# Nursing Staff Compliance regarding Infection Control measures with COVID-19 Patients at Isolation Hospitals.

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## Abstract

**Background**: Nurses' compliance with infection control practices is the key to quality and excellence in Covid-19 patient care; infection control remains one of the most cost beneficial and requires full compliance of the whole nursing team. **Aim** of the current study was to assess nursing staff compliance regarding infection control measures with COVID-19 patients at isolation hospitals. **Design:** Descriptive cross sectional study design was utilized to fulfill the aim of this study. **Setting** The study was conducted in two of corona virus's isolation hospitals at Minia City, Minia governorate, Egypt (Minia Chest Hospital & Minia Fever Hospital). **Subjects:** The study sample included (233) of nursing staff working in the prementioned hospitals, who were on duty during the period of data collection. **Data Collection Tool:** Observational Checklist of Nursing Staff Compliance with Infection Control and Prevention consisting of two parts; personal data sheet followed by Observation Checklist items. **Results:** Most of the studied nursing staff at the two hospitals had high level of compliance with infection control measures, while (12.4%) of them had low compliance level. Also, most of the studied nursing staff at Minia fever hospital had high compliance with protective measures, and linen management, while most of the studied nursing staff at Minia chest hospital had high compliance with safe injection practices, and specimen handling with statistically significance. **Conclusion:** The mean scores of total compliance level as well as the mean scores of personal protective equipment and safe injection practices sub-domain were observed higher in the morning shift than in the other work shifts with high statistically significant differences. **Recommendations**: Continuous education and training for all health care sectors about all waves of the Covid -19 virus. Frequently supervision by management levels to ensure nursing staff compliance with infection control measures during all work shifts.

**Keywords**: COVID -19, Compliance, Infection Control Measures, Nursing Staff.

## Introduction

Nursing job is one of the most exciting and in-demand jobs today. As an integral part of the health care system, it encompasses the promotion of health, prevention of illness, and care of physically, mentally ill, and disabled people of all ages. Nurses are the backbone of any health care system, they work to promote health, prevent disease, and help patient to cope with illness (**American Nurses Association (ANA), 2014**).

They are also advocators and health educators for patients, families, and community. Nurses are persons serving in healthcare settings who have the potential for direct or indirect exposure to patients or infectious materials, including body substances (e.g., blood, tissue, and specific body fluids); contaminated medical supplies, devices, and equipment; contaminated environmental surfaces; or contaminated air so that they need to work in a safe environment (**Al-Qahtani et al., 2020; Center For Disease Control & Prevention (CDC), 2020**).

The last twenty years, several viral epidemics such as the severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002 to 2003, and H1N1 influenza in 2009, have been recorded. Most recently, the Middle East respiratory syndrome coronavirus (MERS-CoV) was first identified in Saudi Arabia in 2012 According to the World Health Organization (WHO), viral diseases continue to emerge and represent a serious issue to public health (**Cascella et al., 2020**).

Coronaviruses are important human and animal pathogens. At the end of 2019, a novel coronavirus was identified as the cause of a cluster of pneumonia cases in Wuhan, China. It rapidly spread, resulting in an epidemic throughout China, followed by an increasing number of cases in other countries throughout the world. In February 2020, the World Health Organization (WHO) designated the disease COVID-19, which stands for coronavirus disease 2019, that causes severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); previously, it was referred to as 2019-nCoV (**WHO, 2020**)

Workplace infection precaution are important elements to safeguard occupational health in healthcare, it will not do well if individual health care workers do not follow them. Thus, implementing agreeable and acceptable workplace infection control guidelines and measures in healthcare settings during an infectious pandemic is necessary to protect HCW's health and reduce the risk of cross-transmission and infection in the workplace (**Kim & Hwang, 2020**).

Knowledge and compliance with standard precautions among nurses are important to reduce the incidence of those secondary infections. All nurses and the health care team must receive the highest level of protection to provide care for the individuals and communities in which they serve. It is essential to develop and educate all staff on preparedness plans that provide infection control procedures and protocols used within the health care facility for the early identification, containment, and care of patients with symptoms associated with Coronavirus Disease (COVID-19) to prevent spread within the facility (**Eckardt, et al., 2020**).

CDC (2020) recommends using additional infection prevention and control practices during the COVID-19 pandemic, along with standard practices recommended as a

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part of routine healthcare delivery to all patients. These practices are intended to apply to all patients, not just those with suspected or confirmed SARS-CoV-2 infection, for additional practices that should be used when caring for patients with suspected or confirmed SARS-CoV-2 infection, the level of practice and compliance of infection control and prevention by health care workers may differ from one type of health care worker to another. The differences in knowledge of universal precaution by health care workers may be influenced by their different type of training **(CDC, 2020)**.

