training opportunities.[5] The lack of adherence to standard precautions is a cause for worry due to the possibility of exposing the workplace to unneeded occupational risks. This non-compliance is evident in the elevated rates of occupational accidents resulting from exposure to bodily fluids and sharp objects.[6]

Several factors can influence healthcare workers' adherence to IPC measures within healthcare settings. These factors include the individual's level of knowledge, their educational background, the training received, and their professional experience.

Additionally, the availability or scarcity of essential supplies such as alcohol hand rub, nearby sinks, soap, or paper towels can impact compliance. Lastly, caring for patients exposed to their blood or body fluids can further influence a Healthcare Worker's (HCW's) compliance with IPC measures.

A heavy workload, limited time availability, and an inadequate patient-to-nurse ratio may impede adherence to IPC protocols. Using a diverse approach to improve intervention techniques in IPC has reduced healthcare-associated infections (HAIs) and enhanced the compliance of HCWs.[7]

The current study aims to evaluate nurses' knowledge and perception of adherence regarding standard precautions and analyze the factors affecting the National Cancer Institute (NCI) and Cairo University (CU).

Materials and Method

Research design

Cross-sectional study

Study population and setting

The target population is registered nurses with at least one year of experience who work at the NCI, CU. The study included 213 nurses out of 220 nurses (96.8% response rate) and was conducted from April 4 to August 29, 2023.

Data Collection Instruments:

A self-administered questionnaire that consists of the following sections:

The first section consisted of three parts.

It consisted of questions about socio-demographic characteristics, exposure to sharp injury, waste disposal methods, and previous HBV vaccination.

The second section consisted of two parts.

Part I: The respondents' knowledge about infection control practices questionnaire (ICPQ), a self-administered questionnaire that considers knowledge about infection control practices. The questionnaire was modified from a previous study.[9, 10, 11]

The questionnaire was constructed as true, false, or do not know, coded as an ordinal scale from 1-3. Knowledge scores are ranged from 25 (maximum) to 0 (minimum). The higher the score, the better knowledge the participant has.

A discrete variable was derived by summing all the scores and converting them to a 100-point scale (%), with 100% representing the highest possible score.

Bloom's original cutoff points, with a slight modification, were used to judge knowledge as good (>85%), moderate (70%–85%), or poor (<70%).[12] Overall, we considered participants who scored less than 70% with an inadequate level of knowledge, while those who scored 70-100% had an adequate level of knowledge

Part II: The respondent's compliance regarding Infection Control Practices Questionnaire (ICPC)

Adherence perception regarding standard precautions was determined using the standard precautions questionnaires.[9, 10, 11] There are 18 adherence perception items, each rated from 0 to 4 points, giving a score range of 0 to 72. The higher the score, the better the person's adherence perception regarding standard precautions.

Participants who achieved a score greater than or equal to the mean score exhibited excellent adherence to standard precaution procedures. In contrast, those who scored below the mean were categorized as displaying poor adherence perception regarding standard precaution measures. The adherence perception ratings

of the respondents were transformed into percentages. Participants with scores above the mean value were deemed as "had adequate adherence perception," while those below the mean value were deemed as "had no adequate adherence perception."[2, 4]

Data quality control

The questionnaire was first developed in English and then translated into Arabic. To ensure the reliability and consistency of the data-collecting instrument, it was then translated back into English.

Three experts in infection control and public health assessed the validity of the questionnaire related to the standard precautions' knowledge and adherence perception questions.

A pilot study was conducted on a subset of the sample population to assess the questionnaire's consistency and clarity. The reliability of the questions was assessed using Cronbach's alpha, yielding coefficients of 0.72 and 0.70 for the knowledge and adherence perception questions, respectively.

Sample Size Determination

According to prior research by Luo and colleagues[8], the anticipated frequency of nurse compliance is 64.7%. To obtain a two-sided 95% confidence interval, a total sample size of 210 nurses is required. This sample is derived from a population of 525 nurses at the NCI, CU. The process of determining the appropriate sample size was conducted using the Epi info statistical software.

Statistical analysis

Data was analyzed using SPSS statistical package version 27. Mean and standard deviation (SD), median, and range were used to summarize numerical data. Frequency and percentage were used to express qualitative data. The Chi-square (or Fisher's exact) test was used to examine the relation between qualitative variables as appropriate.

