

## Evaluate Nurses knowledge and Adherence to Infection Prevention Control Measures during Caring for Covid19 Patients



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### 1.ABSTRACT

**Background:** Health care workers, especially nurses, are at risk of acquiring COVID 19 infection through occupational exposure. The primary transmission of COVID-19 is from person-to-person through respiratory droplets. Adherence to infection prevention control measures remain the best weapon to protect health care worker against COVID 19. **Aim:** Evaluate nurses' knowledge and adherence to infection prevention control measures during caring for COVID 19 patients. **Method:** A descriptive cross-sectional design used throughout this study. A convenient sample technique was utilized on 106 nurses in the Convalescence building at Mansoura University Hospital. Data was collected using 2 tools, COVID-19 Nurse's Knowledge Questionnaire and COVID -19 Infection Prevention Control Measures Observational Checklist. **Results:** It was observed that 53.8% of the studied nurses had average knowledge level and 52.8% of them had poor adherence to infection prevention control measures. It was noticed that, there was strong positive correlation found between nurse's total adherence, knowledge level and infection with COVID 19. **Conclusion:** most studied nurses had average knowledge level and poor adherence to COVID 19 infection prevention control measures **Recommendation:** Adequately planned training programs and refreshing training is imperative to improve the level of nurses knowledge and adherence to infection prevention control measures during caring for covid19 patient's.

**Keywords:** Adherence, Infection, Prevention, Control, Measures, Covid19

### 2.Introduction:

The coronavirus disease 19 (COVID-19) is a highly pathogenic and transmittable viral infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), that led to global pandemic and a dramatic loss of human life worldwide (Shereen, Khan, Kazmi, Bashir, & Siddique, 2020). The total worldwide confirmed cases in January 2022, reached greater than 321 million, deaths more than 5.5 million , total administered vaccine doses more than 9.5 billion and in Egypt, population prevalence have been 515,308 confirmed cases of covid 19 with 24,794 deaths and total of 97,076,742 vaccine doses have been administered (Chevallier et al., 2021).

Healthcare workers (HCWs) play a main role in fighting the COVID-19 pandemic and are at high risk of COVID-19 virus infection in the line of duty. Recent published studies reported that HCWs are exposed more likely to SARS-COV-2 and consequently at

higher risk of COVID-19 infection than the general population (Ashinyo et al., 2021). In Egypt, occupational exposure account for about 40% of infections among HCWs (El-Sokkary et al., 2021). Therefore, the effect of the COVID-19 pandemic on HCWs is massive and prevention remains the best weapon to protect HCWs against the COVID-19 infection ( Ashinyo et al., 2021).

To achieve the highest level of effectiveness in the response to the COVID-19 outbreak using the strategies and practices recommended, an Infection Prevention Control (IPC) program with a dedicated and trained team should be in place and supported by the national and facility senior management (Kim, & Lee, 2022). The five infection prevention and control strategies needed to limit or prevent COVID-19 transmission in health care settings involve the following: screening and triage for early detection of suspected COVID-19 patients, and rapid implementation of

source control measures; Applying standard precautions for all patients that include, but are not limited to, hand and respiratory hygiene, the use of appropriate Personal Protective Equipment(PPE) according to risk assessment, environmental cleaning, and safe waste management, Implementing additional precautions that include patients isolation, droplet , contact and airborne precautions, administrative , environmental and engineering controls (WHO, March 2020)

Protecting HCWs is of paramount importance to maintain continuous patient care and keep health care systems functioning (Park, 2020). Adherence to IPC protocol is important to reduce COVID-19 infection risk among HCWs. However, data on adherence to COVID 19 IPC measures among HCWs are unknown, most studies evaluated self-reported adherence and minor studies observed nurse's adherence during practice to COVID 19 IPC measures. Therefore, the present study evaluates knowledge and adherence gaps that may serve as a tool for nurse's education and training programs

### 2.1 Aim of the study

The aim of this study was to evaluate nurse's knowledge and adherence to IPC measures during caring for covid 19 patients.

### 2.2 Research questions:

- What is the knowledge level of nurses caring for covid 19 patients at Mansoura University Hospital?
- What is nurse's adherence level to IPC measures during caring for covid 19 patients at Mansoura University Hospital?

## 3Method

### 3.1 Study Design:

Descriptive cross-sectional design was utilized throughout the study.

### 3.2 Setting:

This study was conducted at Convalescence building at Mansoura University Hospital. The building consists of eight floors with COVID 19 isolation units are located in the third, fourth, fifth, and sixth floors. Each floor had one ICU and 3 wards. Each ICU has 5 beds, and managed by 2

nurses, each ward had 40 beds and managed by 2 nurses per shift.

### 3.3 Subjects:

#### Sample technique:

A convenient sample of 106 Nurses working at previously mentioned setting and fulfilling the following criteria:

Inclusion criteria:

- Nurses who agree to participate.
- Nurses of both sexes.
- All licensed nurses with different educational levels.
- Nurses who caring with covid 19 patients.
- Nurses that don't have any chronic diseases

Sample size was calculated using the following formula  $n = (Z\alpha/2)^2 P(1-P) / d^2$  and based on the following assumption: (p) the expected proportion of good knowledge among nurses 93.3%, (Saqlain et al., 2020).  $(Z\alpha/2) = 1.96$  at alpha error of 5.0% and (d) margin error 5%.  $N = (1.96)^2 (0.933) (1-0.933) / (0.05)^2 = 96$ . By adding 10 % for improving data collection, so the sample size will be  $96+10= (106)$  nurse.