**Significance of the study:**

COVID-19 emerged as a global threat, affecting 94 million people worldwide and causing about 2 million deaths as of January 2021. As the COVID-19 pandemic progresses, HCWs are the most important resources in providing care for the patients at the frontline in the battle against the disease. However, they are also at higher risk of becoming infected themselves, which could pose a big challenge for epidemic control and lead to the collapse of the healthcare system **(Barranco & Ventura, 2020)**.

**Alajmi et al., (2020)** reported that the prevalence of COVID-19 in health care workers was around 10%, and 29% of infections were due to accident exposure to a patient at a non-COVID-19 facility. Recent evidence also suggests that the risk of asymptomatic spread of COVID-19 to HCWs was presented.

**Aim of the Study:**

The aim of the current study is to assess nursing staff compliance regarding infection control measures with covid-19 patients at isolation hospitals.

**Research Question:**
- What is the degree of nursing staff compliance regarding infection control measures with covid -19 patients at isolation hospitals**?**

**SUBJECT and METHODS**
**Research design:**
Descriptive cross sectional study design was utilized to fulfill the aim of this study.

**Setting:**
study was conducted in two of corona virus's isolation hospitals at Minia City, Minia governorate, Egypt (Minia Chest Hospital & Minia Fever Hospital).

**Subjects:**
The study sample included (233) of nursing staff working in the two corona virus's isolation hospitals, who were on duty during the period of data collection. Which divided into (119) staff nurses working in Minia fever hospital and (114) staff nurses working in Minia chest hospital

**Data Collection Tool:**
Considering the aim of the study data needed was collected through the following tool:
**Observational Checklist of Nursing Staff Compliance with Infection Control and Prevention,** it consists of two parts as follows:
**Part I: personal data sheet** that was used to collect the data about the personal characteristics of the study participants it (6) items including (Hospital name, age, gender,

educational qualification, department, years of experience). Followed by (3) Yes or No questions about previous infection for COVID-19, immunization with COVID-19 vaccine and training about COVID-19).

**Part II: Observational Checklist of Nursing Staff Compliance with Infection Control and Prevention** developed by (**Labrague et al., 2012**) and modified by the investigator to assess the degree of nursing staff compliance regarding infection control and prevention measures. It consisted of 50 items sub grouped under 7 sub-domain as follow: protective measures (8 items), personal protective equipment (27 items), decontamination of patient care equipment (3 items), safe injection practices (5 items), linen management (2 items), spacemen handling (4 items), and employee health (1 item).

- The scoring system: each statement will measure by done=1, not done= 0. total score of the checklist ranges (from 0 to 50) divided into 2 groups as follows:
- Total score of $\geq 60\%$ (from 30 to 50 score) considered high of compliance to protective measures. While total score of $< 60\%$ (from 0 to 29 score) considered low level of compliance.

**Validity of tools:**
The tools were tested for the face validity by a jury of 5 experts in nursing administration and education field from Faculty of Nursing - Minia University. Each of the expert panel was asked to examine the instruments for content coverage, clarity, wording, length, format, and overall appearance. And necessary modification from jury panel was done.

**Reliability of tools:**
Reliability of tools was performed to confirm consistency of scales. The internal consistency measured to identify the extent to which the items of the scales measured what it was intended to measure. Also, the scales were tested for its reliability by using Cronbach alpha test which indicated that, reliability of tool is 0.895.

**Pilot study:**
Pilot study was carried out before starting data collection and after the development of the scales on 10% of nurses (23 nurses) form the selected hospitals. It was performed over the period of one month (January, 2022). The researcher filled observational checklist through three observation intervals during morning, evening, and night shifts, to test the clarity, comprehensiveness, and applicability of the study tool, as well as to estimate accessibility of staff and time needed to fill the study tool, in addition it helped in identifying any obstacles and problems that might interfere with data collection.

**Data collection procedure:**
- An official letter was granted from the Nursing Faculty Dean at Minia University, Ethical Committee, Nursing Faculty at Minia University.
- The tools were adopted and translated into Arabic; then collect the jury approval for the scales to collect data of the study.
- Written approvals were obtained from the directors of Minia Fever Hospital and Minia Chest Hospital after explaining the purpose of the study.