Finally, a logistic regression model and stepwise selection were used to evaluate the significant independent variables. A P-value less than or equal to 0.05 was considered statistically significant. All tests were two-tailed.

Results

1- Participants' Characteristics

The study included 212 nurses, of which 142 (66.7%) were females, approximately 56.3% being 30 years or younger. The nurses' average age and years of experience were 34.1±11.6 and 12.9±12.3 years, respectively. Most nurses (54.9%) graduated from the Technical Institute of

Nursing. Most of the nurses (80.8%) held the position of Nurse Practitioner.

Most participants (79.3%) attended previous training on prevention methods and precautions, and a significant number (72.3%) received vaccination against Hepatitis B. Additionally, 30.0% reported a history of infectious exposure within the last six months.

Among the participants who reported exposure (n=64), the most common types of exposure were injury from a contaminated sharp object and skin or eye exposure to blood, body fluids, or secretions of patients. More than half of the nurses (59.4%) reported exposure incidents, indicating a positive reporting culture.

However, among those who did not report their exposure incidents (n=26), the primary reasons cited were the perceived lack of need to report (65.4%) and not realizing they were infected until at home (19.2%) (Table 1).

2- Knowledge and adherence perception

In this study, regarding knowledge level, the mean knowledge score was 16.5±2.4, and 64.3% of the participants had inadequate knowledge about standard precautions; however, the mean **adherence perception** score was 64.0 ±6.9, and almost half of the nurses had adequate adherence perception (51.2 %) (Table 2).

3- Factors associated with knowledge adherence perception

Participant age, professional title, years of experience, and receiving hepatitis B virus vaccine were statistically significantly associated with adherence perception regarding standard precautions; however, the level of knowledge was not associated with any of these factors except for the department where the nurses work.

A multivariate analysis revealed that nurses who worked in the medical, surgical, and pediatrics oncology wards were 77% less likely to know adequate standard precautions than their counterparts at outpatient clinics.

Furthermore, nurses who worked in OR, ICU, and endoscopy were 85% less likely to have adequate knowledge of standard precautions than their counterparts at outpatient clinics. Regarding adherence perception score, we found that nurses who had ≤8 years of experience were 2.2 times more likely to have adequate adherence perception than those who had >8 years of experience; nurses who were not vaccinated against Hepatitis B were more likely to have adequate adherence perception than those who were vaccinated (Tables 3 and

4). Standard precautions knowledge and adherence perception were positively correlated with compliance (r = 0.179), suggesting that the greater the knowledge about standard precautions, the better the adherence perception (Figure 1).

Discussion

Implementing infection prevention measures is paramount in ensuring high-standard healthcare services. All healthcare professionals are equally responsible for preventing HAIs; nonetheless, nurses play a critical role as front-line personnel, and they are highly vulnerable to biological hazards as they deliver direct care to their patients.[13]

The current study shows that nearly half of the nurses reported compliance with standard precautions (51.2 %). The result is consistent with the results of a study conducted in North Jordan[14] and Bahirdar City[15]; however, the finding was lower than another study by Russell and colleagues (2018) [16], who reported compliance with infection control practices exceeded 90%. The observed discrepancy could be attributed to variations in understanding of infection prevention, differences in research methodologies, variations in sample sizes, and disparities in socio-demographic characteristics.

Poor compliance has also been documented in studies utilizing direct observation techniques by Felembam and his colleagues (2012).[17] These contradictory results suggest that nurses' self-reported compliance with infection control practices may be greater than what could have been directly observed and more attributable to their intentions or perceptions.[18, 19]

The present study shows a significantly higher proportion of compliance among younger age; this finding is inconsistent with other studies by Russel and colleagues (2018) [16], which documented that older nurses reported greater compliance with IC practices than younger nurses.

The current study showed a significantly lower proportion of compliance among those with lengthy years of experience. This finding contrasts with the study by Desta and colleagues (2018) [20], which concluded that lengthy work experience is associated with better compliance.