#### Tools of data collection:

Two tools were utilized in collecting data relevant to the study:

### 3.4 Tool I: COVID-19 Nurse's Knowledge Questionnaire:

This tool was developed after thorough review of literature and it includes two parts:

- **Part 1:** Demographic and occupational data, it includes information about nurses' general characteristics such as, age, sex, education level, residence, marital status, household size, work experience, have any infection with corona virus, have previous epidemic experience dealing with (SARS-Tuberculosis-Influenza, Ebola), and means of transportation to work.
- **Part 2:** Covid 19 Knowledge assessment questioner, this tool was used to assess nurse's knowledge regarding covid-19 disease and includes 11 domains (causative agent; 4 items), pathophysiology; 4 items),

risk group; 5 items), diagnosis; 11 items), signs and symptoms; 8 items), mode of transmission; 14 items), treatment; 5 items), vaccine ;6 items), clinical care; 3 items), optimize PPE) supply; 4 items), return to work after covid 19 infection based on symptoms and strategy 6 items).

#### Scoring for Covid 19 Knowledge assessment questioner

**Scoring system**, the total score ranges from 0 to 70 applied by adding 1 point for each correct answer and 0 point for each wrong answer. The level of knowledge was considered as

- **Poor:** if percentage score was less than 50%,
- **Average:** from 50% to 75%,
- **Good:** more than 75%. (Abolfotouh, Soliman, Abolfotouh, & Raafat , 2011; Elzeky, Sherief, Ellateef, & Soliman, 2015).

#### Tool II: COVID -19 Infection Prevention Control Measures Observational Checklist:

This tool had been adapted from (Elsevier clinical skills, 2020) for assessment of nurse's adherence to covid 19 infection control precautions and was modified by researchers in accordance with CDC and WHO covid 19 guidelines (WHO, June 2020; WHO, March 2020). It consists of 2 parts. **Part 1:** Standard precaution adherence Checklist, which include 7 domains, hand hygiene, 11 items), PPE 5 items), respiratory hygiene/cough etiquette 1 items), sharps safety, 2 items), safe injection practices, 5 items), sterilization and disinfection of patient-care items and devices 4 items), and environmental infection prevention and control 2 items), and **Part 2:** Covid 19 isolation precaution adherence checklist. It includes 17 domains: preparations, 6 items), donned an isolation gown, 3 items), mask: if aerosol mask, 11 items), not aerosol mask, 3 items), face shield, 2 items), gloves, 1 items), verified the integrity of the ensemble, 1 items), provided designated care to the patient while maintaining precautions, 2 items), administered medications as ordered while maintaining precautions, 1 items), collected

any ordered specimens, 4 items), after providing patient care, 3 items), removed gloves, 5 items), removed the gown, 5 items), removing disposable medical face shield, 4 items), removed surgical mask, 1 items), removed the N95 respirator, 5 items), and completing the procedure, 5 items).

#### Part I: Scoring for standard precaution adherence checklist

The standard precaution adherence score ranges from 0 to 30, and was classified as follow:

- **Poor:** less than 50% (score < 15).
- **Average:** 50% to less than 75% (score 15 to < 22.5).
- **Good:** more than or equal 75% (score  $\geq 22.5$ ).

#### Part II: Scoring for Covid 19 isolation precaution adherence checklist

The Covid 19 isolation precaution adherence ranges from 0 to 62 and classified as follow:

- **Poor:** less than 50% (score < 31).
- **Average:** 50% to less than 75% (score 31 to < 46.5).
- **Good:** more than or equal 75% (score  $\geq 46.5$ ).

**The total adherence to COVID 19 IPC measures score ranges from 0 to 92 and was classified as follow:**

- **Poor:** less than 50% (score < 46).
- **Average:** 50% to less than 75% (score 46 to < 69).
- **Good:** more than or equal 75% (score  $\geq 69$ ). (Abolfotouh, Soliman, Abolfotouh, & Raafat , 2011; Elzeky, Sherief, Ellateef, & Soliman, 2015).

#### 3.5 Data collection process

**I: Preparatory phase:** - It included the following.

- **Administrative stage:** An official approval was obtained from the dean of Faculty of Nursing- Mansoura University, **Literature review;** reviewing national and international literatures on the various aspects and this review was a guide for developing the study tools. **Developing the**

**study tools** of data collection: -

- Tool I; that has been translated into the Arabic language by the researcher, and the validity of the translation were checked by an expert of English language from the Faculty of Education. To ensure the validity of the translation, a backup translation technique had been used in this study.
- Tool II; had been adapted from (**Elsevier clinical skills, 2020**) for assessment of nurse's adherence with covid 19 infection control precautions and was modified by researchers in accordance with CDC and WHO covid 19 guidelines.
- **Content validity**, the study tools (tool I, and tool II) were tested for content validity by a jury of five experts in the related fields of expert's faculty staff of medicine and nursing. Accordingly, their recommended modifications had been done and the final forms were used for data collection. Content validity index CVI (was for tool I & tool II respectively 0.85, 0.91). **Face validity**; it was carried out by conducting a **pilot study** on 10% (11) of the study subjects to ascertain the clarity, feasibility, relevance, comprehensiveness, applicability of the developed tools and to estimate the time required to fill the data collection tools, and they weren't included in the study sample, then the necessary modifications had been done. The time needed to fill the tool I was 20 min and tool II was 30 min. **The reliability**, tool, I and tool II had been tested by means of the Cronbach Alpha test ( $\alpha = .834$ , &  $\alpha = .801$ ) respectively.