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- An interview was arranged by the researcher with the members of the studied sample to get their personal data, and then forms observation checklist items were coded to complete the data collection.
- The researcher trained three peer inspectors (external nursing supervisors, who working at Minia health directorate) on how to use the observation checklist in collecting data to help him in the collection of data from the nursing staff.
- The researcher filled observation checklist through three observation intervals during morning, evening, and night shifts for each of the studied nurses.
- The actual field work started from the beginning of February 2022 to the end of December 2022 for collecting data.
- The researcher scheduled the visits to each department of each hospital based on the staff nurse's schedule of work.

## Ethical Considerations:
- An official letter was granted from the research ethics Committee of the Faculty of Nursing, Minia University.

- Approval to conduct the study was obtained from Dean of the Faculty of Nursing, Minia University.
- A permission and consent were obtained from director of the Hospitals and nursing managers of Minia Fever Hospital and Minia Chest Hospital.
- Participation in the study was on voluntary basis and participants be assured that all their data are highly confidential; anonymity was also assured through assigning a number for each nurse instead of names to protect their privacy.

## Data statistical analysis
Upon completion of data collection, the data were scored, tabulated, and analyzed through data entry and analysis by computer using the "Statistical Package for Social Science" (SPSS) (IBM 28). Data were presented using descriptive statistics in percentages, frequency mean, and standard deviation. Inferential statistical tests of significance such as the Fisher exact test and Pearson correlation were used to identify group differences and the relations among the study variables. The p-value $> 0.05$ indicates a non-significant result, while the p-value $\cdot$ 0.05 is significant, and the p-value $\leq 0.01$ is highly significant

## Results
**Table (1): Distribution of the studied nursing staff according to their personal data (n= 233).**

| Personal data | Nursing staff (n= 233) | |
|---|---|---|
| | No. | % |
| **Hospital name** | | |
| Minia chest Hospital | 114 | 48.9 |
| Minia fever Hospital | 119 | 51.1 |
| **Age / years** | | |
| 20 - < 30 | 135 | **57.9** |
| 30 - < 40 | 54 | 23.٢ |
| 40 – 50 | 29 | 12.4 |
| > 50 | 15 | 6.4 |
| **Mean ± SD** | 31.7 ± 9.3 year | |
| **Years of experience** | | |
| 1 –< 5 | 127 | 54.5 |
| 5 – 10 | 60 | 25.8 |
| > 10 | 46 | 19.7 |
| **Mean ± SD** | 6.0 ± 3.7 year | |
| **Educational qualification** | | |
| Master | 3 | 1.3 |
| Bachelor | 53 | 22.7 |
| Institute of nursing | 105 | 45.1 |
| Diploma | 72 | 30.9 |
| **Gender** | | |
| Female | 184 | 79.0 |
| Male | 49 | 21.0 |
| **Department** | | |
| Emergency | 27 | 11.6 |
| ICU | 110 | 47.2 |
| Isolation | 96 | 41.2 |

**Table (1):** Presents that more than half (57.9%) of the studied nursing staff 'age is ranging 20 - < 30 with mean age 31.7 ± 9.3 years. More than half of the studied nursing staff working in Minia fever hospital and have years of experience ranging between 1 - 5 years with mean experience 6.0 ± 3.7 years in the nursing field (51.1% & 54.5%, respectively), and nearly half (45.1%) of the studied nursing staff had institute of nursing. This table also illustrates that more than three-quarters (79.0%) of the nursing staff were female. In addition, nearly half (47.20%) of the nursing staff working in the ICU, followed by (41.2% & 11.6%) in the isolation and emergency department respectively.
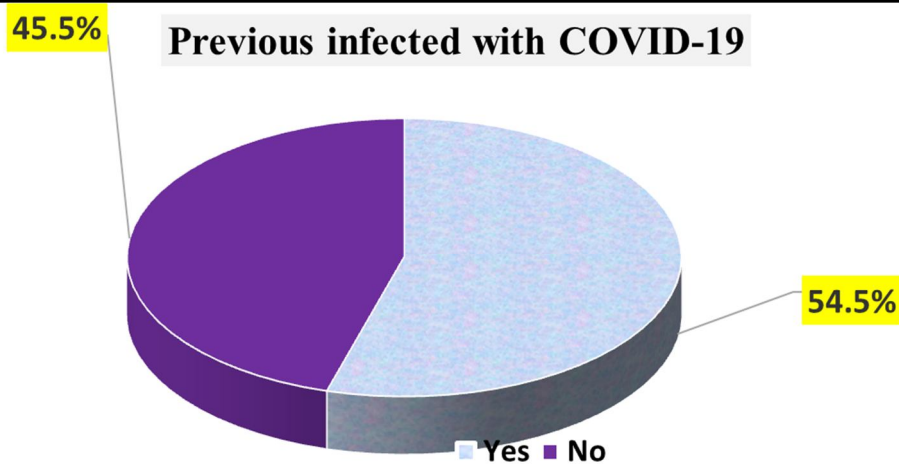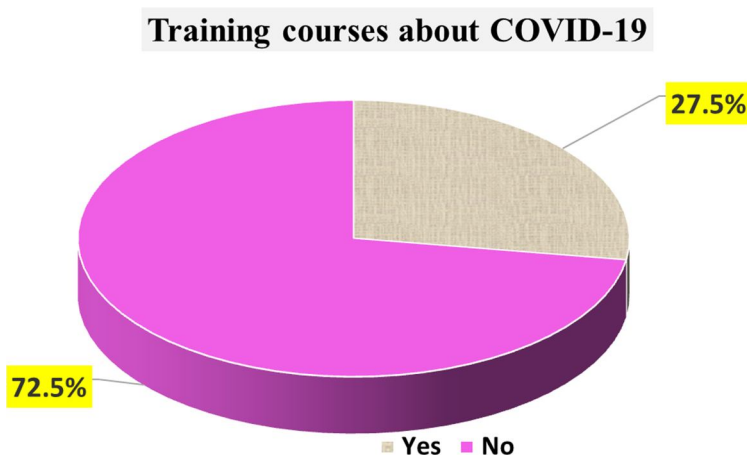
**Figure (1): Distribution of the nursing staff according to their previous infected with COVID-19 (n = 233).**