This study identified that 84.5 % of nurses always wear eye protection, and 85.9% wear gowns during patient care procedures, which are likely to generate body fluid splashes into the eye and mouth. This result is significantly higher than the study results from Northern Ethiopia (10.4%).[21]

This gap may result from the study populations' different PPE supply and utilization levels and their varying awareness of infection protection practices.

This study also evaluated the overall knowledge of nurses of infection prevention measures. Over one-third (35.7%) of nurses had good knowledge of infection control measures. This result is significantly lower than the results of studies conducted in Northwest Ethiopia (84.2%) [15] and an Egyptian Cancer Hospital (63.6%).[22] The discrepancy could be attributed to variations in sample size, study site, and demographic makeup.

This study shows no statistically significant relation between knowledge and compliance. This is consistent with the study by Sahiledengle and his colleagues (2018) [23], who reported that good awareness of infection prevention strategies among nurses was associated with a 1.5-fold increase in compliance with effective infection prevention techniques.

The current study shows no statistically significant relation between age, gender, experience years, and knowledge score. These results disagree with the study [20], which found that older age, lengthy experience years, and males were more knowledgeable about infection prevention.

Our study shows no significant relationship between knowledge, compliance score, and training; however, previous research has shown that training on infection prevention for healthcare staff will improve their knowledge and compliance [24, 25], which may be attributed to the weakness and inefficiency of the training provided.

Study Limitations

The method of data collection used in this study was a self-administered questionnaire without any confirmation of stated compliance by direct observation. Due to the cross-sectional nature of this study design, temporal correlations cannot be established between the explanatory and outcome variables of infection prevention knowledge and compliance practice.

Conclusions and Recommendations

Most nurses needed more knowledge, and almost half needed to comply with standard precautionary practices. Written policies and communication of them to all nurses, intensified training, and regular supervision are recommended. Implementing strategies effectively and disseminating a comprehensive understanding of infection control techniques is essential. Regular courses on infection control procedures should be held

for experienced and newly recruited nurses. Compliance monitoring should be done frequently, and performance should be linked to the promotion strategy.

Declaration

Conflict of interest: The authors declare no conflict of interest.

Fund: The study is self-funded

Data availability statement:

The corresponding author will provide an English version of the data-collecting instrument upon a reasonable request.

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We appreciate the participation of all the nurses who have contributed to the study.

Abbreviations

AOR: Adjusted odds ratio

CDC: Centers for disease control and prevention

CI: Confidence interval

HAIs: Healthcare-associated infections;

HBV: Hepatitis B virus

HCWs: Healthcare workers

IRB: Institutional Review Board

PPE: Personal protective equipment

SP: Standard precautions

SPSS: Statistical package for social sciences

WHO: World Health Organization

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Table 1: ***Participants' characteristics (n=213)***

Characteristics		**n(%)**
Age (years)	Mean ±SD	34.1±11.58
	≤30	120 (56.3)
	>30	93 (43.7)
Gender	Female	142 (66.7)
	Male	71 (33.3)
Education level	College of Nursing	23 (10.8)
	Master and MD of Nursing	10 (4.7)
	Technical Institute of Nursing	117 (54.9)
	Technical Secondary School	63 (29.6)
Professional title	Head nurse	41 (19.2)
	Nurse practitioner	172 (80.8)
Department of work	Endoscopy	41 (19.2)
	Operating room	34 (16.0)
	Pediatric oncology ward	34 (16.0)
	Surgical oncology ward	23 (10.8)
	ICU	30 (14.1)
	Medical oncology ward	30 (14.1)
	Outpatient clinics	21 (9.9)
Experience years	Median (range)	8 (1-52)
	≤8	110 (51.6)
	>8	103 (48.4)
Attendance previous training on prevention methods and precaution	Yes	169 (79.3)
Vaccination against Hepatitis B	Yes	154 (72.3)
History of infectious exposure In the last six months	Yes	64 (30.0)
Type of exposure (n=64) *	Injury from a contaminated sharp object	22 (34.4)
	Skin or eye exposure to (blood, body fluids, and secretions) of patients	60 (93.8)
Reporting for that exposure(n=64)	Yes	38 (59.4)
Causes of non-reporting(n=26)	There is no need	17 (65.4)
	I did not realize I was infected until I got home	5 (19.2)
	Fear	2 (7.7)
	Work Congestion	2 (7.7)