### 3.6 Ethical consideration of the study:

- Ethical consideration approval was obtained from the Research Scientific Ethical Committee of Faculty of Nursing, Mansoura University at 17-12-2020. Prior to this study, the researcher obtained a verbal consent from each subject enrolled in this study, after clarification of the purpose of the study. The researcher highlighted that the collected data was treated confidentially and only used for the

study. Safety, anonymity, and privacy had been assured throughout the whole study. Each nurse was assured that their participation was voluntary, and they have the right to refuse to participate or withdraw from the study at any time without giving any reason, or penalty.

**II: Operational phase**; this phase extended through 5 months period; started from the beginning of March 2021 and ended in July 2021. This phase consisted of the following steps:

- The researcher used to go to the previously selected setting 6 hours/ day, for 3 consecutive days /week.
- When arrived at the isolation unit, the researcher was received and delivered protective clothing against infection, and before that the researcher took the necessary dose of vaccination against the Covid-19.
- Study subjects who match sample criteria and accept to participate in the study were interviewed individually; starting by the researcher introduced herself and given an explanation of the purpose of the study to collect the necessary data using all study tools.
- Assessing demographic, health-relevant data, and work experience years, and knowledge about Covid19 was done through the interview using tool I (part 1, and 2).
- Then start with observation checklist regarding nurses' adherence to IPC measures during caring for COVID 19 patients in the setting by standing in the corner in the unit and trying to see how each nurse treats her patients, how she follows infection precautions, and how well she/he adheres to them.
- After the daily interview with the nurses, the researcher removes the protective clothing, performs all precautionary obligations, and isolates himself in a special room for a week. a swap is performed after the third visit to the unit to return to work and home.

**4. Results:**

Table (1) shows the studied nurse's distribution according to socio-demographic and occupational data. The age of the studied nurses ranged from 25 - 49 years, with a mean age of  $33.84 \pm 7.20$  years. 33.0% of them aged from 25 to less than 30 years. Females constituted 71.7% of the studied nurses. Nurses with bachelor's degree constituted 39.6%. Regarding family size those nurses who had 1-3 persons constitute 64.2%. Regarding the marital status, 41.5% of the studied nurses were married

Table (1) cont. shows the studied nurse's distribution according to socio-demographic

and occupational data. Most studied nurses (56.6%) had 1-5 years' experience by Mean  $\pm$  SD of  $6.70 \pm 4.93$  years. 87.7% reported yes concerning previous experience about dealing with SARS or influenza. About having any infection with coronavirus 73.6 %reported yes also. While regarding transportation to workplace most nurses (45.3%) reported that they go to their workplace by taxi.

Table (2) shows the total distribution of the studied nurse's regarding their covid 19 knowledge. It was found that all knowledge domains were at average level except causative agent knowledge was at good level and vaccine knowledge was at poor level.

**Table (1):** Distribution of the studied nurse's according to socio-demographic characteristics and occupational data (N=106)

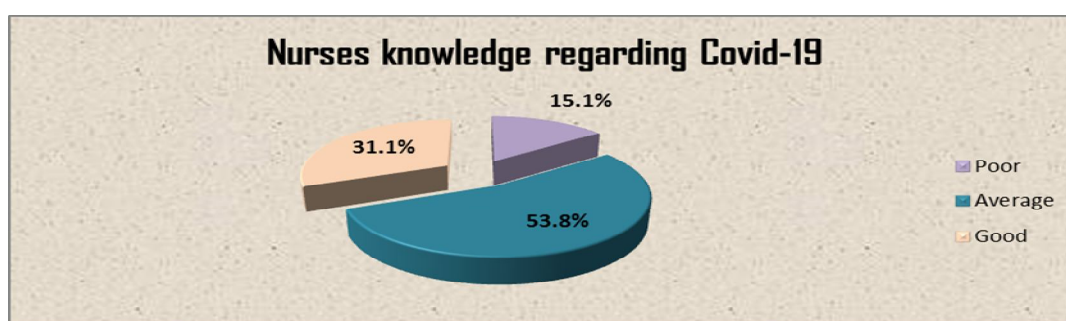
<i>Demographic data</i>	<i>N=106</i>	<i>100%</i>
<b>Age</b>		
25 to less than 30	35	33.0
30 to less than 35	21	19.8
35to less than 40	27	25.5
$\geq 40$	23	21.7
<i>Mean <math>\pm</math> SD</i> <i>(Min – Max)</i>	$33.84 \pm 7.20$ (25-49 years)	
<b>Sex</b>		
Male	30	28.3
Female	76	71.7
<b>Educational level</b>		
Diploma	29	27.4
Technical	28	26.4
Bachelor's degree	42	39.6
Postgraduate	7	6.6
<b>Family size</b>		
1-3 persons	68	64.2
4-5 persons	15	14.1
More than 5 persons	23	21.7
<b>Marital status</b>		
Single	33	31.1
Married	44	41.5
Widow	10	9.5
Divorced	19	17.9

**Table (1) cont.:** Distribution of the studied nurse's according to socio-demographic and occupational data (N=106)

<i>Occupational data</i>	<i>N=106</i>	<i>100%</i>
<b>Years of experience</b>		
1-5 years	60	56.6
>5-10 years	17	16.0
>10 years	29	27.4
<i>Mean ± SD</i> <i>(Min – Max)</i>	6.70 ± 4.93 (2 – 20 years)	
<b>Previous experience dealing with SARS or influenza</b>		
Yes	93	87.7
No	13	12.3
<b>Transportation to workplace</b>		
Taxi Transport	48	45.3
Alone in a personal car	18	17.0
Transportation Bus	40	37.7
<b>Have any infection with coronavirus</b>		
Yes	78	73.6
No	28	26.4