**Figure (1)**: illustrates that more than half (54.5%) of the nursing staff exposes to infection with COVID-19 disease, and nearly half (45.5%) of them not exposes to infection
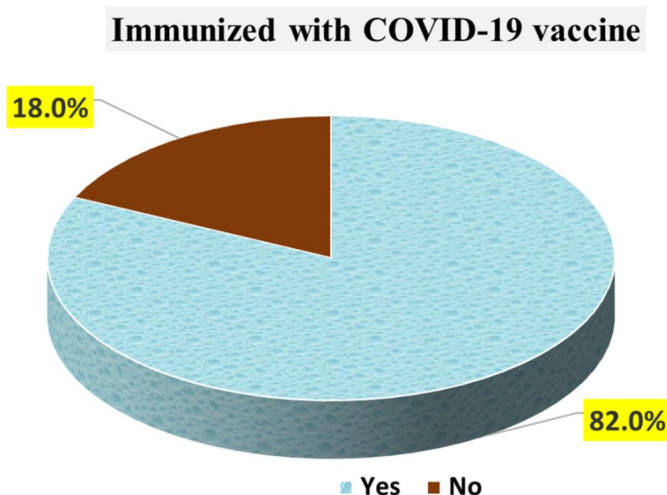


**Figure (2): Distribution of the nursing staff according to immunization with COVID-19 vaccine (n = 233).**

**Figure (2)**: demonstrates that the majority (82.0%) of the nursing staff were immunized with COVID-19 vaccine, and minority (18.0%) of them not immunized



**Figure (3): Distribution of the nursing staff regarding training courses about COVID-19 (n = 233).**

**Figure (3)**: illustrates that nearly three-quarters (72.5%) of the nursing staff attended training courses about COVID-19, and more than one-quarter (27.5%) of them not attending

**Table (2): Average mean scores of total compliance level and its sub-domain among studied nursing staff at Minia chest and fever hospitals (n = 233).**