SD: Standard deviation, *: Participants had more than one exposure at the same time

Table 2: Knowledge and adherence perception of nurse participants (n=213)

		Frequency	Per cent
Standard precautions knowledge	**Mean ±SD**	16.5±2.4	
	Inadequate	137	64.3
	Adequate	76	35.7
Adherence perception with standard precautions	**Mean ±SD**	64.0±6.9	
	Inadequate	104	48.8
	Adequate	109	51.2

SD: standard deviation

Table 3: Factors associated with knowledge compliance with standard precautions

		Standard precautions knowledge			*Adherence perception* with standard precautions		
	n	**Inadequate (n=137)**	**Adequate (n=76)**	**p-value**	**Inadequate (n=104)**	**Adequate (n=109)**	**p-value**
Age (years)							
≤30	120	75 (62.5)	45 (37.5)	0.529	46 (38.3)	74 (61.7)	0.001
>30	93	62 (66.7)	31 (33.3)		58 (62.4)	35 (37.6)	
Gender							
Female	142	91 (64.1)	51 (35.9)	0.919	68 (47.9)	74 (52.1)	0.698
Male	71	46 (64.8)	25 (35.2)		36 (50.7)	35 (49.3)	
Education level							
College of Nursing	23	16 (69.6	7 (87.0)	0.892	12 (52.2)	11 (47.8)	0.387
Master or MD of Nursing	10	7 (70.0)	3 (30.0)		6 (60.0)	4 (40.0)	
Technical Institute of Nursing	117	73 (62.4)	44 (37.6)		51 (43.6)	66 (56.4)	
Technical Secondary School	63	41 (65.1)	22 (34.9)		35 (55.6)	28 (44.4)	
Job title							
Head nurse	41	28 (68.3)	13 (31.7)	0.555	27 (65.9)	14 (34.1)	0.015
Nurse practitioner	172	109 (63.4)	63 (36.6)		77 (44.8)	95 (55.2)	
Experience years							
≤8	110	69 (62.7)	41 (37.3)	0.616	42 (38.2)	68 (61.8)	0.001
>8	103	68 (66.0)	35 (34.0)		62 (60.2)	41 (39.8)	
Department of work							
Outpatient clinic	21	6[a] (28.6)	15[b] (71.4)	0.001	11 (52.4)	10 (47.6)	0.349
Medical, Surgical, and Pediatrics Ward	87	55[a] (63.2)	32[a] (36.8)		47 (54.0)	40 (46.0)	
OR, ICU, and endoscopy	105	76[a] (72.4)	29b (27.6)		46 (43.8)	59 (56.2)	
Vaccination against Hepatitis B							
No	59	34 (57.6)	25 (42.4)	0.207	21 (35.6)	38 (64.4)	0.017
Yes	154	103 (66.9)	51 (33.1)		83 (53.9)	71 (46.1)	
Attendance of previous training							
No	44	31 (70.5)	13 (29.5)	0.340	22 (50.0)	22 (50.0)	0.861
Yes	169	106 (62.7)	63 (37.3)		82 (48.5)	87 (51.5)	
History of infectious exposure in the last six months							
No	149	91(61.1)	58(38.9)	0.161	71(47.7)	78(52.3)	0.601
Yes	64	46(71.9)	18(28.1)		33(51.6)	31(48.4)	
Standard precautions knowledge level							
Inadequate Knowledge	137				72 (52.6)	65 (47.4)	0.144
Adequate Knowledge	76				32 (42.1)	44 (57.9)	

P ≤0.05 is statistically significant, and analysis was done by chi-square test.
Cells that share the same results are not statistically significant.