**Table (2)** the total distribution of the studied nurse's according to their COVID 19 knowledge

<b>Knowledge domains</b>	<b>Mean ± SD</b>
Causative agent	3.83±0.36
Pathophysiology	2.87±1.32
High risk group	3.66±1.35
Diagnosis	7.03±3.55
Signs and symptoms	5.04±3.19
Mode of transmission	8.50±4.52
Treatment	2.66±2.18
Vaccine	2.66±2.16
Clinical care	1.88±1.2
Optimize personal protective equipment (PPE) supply	2.01±1.47
Return to work after covid 19 infection	3.95±1.73
<i>Total knowledge score</i>	<b>44.16±15.38</b>



**Figure (1)** Distribution of the studied nurse's according to their knowledge levels regarding COVID 19

**Figure (1)** show studied nurse's knowledge levels regarding COVID 19. More than half (53.8%) of the studied nurses had average knowledge level, nearly one third (31.1%) of them had good knowledge level and only 15.1% of them had poor knowledge level

Table (3) show studied nurse's distribution regarding standard precautions adherence. It was found that all standard precautions domains were at poor level except safe injection, sterilization and disinfection were at average level and environmental infection prevention and control was at good level.

**Table (4)** Total Distribution of the studied nurse's according to COVID 19 isolation precautions adherence. It was found that all COVID 19 isolation precautions domains were at average level except removal of face shield, verifying the integrity of the ensemble and removal of surgical mask were at poor level.

**Table (5)** show the studied nurse's distribution according to their total adherence to IPC measures during caring for COVID 19 patients. It was found that 40.6% of the studied nurses had poor standard precaution adherence and (52.8%) of the studied nurses had poor adherence to COVID 19 isolation precautions with only 11.3% of the studied nurses had good adherence to total IPC measures.

Table (6) show relationship between demographic data and knowledge level of the studied nurses (N=106). It was found that there was statistically relationship between knowledge level regarding age, sex,

educational level, and family size, as p value = (<0.0001).

**Table (7)** show relationship between Occupational data and knowledge level of the studied nurses (N=106). It was found that there was statistically significance relationship between knowledge level and occupational data regarding years of experience, previous experience, dealing with SARS or influenza, have any infection with, and transportation to workplace, as p value = (<0.0001).

Table (8) show relationship between demographic data and total adherence level of the studied nurses (N=106). It was found that there was statistically relationship between total adherence level and age, sex, educational level, family size, place of residence, and marital status as p value (<0.0001).

**Table (9):** Relationship between occupational data and total adherence level of the studied nurses (N=106). It was found that there was statistically significance relationship between total adherence level and occupational data regarding, years of experience, previous experience dealing with SARS or influenza, and transportation to workplace as P value (<0.0001).

Figure (2) show relationship between total adherence level and suffering from corona virus. It was found that 59% of those who had poor adherence were have infection with corona virus.

Figure (3) show the correlation between nurse's total adherence to IPC measures and knowledge level. The Figure showed that there was strong positive correlation found between nurse's total adherence to IPC measures and knowledge level as (r = 0.146, P=<0.0001\*\*).

**Table (3)** Distribution of the studied nurse's according to the standard precautions adherence (N=106)

Part 1: Standard precautions adherence	Mean ± SD
A-Hand Hygiene	5.49±3.19
B. Personal Protective Equipment (PPE)	2.46±1.81
C. Respiratory Hygiene/Cough Etiquette	0.33±0.47
D. Sharps Safety	0.86±0.94
E. Safe Injection Practices	3.04±1.46
F. Sterilization and Disinfection of Patient-Care Items and Devices	2.64±1.38
G. Environmental Infection Prevention and Control	1.59±0.49

**Table (4)** Total Distribution of the studied nurse's according to Covid 19 isolation precaution (N=106)

Part 2: Covid 19 isolation precaution adherence checklist	Mean ± SD
A. Preparations	4.05±1.93
B. Donned an isolation gown.	1.96±1.05
C. Don Mask: if aerosol mask	6.56±3.26
D. Don Not aerosol mask	1.93±1.16
E. Don Face shield	1.33±0.78
F. Don Gloves	0.53±0.50
G. -Verified the integrity of the ensemble.	0.41±0.49
H. Provided designated care to the patient while maintaining precautions.	1.10±0.80
I. Administered medications as ordered while maintaining precautions.	0.48±0.50
J. Collected any ordered specimens.	2.04±1.54
K. After providing patient care	2.13±1.01
L. Removed gloves	2.93±1.69
M. Removed the gown.	2.74±1.82
N. Removing Disposable Medical Face Shield	1.70±1.65
O. Remove surgical mask	0.44±0.49
P. Removed the N95 respirator.	2.83±1.78
Q. Completing the Procedure	2.16±1.98

**Table (5)** Total Distribution of the studied nurse's according to their total adherence to IPC measures during caring for COVID 19 patients (N=106)