| Total Compliance Level and Its sub domain | No. of items | Min- Max | Average mean of nursing staff compliance level | | Average mean of nursing staff compliance (n= 233) |
|---|---|---|---|---|---|
| | | | Minia chest Hospital (n=114) | Minia fever Hospital (n=119) | |
| | | | Mean ± SD | Mean ± SD | Mean ± SD |
| • Protective measures | 8 | 1-8 | 5.7 ± 1.8 | 6.0 ± 1.1 | 5.8 ± 1.5 |
| t-test (*P* – Value) | | | 1.357 (0.176)NS | | |
| • Personal protective equipment | 27 | 8-27 | 23.8 ± 4.4 | 23.1 ± 3.5 | 23.4 ± 4.0 |
| t-test (*P* – Value) | | | 1.297 (0.196) NS | | |
| • Decontamination of patient care equipment | 3 | 0-3 | 2.8 ± 0.2 | 2.6 ± 0.4 | 2.8 ± 0.2 |
| t-test (*P* – Value) | | | 1.477 (0.141) NS | | |
| • Safe injection practices | 5 | 0-5 | 4.6 ± 0.8 | 4.6 ± 0.9 | 4.6 ± 0.4 |
| t-test (*P* – Value) | | | 0.723 (0.470) NS | | |
| • Linen management | 2 | 0-2 | 1.5 ± 0.5 | 1.9 ± 0.1 | 1.9 ± 0.1 |
| t-test (*P* – Value) | | | 2.682 (0.008)** | | |
| • Specimen handling | 4 | 0-4 | 3.7 ± 0.3 | 2.7 ± 0.9 | 3.2 ± 0.8 |
| t-test (*P* – Value) | | | 8.996 (0.001)** | | |
| • Employee health | 1 | 0-1 | 0.9 ± 0.1 | 0.9 ± 0.2 | 0.9 ± 0.1 |
| t-test (*P* – Value) | | | 1.877 (0.062) NS | | |
| **Total Compliance** | **50** | **16-50** | **43.5 ± 6.9** | **42.0 ± 5.6** | **42.7 ± 6.3** |
| **t-test (*P* – Value)** | | | **1.839 (0.067) NS** | | |

NS= Not statistically significance differences     ** = statistically significance differences at < 0.01

**Table (2):** proves that average mean scores of nursing staff compliance at Minia fever hospital are high in linen management is 1.9 ± 0.1 from 2, and mean scores of nursing staff compliance at Minia chest hospital are high in specimen handling is 3.7 ± 0.3 from 4 with statistically significant differences favored to nursing staff at Minia chest hospital in sub-domain "specimen handling" and favored to nursing staff at Minia fever hospital in the sub-domain "linen management" at p-value (0.008, and 0.001 respectively). In addition, average mean scores of nursing staff compliance are high in all sub domains as protective measures is 5.8 ± 1.5 from 8, personal protective equipment is 23.4 ± 4.0 from 27, decontamination of patient care equipment is 2.8 ± 0.2 from 3, safe injection practices is 4.6 ± 0.4 from 5, linen management is 1.9 ± 0.1 from 2, specimen handling is 3.2 ± 0.8 from 4, employee health is 0.9 ± 0.1 from 1, and total compliance are 42.7 ± 6.3 from 50 with no statistically significant differences
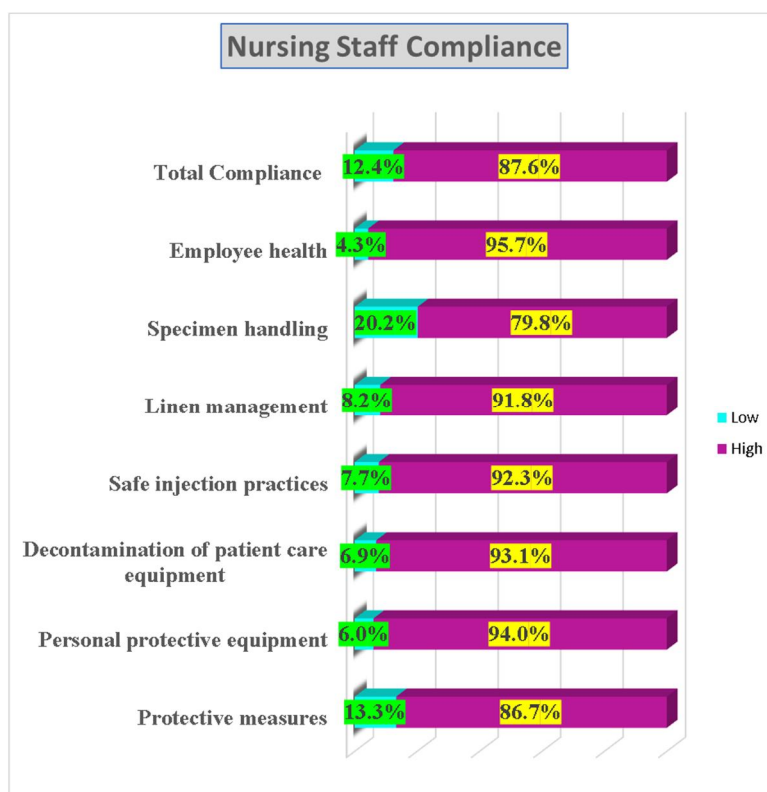


**Figure (4) Distribution of the Nursing Staff Compliance Level and its sub-domain among nursing staff (n= 233).**

**Figure (4):** Shows that most of the studied nursing staff at Minia chest hospital and Minia fever hospital had high compliance (87.6%), while (12.4%) of them had low compliance. Also, the same figure proves that most of the studied nursing staff had high compliance with personal protective equipment, decontamination of patient care equipment, safe injection practices, linen management, and employee health (94.0%, 93.1%, 92.3%, 91.8%, 95.7%, respectively)