Table 4: Factors associated with nurses' Knowledge and adherence perception with standard precautions in multivariate logistic regression

Parameters	p-value	AOR	95% CI for OR	
			Lower	Upper
Standard precautions knowledge				
Department of Work (outpatient clinics)		Reference		
Medical, Surgical, and Pediatrics Ward	0.006	0.233	0.082	0.660
OR, ICU, and endoscopy	<0.001	0.153	0.054	0.431
Standard precautions Adherence perception				
Experience years (≤8 versus>8)	0.006	2.231	1.256	3.961
Vaccination against Hepatitis B (no /yes)	0.012	2.326	1.204	4.495

AOR: adjusted odds ratio, CI: confidence interval, p ≤0.05 is statistically significant

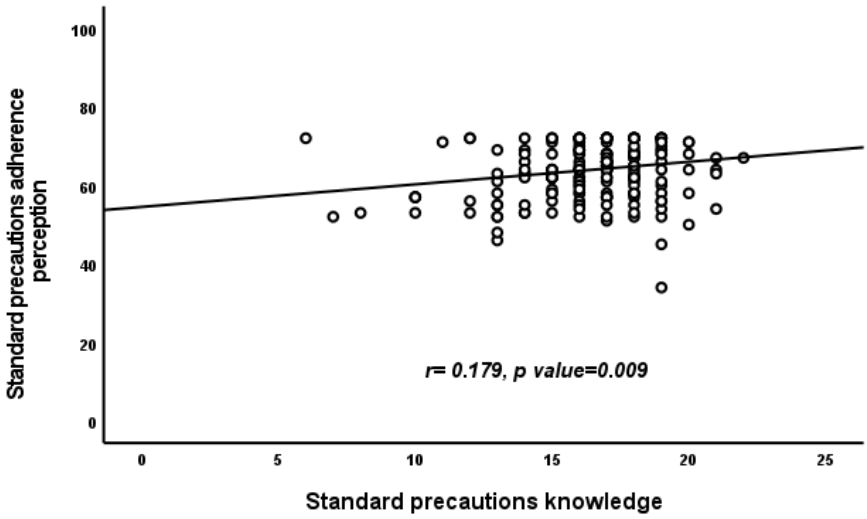

Figure 1: Correlation between standard precautions knowledge and adherence perception

الملخص العربى

تقييم مدي معرفة الممرضات و ادراك مدي التزامهم باجراءات مكافحه العدوي: تجربة مركز واحد

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المقدمه: يلعب فهم وتنفيذ بروتوكولات الوقاية من العدوى ومكافحتها بين الممرضات دورًا حيويًا في ضمان فعالية وتنفيذ اجراءات مكافحه العدوي. إن الالتزام بإجراءات مكافحه العدوي له دور كبير في الحفاظ سلامة العاملين في مجال الرعاية الصحية وحماية المرضى. **الهدف:** القيام باختبار مدي معرفة الممرضات بإجراءات مكافحه العدوي وتقييم مدي ادراك الالتزام بها. **طرق البحث:** تم إجراء بحث مقطعي في المعهد القومي للسرطان، جامعة القاهرة، مصر. شملت الدراسة ٢١٣ ممرضة و أكملت الممرضات استبيانًا ذاتيًا كجزء من الدراسة. **النتائج:** وجد أن عمر المشارك والمسمى المهني وسنوات الخبرة والتطعيم بلقاح فيروس التهاب الكبد يرتبط بشكل كبير إحصائيًا بالامتثال باجراءات مكافحه العدوي؛ إلا أن مستوى المعرفة لم يرتبط بأي من هذه العوامل باستثناء مكان العمل. بعد إجراء تحليل متعدد المتغيرات فيما يتعلق بدرجة المعرفة، وجدنا أن الممرضات العاملات في العيادات الخارجية ارتبطن بمعرفة أفضل من غيرهن العاملات في أجنحة الباطني والجراحة وطب الأطفال وايضا الممرضات العاملات في غرفة العمليات ووحدات العناية المركزة والمناظير اكثر معرفه، لقد وجدنا أن قله عدد سنوات الخبرة والتطعيم ضد التهاب الكبد كانا مرتبطين بمزيد من الالتزام بإجراءات مكافحه العدوي. **الملخص**: تحتاج معظم االممرضات إلى مزيد من المعرفة عن اجراءات مكافحه العدوي، وكان نصفهم تقريبًا غير ملتزمين بالاجراءات الاحترازية لمكافحه العدوي. لذلك توصي الدراسه بوجود سياسات مكتوبة وإبلاغها لجميع الممرضات والتدريب المكثف والإشراف المنتظم لضمان الالتزام بتنفيذها .

الكلمات المفتاحية: ادراك مدي الالتزام,المعرفة، الاحتياطات القياسية، الممرضات، مكافحة العدوى.