Nurses' adherence to IPC measures during caring for COVID 19 patients	Mean ± SD	Adherence levels %		
		Poor	Average	Good
<b>Total Standard precaution adherence score</b>	<b>16.44±6.33</b>	<b>40.6</b>	<b>39.6</b>	<b>19.8</b>
<b>Total Covid 19 isolation precaution adherence score</b>	<b>35.40±14.18</b>	<b>52.8</b>	<b>23.6</b>	<b>23.6</b>
<b>Total IPC measures adherence score</b>	<b>51.85±17.83</b>	<b>52.8%</b>	<b>35.8%</b>	<b>11.3%</b>

**Table (6):** Relationship between demographic data and knowledge level of the studied nurses (N=106)

Demographic data	N (%)	Knowledge level			Test of Significance (P) ^
		Poor	Average	Good	
Age					$\chi^2 = 78.299$ ( $<0.0001$ ) **
25 to less than 30	35	3 (8.6)	32 (91.4)	0 (0.0)	
30 to less than 35	21	0 (0.0)	6 (28.6)	15 (71.4)	
35 to less than 40	27	0 (0.0)	12 (44.4)	15 (55.6)	
≥40	23	13 (56.5)	7 (30.4)	3 (13.0)	



*Evaluate Nurses knowledge and Adherence to .....*

<b>Sex</b>					
<b>Male</b>	30	0 (0.0)	15 (50.0)	15 (50.0)	FET = 12.290 (0.004) **
<b>Female</b>	76	16 (21.1)	42 (55.3)	18 (23.7)	
<b>Educational level</b>					
<b>Diploma</b>	29	13 (44.8)	16 (55.2)	0 (0.0)	$\chi^2 = 56.326$ ( $<0.0001$ ) **
<b>Technical</b>	28	3 (10.7)	20 (71.4)	5 (17.9)	
<b>Bachelor's degree</b>	42	0 (0.0)	15 (35.7)	27 (64.3)	
<b>Postgraduate</b>	7	0 (0.0)	6 (85.7)	1 (14.3)	
<b>Family size</b>					
<b>1-3 persons</b>	68	3 (4.4)	32 (47.1)	33 (48.5)	$\chi^2 = 58.982$ ( $<0.0001$ ) **
<b>4-5 persons</b>	15	0 (0.0)	15 (100.0)	0 (0.0)	
<b>More than 5 persons</b>	23	13 (56.5)	10 (43.5)	0 (0.0)	

**Table (7): Relationship between Occupational data and knowledge level of the studied nurses (N=106)**

<i>Occupational data</i>	<i>N (%)</i> <i>106</i>	<i>Knowledge level</i>			<i>Test of Significance (P) ^</i>
		<i>Poor</i>	<i>Average</i>	<i>Poor</i>	
<b>Years of experience</b>					
1-5 years	60	3 (5.0)	41 (68.3)	16 (26.7)	$\chi^2 = 39.879$ ( $<0.0001$ ) **
>5-10 years	17	0 (0.0)	5 (29.4)	12 (70.6)	
>10 years	29	13 (44.8)	11 (37.9)	5 (17.2)	
<b>Previous experience dealing with SARS or influenza</b>					
Yes	93	13 (14.0)	47 (50.5)	33 (35.5)	FET = 8.113 (0.035) *
No	13	3 (23.1)	10 (76.9)	0 (0.0)	
<b>Have any infection with coronavirus</b>					
Yes	78	16 (20.5)	41 (52.6)	21 (26.9)	FET = 8.727 ( $<0.0001$ ) **
No	28	0 (0.0)	16 (57.1)	12 (42.9)	
<b>Transportation to workplace</b>					
Taxi Transport	48	0 (0.0)	33 (68.8)	15 (31.2)	$\chi^2 = 78.245$ ( $<0.0001$ ) **
Alone in a personal car	18	0 (0.0)	0 (0.0)	18 (100.0)	
Transportation Bus	40	16 (40.0)	24 (60.0)	0 (0.0)	

**Table (8):** Relationship between demographic data and total adherence level of the studied nurses (N=106)

Demographic data	N (%)	Total Adherence level			Test of Significance (P) ^
	106	Poor	Average	Good	
<b>Age</b>					
25to less than 30	35	32 (91.4)	3 (8.6)	0 (0.0)	$\chi^2 = 92.193$ ( $<0.0001$ ) **
30 to less than 35	21	21 (100.0)	0 (0.0)	0 (0.0)	
35 to less than 40	27	3 (11.1)	15 (55.6)	9 (33.3)	
$\geq 40$	23	0 (0.0)	20 (87.0)	3 (13.0)	
<b>Sex</b>					
Male	30	15 (50.0)	6 (20.0)	9 (30.0)	FET = 14.135 ( $<0.0001$ ) **
Female	76	41 (53.9)	32 (42.1)	3 (3.9)	
<b>Educational level</b>					
Diploma	29	3 (10.3)	26 (89.7)	0 (0.0)	$\chi^2 = 59.107$ ( $<0.0001$ ) **
Technical	28	23 (82.1)	1 (3.6)	4 (14.3)	
Bachelor degree	42	23 (54.8)	11 (26.2)	8 (19.0)	
Postgraduate	7	7 (100.0)	0 (0.0)	0 (0.0)	
<b>Family size</b>					
1-3 persons	68	41 (60.3)	15 (22.1)	12 (17.6)	$\chi^2 = 19.206$ ( $0.0001$ ) **
4-5 persons	15	5 (33.3)	10 (66.7)	0 (0.0)	
More than 5 persons	23	10 (43.5)	13 (56.5)	0 (0.0)	
<b>Place of residence</b>					
Rural	69	41 (59.4)	16 (23.2)	12 (17.4)	FET = 17.424 ( $<0.0001$ ) **
Urban	37	15 (40.5)	22 (59.5)	0 (0.0)	
<b>Marital status</b>					
Single	33	18 (54.5)	3 (9.1)	12 (36.4)	$\chi^2 = 61.365$ ( $<0.0001$ ) **
Married	44	32 (72.7)	12 (27.3)	0 (0.0)	
Widow	10	0 (0.0)	10 (100.0)	0 (0.0)	
Divorced	19	6 (31.6)	13 (68.4)	0 (0.0)	