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**Table (3): Differences in mean scores for the level of compliance with infection control measures and its sub-domain among nursing staff at Mini chest and fever hospitals during the three observations (n=233).**

| Nursing staff compliance | Morning shift (1st observation) | | | Evening shift (2nd observation) | | | Night shift (3rd observation) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Minia chest Hospital (n=114) | Minia fever Hospital (n=119) | Test of significance | Minia chest Hospital (n=114) | Minia fever Hospital (n=119) | Test of significance | Minia chest Hospital (n=114) | Minia fever Hospital (n=119) | Test of significance |
| | Mean ± SD | Mean ± SD | t-test (P value) | Mean ± SD | Mean ± SD | t-test (P value) | Mean ± SD | Mean ± SD | t-test (P value) |
| Protective measures | 5.7 ± 1.8 | 6.1 ± 1.0 | **2.064 (0.04)\*** | 5.7 ±1.8 | 6.0 ± 1.1 | 1.612 (0.108) | 5.7 ± 1.8 | 5.8 ± 1.3 | 0.265 (0.792) |
| Personal protective equipment | 24.1 ± 4.0 | 23.8 ± 2.6 | 0.742 (0.459) | 23.8 ± 4.4 | 23.0 ± 3.7 | 1.471 (0.143) | **23.7 ± 4.5** | 21.5 ± 4.4 | **3.876 (0.001)\*\*** |
| Decontamination of patient care equipment | 2.9 ± 0.4 | 2.7 ± 0.6 | **2.157 (0.032)\*** | 2.8 ± 0.6 | 2.7 ± 0.7 | 1.363 (0.174) | **2.8 ± 0.6** | 2.6 ± 0.7 | **2.015 (0.045)\*** |
| Safe injection practices | 4.8 ± 0.4 | 4.7 ± 0.7 | 0.088 (0.930) | 4.6 ± 0.8 | 4.6 ± 0.8 | 0.733 (0.464) | 4.6 ± 0.8 | 4.6 ± 0.8 | 0.733 (0.464) |
| Linen management | 1.9 ± 0.4 | 1.9 ± 0.3 | 1.175 (0.241) | 1.8 ± 0.1 | 1.9 ± 0.1 | 2.480 (0.141) | 1.8 ± 0.5 | 1.9 ± 0.4 | 1.315 (0.190) |
| Specimen handling | 3.8 ± 0.5 | 2.7 ± 0.9 | **11.202 (0.001)\*\*** | 3.7 ± 0.7 | 2.7 ± 0.9 | **8.996 (0.001)\*\*** | **3.7 ± 0.7** | 2.6 ± 0.9 | **9.601 (0.001)\*\*** |
| Employee health | 1.0 ± 0.0 | 0.9 ± 0.3 | 2.854 (0.052) | 0.9 ± 0.1 | 0.9 ± 0.3 | 1.877 (0.062) | 1.0 ± 0.0 | 0.9 ± 0.3 | 2.854 (0.052) |
| **Total Compliance** | 44.1 ± 6.0 | 43.0 ± 4.3 | 1.737 (0.084) | 43.5 ± 6.9 | 41.9 ± 5.7 | 1.888 (0.061) | **43.4 ± 6.9** | 39.7 ± 7.2 | **4.073 (0.001)\*\*** |

\* = statistically significance differences at < 0.05   \*\* = statistically significance differences at < 0.01.

**Table (3):** illustrates that the total mean scores of nurses' level of compliance with infection control measures in morning, evening, and night shifts in Minia chest hospital (44.1 ± 6.0, 43.5 ± 6.9 &43.4 ± 6.9, respectively) were higher than the total mean scores of the compliance level in Minia fever hospital (43.0 ± 4.3, 41.9 ± 5.7&39.7 ± 7.2, respectively). Also, mean scores of nurses' level of compliance with infection control measures during decontaminations of patient care equipment, and specimen handling at Minia chest hospital in the morning shift (1st observation) higher than nurses mean scores at Minia fever hospital with statistically significant difference (P – value < 0.032 & 0.001 respectively). In addition, mean scores of personal protective equipment, decontamination of patient care equipment, specimen handling, and total compliance levels among nurses at Minia chest hospital higher than nurses mean scores at Minia fever hospital with statistically significant difference (P – value < 0.001, 0.45, 0.001 & 0.001 respectively) in the night shift (3rd observation). Whereas the mean scores of nurses' level of compliance with protective measures at Minia fever hospital in the morning shift only (1st observation) higher than nurses mean scores at Minia chest hospital with statistically significant difference (P – value < 0.04)