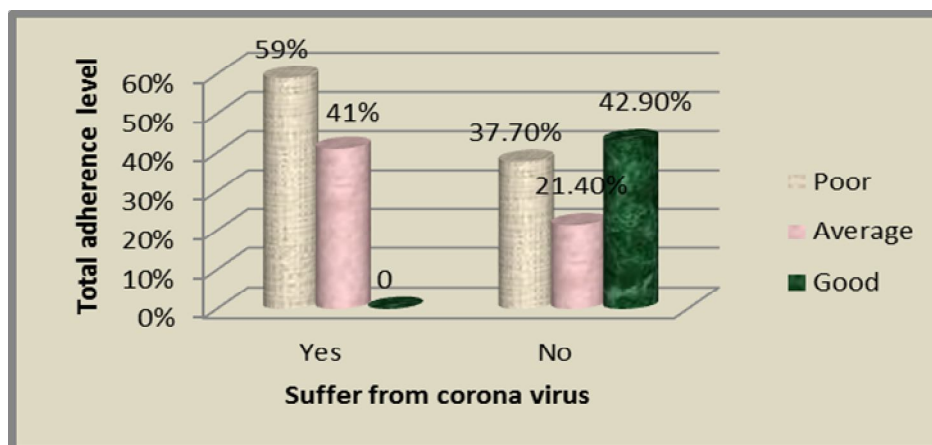
- ^ P value based on Monte Carlo exact probability
- $\chi^2$  Pearson Chi-Square test
- FET= Fisher Exact Test
- \*Significant at  $P \leq 0.05$

**Table (9):** Relationship between occupational data and total adherence level of the studied nurses (N=106).

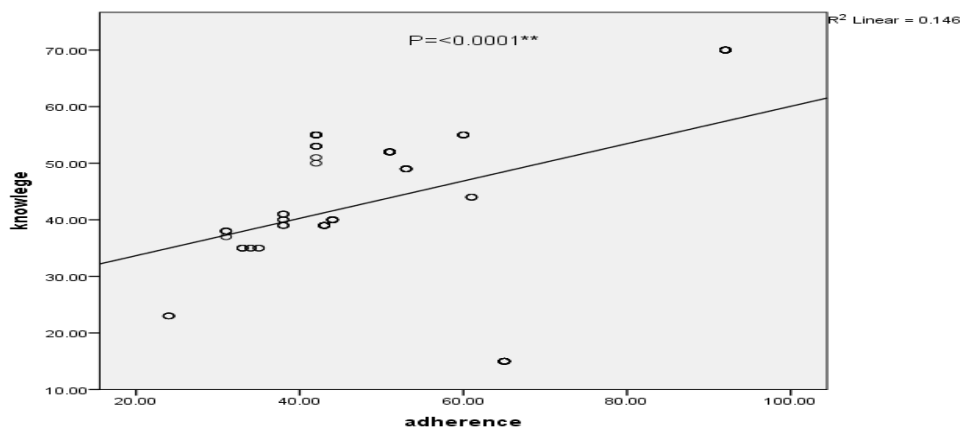
Occupational data	N (%) 106	Total Adherence level			Test of Significance (P) ^
		Poor	Average	Good	
<b>Years of experience</b>					
1-5 years	60	53 (88.3)	6 (10.0)	1 (1.7)	$\chi^2 = 81.189$ ( $<0.0001$ ) **
>5-10years	17	2 (11.8)	8 (47.1)	7 (41.2)	
>10 years	29	1 (3.4)	24 (82.8)	4 (13.8)	
<b>Previous experience dealing with SARS or influenza</b>					
Yes	93	43 (46.2)	38 (40.9)	12 (12.9)	FET = 13.375 (0.0001) **
No	13	13 (100.0)	0 (0.0)	0 (0.0)	
<b>Transportation to workplace</b>					
Taxi Transport	48	32 (66.7)	16 (33.3)	0 (0.0)	$\chi^2 = 70.614$ ( $<0.0001$ ) **
Alone in a personal car	18	0 (0.0)	6 (33.3)	12 (66.7)	
Transportation Bus	40	24 (60.0)	16 (40.0)	0 (0.0)	

- ^ P value based on Monte Carlo exact probability
- $\chi^2$  Pearson Chi-Square test
- FET= Fisher Exact Test

\*Significant at  $P \leq 0.05$



**Figure (2):** Relationship between total adherence level and suffering from corona virus



**Figure (3)** correlation between nurse's total adherence to IPC measures and knowledge level

**5. Discussion:**

The COVID-19 pandemic revealed the fundamental vulnerability of long-term care hospitals related to infection control and prevention (Kim, & Kang, 2022). HCWs are at the frontline of fighting COVID-19, Nurses play a critical role in healthcare teams that are tasked with preventing and controlling infectious diseases spread. Also, nurses are in the front lines and provide care to COVID-19-infected people directly (Chen, et al 2020). Hospitals around the globe have implemented safety measures in order to decrease the risk of spreading the virus among HCWs (Shatnawi et al., 2022). Therefore; this descriptive cross sectional study highlights the nurse’s adherence to IPC measures during caring for COVID 19 patients.