## Discussion

COVID-19 infection among HCWs is attributed to delay in the implementation of safety measures, shortage of personal protective equipment (PPE), lack of training on how to use PPE, and exposure to infected COVID-19 patients. Thus, the World Health Organization (WHO) recommends the implementation of safety precautions including the use of PPE, hand hygiene, and social distancing among HCWs to reduce the risk of nosocomial COVID-19 transmission (Abubakar et al., 2022).

Regarding the personal data of the studied nursing staff, the present study showed that, more than half of the studied nursing staff 'age is ranging from twenty to less than thirty years and nearly half of the studied nursing staff had institute of nursing. As regarding years of experience, the current study showed that more than half of the studied nursing staff have years of experience ranging between one to five years in the nursing field.

Also, the present study illustrates that more than three-quarters of the nursing staff were female, and near to a quarter of them were male. This result may be due to traditionally nursing has been a career only for women, as care and comfort of sick family members were relegated to women. Regarding the distribution of the nursing staff according to their departments, the current study illustrates that nearly half of the nursing staff work in the ICUs, more than one-third and less than fifth of them work in the isolation and emergency department.

Concerning the distribution of the nursing staff according to the previous infected with COVID-19, the current study illustrates that more than half of the nursing staff

exposes to infection with COVID-19 disease, and nearly half of them not exposes to infection. This result may be related that the nursing services required the nurse to be face to face with the infected patients who increase the chance of infection among nurses. Also, this may be due to the nursing work load that may affect the nurses' compliance to the standard precautions

This result supported by **El Sharif et al., (2022)** who studied "COVID-19 infection prevention and control procedures and institutional trust: Perceptions of Palestinian healthcare workers" and reported that slightly less than one quarter of the studied nurses reported being diagnosed with COVID-19 and more than half of them reported COVID-like symptoms.

Also this result confirmed by **Dharra and Kumar, (2021)** who studied "Promoting Mental Health of Nurses During the Coronavirus Pandemic: Will the Rapid Deployment of Nurses' Training Programs During COVID-19 Improve Self-Efficacy and Reduce Anxiety? In India" and stated that more than one third of the participants had tested positive for COVID-19 themselves and had quarantined with a mean duration of (13.81±6.14) day. In addition this result come in accordance with **El Shahat et al., (2021)** who reported that less than half had previous Covid-19 infection.

Regarding nursing staff immunization against COVID-19, the present study demonstrates that the majority of the nursing staff immunized with COVID-19 vaccine, and minority of them not immunized. This result may relate to the studied nurses had good knowledge regarding the importance of the vaccine in preventing infection. The current study result in this regard come in the line with **Khubchandani et al., (2022)**

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who studied "COVID-19 Vaccine Refusal among Nurses Worldwide: Review of Trends and Predictors" and reported that only less than on quarter of the nurses refuse the COVID 19 vaccine and more than three quarter of them take it.

Otherwise, this result differ with **Kregar Velikonja et al., (2021)** who studied "attitudes of nursing students towards vaccination and found that only less than one quarter of the studied nurses were vaccinated against COVID 19. Also, this result contraindicated with **Elmetwaly and Fahmy, (2022)** who studied "acceptance of covid-19 vaccines among nurses" and reported that only more than one fifth of study participants accepted vaccines.

Concerning the nursing staff training courses about COVID-19, the current study illustrates that nearly three-quarters of the nursing staff attends training courses about COVID-19, and more than one-quarter of them not attending. This result come in accordance with **Elshaer and Agage, (2022)** who reported that the most of the studied nurses receive previous training on PPE usage and hand hygiene. In addition this result come in the line with **Dharra and Kumar, (2021)** who stated that less than two third of the participants had attended training programs on COVID-19 (virtual or in-person training on critical issues, i.e., airway, ventilation, ventilator, use of personal protective equipment, social-distancing norms).

Considering the nursing staff compliance with infection control and preventive measures, the current study showed that most of the studied nursing staff at Minia chest hospital and Minia fever hospital had high total compliance level. This result may be attributable to that the hospital administrators were obliged to provide training programs, adequate nurse to patient ratio, infection control facilities, as well as high motivation levels and proper administrative support from policymakers, in addition to the fear of nurses themselves from infection and infecting their families and their young age, which facilitates the implementation of these procedures.

This result supported by **Hussien et al., (2021)** who studied "Effective of Educational Instruction of Nurses Knowledge Regarding Meningitis and Universal Precaution Measures at Selected Department at Minia Fever Hospital" and stated that, the most of study subjects have good knowledge about universal precautions that may had major impact in their compliance to universal precautions.

In the same line, this result confirmed with **Mohamad et al., (2022)** who stated that less than two third of the respondents were compliant and adhered fully to all PPE and hand hygiene and more than one third of the respondents non-compliant. Also this results supported by **Almohammed et al., (2021)** who studied "Knowledge, Attitude, and Practices Associated With COVID-19 Among Healthcare Workers in Hospitals: A Cross-Sectional Study in Saudi Arabia" and reported that the most of the studied nurses were compliant to the protective measures, and linen management

While this result comes inconsistent with **El-Sokkary et al., (2021)** who studied "Compliance of healthcare workers to the proper use of personal protective equipment during the first wave of COVID-19 pandemic in in Egypt" and reported that less than half of participants had noncompliance to protective measures.

Considering the sub-domains for the level of compliance with infection control measures among nursing staff, the current study proves that most of the studied nursing staff had high compliance with personal protective equipment, decontamination of patient care equipment, safe injection practices, linen management, and nurse's health sub-domain. This result may be attributed to the fear of nurses from infection with COVID-19 and most of nurses try to protect their health from the infection with COVID-19.

This results align with **El Gammal et al., (2021)** who reported that the majority of the studied nurses wearing PPE when indicated (PPE includes: medical mask, face shield, gloves, goggles/glasses, gown, coverall, head cover, respirator (for example, N95 or equivalent) and shoe covers). Similarly, this result in agreement with **El-Sokkary et al., (2021)** who reported that two third and more than half of the study participants complied to the proper use of medical/surgical masks and disposable gloves respectively.

As regarding the differences in compliance scores among nursing staff at Minia chest and fever hospitals during the three observations, the current study illustrates that the total mean scores of nurses' level of compliance with infection control measures in morning, evening, and night shifts in Minia chest hospital were higher than the total mean scores of nurses' compliance level in Minia fever hospital. This result may be related to nursing staff in Chest hospital have more experience about isolation measures and how to deal with infectious respiratory diseases such as tuberculosis (TB), understand the impact of Infection prevention and control (IPC) practice, aware of policies and procedures and attend mandatory training sessions about infection control measures

This result proven by **Fahmy et al,. (2022)** who studied "Relation between Compassion Fatigue, Pandemic Emotional Impact, and Time Management among Nurses at Isolation Hospitals during COVID- 19 in Minia fever hospital" and reported that two-thirds of the studied sample had a high level of total compassion fatigue that may have major negative impact in the nursing staff performance regarding compliance to standard precaution in Minia fever hospital.

In addition the present study showed that, in the night shift (3$^{rd}$ observation), the mean scores of personal protective equipment, decontamination of patient care equipment, specimen handling, and total compliance among nurses at Minia chest hospital higher than nurses mean scores at Minia fever hospital with statistically significant difference This result may be related to the shortage of nursing staff in the Minia fever hospital at night shift that make nurses come across many responsibilities to be fulfilled, that leads nurses to avoid the use of infection control measures. Also, this result may be due to the Minia chest hospital had clear processes and policies to manage and monitor infection control and to provide secure isolation facilities.

**Conclusion:**

Most of the studied nursing staff at the two hospitals had high level of compliance with infection control measures while a small portion of them had low compliance level. There have no statistically significant difference in the total level of compliance with infection control measures among the studied nursing staff at the two hospitals while statistically significant difference in two sub-domains "linen management" and "specimen handling has been observed. The mean scores of total compliance level as well as the mean scores of personal protective equipment and safe injection practices sub-domain were observed higher in the morning shift than in the other work shifts with high statistically significant differences

**Recommendations:**

- Continuous education and training for all health sectors for increasing nurses' awareness about all waves of the COVID -19, methods of its transmission and ways of protection against infection.
- Conducting frequent workshops for nursing staff about policies and procedures regarding proper adherence to and hazards of non-compliance with Standard Precautions for Infection Control and Prevention.
- Hospitals Administration should provide periodic vaccination of all Health Care Workers against COVID -19 and other infectious diseases.
- Nursing Management should ensure availability of adequate resources and Personal Protective Equipment for nursing staff at all work departments during all work shifts.
- Frequent supervision and performance appraisal by all management levels to monitor and ensure nursing staff compliance with infection control measures during all work shifts

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