Concerning age, the findings of the present study showed that, more than a third of the studied nurses were aged between twenty-five to less than thirty. This is in the line with the study by Ashinyo et al., (2021), on IPC adherence among exposed HCWs in COVID-19 treatment centers, in Ghana, which reported that the mean age of the HCWs in this study was 33 years. Similar to the study done in Qatar, by Abed Alah et al., (2021), who reported that more than third of the HCWs in this study were aged between thirty to less than forty. Perhaps this is due to the participation of young nursing as one of the components of the first line of defense against the Corona pandemic

Regarding gender, the present study showed that females were more prevalent in

the study subjects. This result is consistent with the study conducted by Silverberg, Puchalski Ritchie, Gobat, & Murthy, (2021), who found that most of the studied nurse were female. Besides the study of Lai et al., (2020), which found that the majority of the studied nurse were female. This result is inconsistent with the study conducted by Etafa, Gadisa, Jabessa, & Takele, (2021), who reported that about two third of the study were male. From the researcher point of view this may be due to the fact that the number of female nurses is greater than that of male nurses in Egypt.

**Distribution of the studied nurse's according to their knowledge regarding covid 19.**

Concerning nurse’s knowledge regarding COVID 19 (causative agent, pathophysiology, risk group, diagnosis, Signs and symptoms, mode of transmission, treatment, vaccine, clinical care, optimize PPE supply, return to work after covid 19 infection), more than half of the studied nurses had moderate knowledge level and only more than one tenth of participant had poor knowledge level.

This is in harmony with Turkish study by Semerci, Kudubes, & Eşref, (2021) which found that most of the studied nurse read and followed the published COVID-19 Guidelines of the Health Ministry. Similarly, Tadesse, Gebrewahd, & Demoz, (2020) stated that most of nurses had good knowledge, and good infection prevention practice. Another study conducted by Nashwan, Abujaber, Mohamed, Villar, & Al- Jabry, (2021), stated that more than half of the nurses reported their overall

COVID-19 knowledge level as “competent” and about third rated themselves as “proficient”. Moreover, **Alwani et al., (2020)**, reported that nurses possess good knowledge about COVID-19, its sources, causative agent, pathophysiology, Signs and symptoms and routes of transmission of the Virus, risk group, diagnosis, treatment, vaccine and clinical care.

On the same line, **Giao et al., (2020)** reported that the majority of nurses had sufficient knowledge regarding COVID-19. In addition an Iranian study conducted by **Nemati, Ebrahimi, & Nemati, (2020)** stated that more than half of nurses had good knowledge related to COVID-19 (e.g. sources, signs and symptoms, transmission, treatment prognosis and mortality rate). Another study conducted by **Nepal et al., 2020**; revealed that most of HCWs had moderate to good knowledge and practice scores and had a positive attitude regarding COVID-19. In agreement with the survey done by **Saqlain et al., 2020** who found that the majority of HCWs have good COVID 19 knowledge.

In contrast a study conducted among HCWs reported that about two thirds of HCWs had poor knowledge of its transmission and symptom onset. This may be due to that one third of subjects in this study were medical students and they mainly used social media as a source of information which sometimes publish unverified malicious information. In addition this study was conducted at the onset of the pandemic (march,2020) and data wasn't collected mainly from isolation hospitals (**Bhagavathula et al, 2020**).

#### **Nurse's adherence to IPC measures during caring for covid 19 patients:**

About two fifth of the studied nurses had poor standard precaution adherence, and more than half of the studied nurses had poor Covid 19 isolation precaution adherence and total adherence to IPC measures.

This is in agreement with **Suliman, Aloush, Aljezawi, & AlBashtawy (2019)** who reported that there is a low adherence with standard isolation practices. In addition, a high percentage of units and wards do not use

isolation signs. Also, **Ezike et al., (2022)** reported poor decontamination of high touch surfaces in most of the units, lack of PPE and only less than half of the wards had adequate PPE during the study. Similarly, **Abed Alah, (2021)**, reported that higher proportions of HCWs reported that there was shortages of PPE and hand washing agents and the most reported barriers were PPE shortage, PPE discomfort as N95 face shields or respirators, lack of time and work overload.

On the same line, another study conducted by **Ahmed, (2020)** reported that the compliance of the HCWs with hand disinfectant use before and after every patient contact was a small percentage. In addition, **Lai et al., (2020)** found that overworked HCWs washed their hands less frequently than those who were not overworked. It is also in agreement with **Silverberg, Puchalski Ritchie, Gobat, & Murthy, (2021)** who found that health worker infection prevention and control compliance, particularly for hand hygiene and disinfection, was inadequate in the outpatient settings. Similarly, **Gon, Dancer, Dreibelbis, Graham, & Kilpatrick, (2020)** reported that hand hygiene may be affected because HCWs may be too overloaded or uncertain of how to employ hand hygiene in this outbreak setting, not because it is not a priority.

Similarly, a study conducted among HCWs reported poor compliance with COVID 19 preventive measures (**Etafa et al, 2021**). Another study which evaluated infection control measures behaviors of HCWs against Covid-19 in Iran hospitals reported that less than half of HCWs using gloves and face mask in all procedures (**Bashirian et al., 2020**). In addition, another study conducted by **Ran et al., (2020)** reported that a lack of hand hygiene after contact with COVID-19 patients led to a higher risk of COVID-19 in Wuhan. Moreover, another study conducted by **Phan et al., (2019)** reported that PPE have not been always available, were not worn or worn incorrectly, and mistakes during donning and doffing were documented. Another study conducted by **Zenbaba et al., (2022)** stated that only one in every two HCWs had good adherence to COVID-19 IPC measures. In

addition, another study conducted among nursing students reported poor observed adherence to COVID 19 IPC measures (Elzeky, & G. Mohamed Ali, (2020).

Conversely with Silverberg, Puchalski Ritchie, Gobat & Murthy, (2021) Canadian nurses had strong self-reported adherence to IPC measures and PPE use. They had high trust levels in health system leadership that they ensure protective measures are reliable and present. And along with Mbachu et al., (2020) Majority of participants had good preventive practices of COVID-19.

This may be due to that most contrasting studies evaluated adherence to covid 19 by use self-reported method while in our study we used observational method. In the researcher's view, the reasons for this variability are multifactorial including PPE lack and the greater patients burden in which all positive COVID-19 cases are treated, wearing PPE increases their stress and workload and lack of continuous training programs.

#### **Relationship between nurse's total adherence to IPC measures and their demographic characteristics**

Regarding the relationship between nurse's total adherence to IPC measures and their demographic characteristics, significant relation was observed between nurse's adherence and their age, sex, educational level, Family size, Place of residence, Marital status, Years of experience, Previous experience dealing with SARS or influenza, Suffer from coronavirus and Transportation to workplace.

This in accordance with Salwa et al., (2022) who found that Compliance with the IPC guidance was significantly associated with increasing age, bachelor nurse and history of exposure to patients with COVID-19. Similarly, a study conducted by Alrubaiee, Al-Qalah, & Al-Aawar, (2020) revealed a significant positive relationship between the respondents' COVID 19 preventive behaviors and their gender, occupation, educational level and years of work experience. In addition, female sex was associated with higher compliance and this contrast our study that male had higher adherence level than females

and this may be due to that male nurses worked for more than one round in isolation unit while female nurses refuse to work more than one round in isolation unit

#### **Relationship between nurse's knowledge level and their demographic characteristic**

Regarding the relationship between nurse's knowledge level and their demographic characteristic, significant relation was observed between nurse's knowledge level and their demographic characteristic. This is in agreement with Alrubaiee, Al-Qalah, & Al-Aawar, (2020), who reported that there was a significant positive correlation between the respondents' level of knowledge of COVID-19 and their occupation and education level. Also Semerci, Kudubes, & Esref, (2021), found a high level of statistically significant difference between the mean scores of nurses for knowledge of COVID-19 in terms of their education level and position at work while no significant difference was determined in terms of age, gender, marital status, working years and the unit they worked in and this contrasting our study. This may be due to that this study was conducted on oncology nurses while more than have of them didn't receive education regarding COVID 19.

#### **Correlation between nurse's total adherence to IPC measures and knowledge level.**

In the present study, a strong positive correlation was found between nurse's total adherence to IPC measures and knowledge level and this in the line with (Odikpo Linda et al., 2022). Another study conducted by Alrubaiee, Al-Qalah, & Al-Aawar, (2020) among HCWs reported a significant positive correlation between knowledge, attitude, anxiety, and adherence to preventive behaviors towards the COVID-19 pandemic. This may due to that the greater the HCWs' knowledge; the more confident they were in defeating the virus (Zhang et al., 2020). In addition, Nurses who have higher knowledge level were more willing to deal with COVID-19 patients (Nashwan, Abujaber, Mohamed, Villar, & Al- Jabry, 2021).

Relationship between total adherence level and suffering from corona virus

In the present study, About two thirds of nurses who had poor adherence to infection control guideline were infected with Corona virus, and this in the line with **Ramezani, Taheri-Kharameh& Yazdizadeh, (2021); Wong et al., (2021) and Wang, Zhou, & Liu, (2020)** who found that most HCWs had been infected with Covid-19 because of the lack of awareness and incorrect use of PPE. In addition another study conducted at Egypt, reported higher prevalence of suspected COVID 19 symptoms among nursing students with poor observed adherence to COVID 19 preventive measures during written exams (**Elzaky, & G. Mohamed Ali, 2020**).

#### 6. Conclusion:

Based on the findings of the present study, it concluded that most studied nurses had average knowledge level, poor covid 19isolation precaution adherence, and poor total adherence to IPC measures. Furthermore, it was found that there was statistically relationship between knowledge level and demographic characteristics and occupational data. Moreover, it was found that there was statistically significance relationship between total adherence level and demographic data and occupational data. Finally there was strong positive correlation found between nurse's total adherence to IPC measures and knowledge level. Finally the majority of studied nurses who had poor adherence to infection control guideline were infected with Corona virus.

#### 7. Recommendations:

**Based on the finding of the study, the following recommendations are suggested:**

Adequately planned in-service training programs and refreshing training is imperative to improve the level of HCWs' adherence to IPC measures during caring for covid19 patient's. Frequent quality checks, continuous monitoring, adequate supplies provision (hand washing agents and PPE) and behavior change interventions are top measures that can be applied by hospital and nursing administrators to enhance adherence. Further research which includes other method of observation to nurses' adherence by using the camera and videotape

is required to minimize Hawthorne effect. The study can be replicated on a larger sample in multicenter settings and on all HCWs for generalizing the findings.

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