Assessment of knowledge and practices of Healthcare Workers in the field of IPC and Control in healthcare in Egypt

Ali Ahmed Mohamed Ibrahim[a*], Rasha Saad Hussein[b], Eman Hany Elsebaie[c]

[a]Medical Services Department, Egyptian Ministry of Defense, Cairo, Egypt.

[b]Public Health and Community Medicine Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt.

[c]Public Health and Community Medicine Department, Faculty of Medicine, Cairo University, Cairo, Egypt

Abstract

Background: IPC and Control (IPC) is essential for delivering safe and effective healthcare and poses a major public health challenge, particularly in low- and middle-income countries like Egypt, where resources may be limited and healthcare infrastructure varies greatly across regions. In such contexts, the role of Healthcare Workers (HCWs) becomes critical. Their knowledge, attitudes, and practices related to IPC directly impact the safety of both patients and healthcare providers.

Objectives: To assess the level of awareness and understanding of standard IPC guidelines among HCWs of various specialties and work experience and evaluate the extent to which they apply IPC practices in their daily clinical routine.

Materials and methods: A cross-sectional study design to assess hospital staff's knowledge of infection control. The study was conducted in four hospitals in different governorates, taking into account geographic and demographic diversity during the study period from October 1, 2024, to December 25, 2024. This study included 190 HCWs from various sectors (40 doctors, 80 nurses, 21 pharmacists, 8 medical equipment engineers, 24 technical staff, and 17 administrators).

Results: Knowledge about IPC for the 190 HCWs participating in this study: 85 (44.63%) were found to have knowledge about IPC, 57 (30%) were found to have moderate knowledge about IPC and 48 (25.37%) were found to have no knowledge about IPC.

Conclusion: This study highlights the critical importance of IPC knowledge and practices among HCWs in Egypt. While many HCWs demonstrated a basic understanding of IPC principles, notable gaps remain between knowledge and its practical application. The findings suggest that factors such as inadequate training, limited access to IPC resources, and workplace constraints contribute to suboptimal adherence to standard precautions.

Keywords: IPC and Control (IPC); Healthcare Workers (HCWs); Healthcare-associated infections (HAIs); Personal protective equipment (PPE).

DOI: 10.21608/SVUIJM.2025.378652.2171

***Correspondence**: aliapache73@gmail.com

Received: 16 April,2025.

Revised: 1 May, 2025.

Accepted: 2 May, 2025.

Published: 3 May, 2025

Cite this article as Ali Ahmed Mohamed Ibrahim, Rasha Saad Hussein, Eman Hany Elsebaie. (2025). Assessment of knowledge and practices of Healthcare Workers in the field of IPC and Control in healthcare in Egypt. *SVU-International Journal of Medical Sciences*. Vol.8, Issue 1, pp: 1064-1074.

Copyright: © Ahmed et al (2025) Immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge. Users have the right to Read, download, copy, distribute, print or share link to the full texts under a Creative Commons BY-NC-SA 4.0 International License

Introduction

IPC measures are essential components of delivering safe, high-quality healthcare, preventing healthcare-associated infections (HAIs) and protecting both patients and HCWs **(Alhumaid et al., 2021)**. Good knowledge of IPC among HCWs is essential for effective IPC **(Magill et al., 2014)**. Lack of knowledge and ignorance of IPC principles and guidelines and negligence or laziness in using necessary preventive measures are among the most significant challenges to implementing IPC **(Albano et al., 2014)**.

To overcome these challenges education and training must begin with the existing IPC practices **(Safdar a**

HCWs awareness should include all elements related to IPC such as hand hygiene, wearing personal pro

must adhere to IPC precautions and the methods and strategies necessary to ensure the reduction of HAIs in healthcare facilities. Adherence to IPC practices including hand hygiene and the use of PPE has been found to vary significantly among HCWs depending on their level of education and experience **(Whitby et al., 2007)**. However, good knowledge does not necessarily translate into good IPC practices. HCWs have been found to be unable to adhere to hand hygiene practices despite established guidelines for the prevention of HAIs. HCWs play a pivotal role in implementing IPC practices by making their knowledge, attitudes and behaviors critical to the success of any IPC strategy **(Shah et al., 2015)**. Discrepancies between knowledge and actual practice can undermine infection control efforts **(Lam et al., 2016)**. In Egypt, despite national and international efforts to strengthen IPC programs, studies assessing HCWs competency and compliance with IPC guidelines remain limited and fragmented. This study aims to assess the current level of knowledge and practical adherence to IPC protocols among healthcare workers in Egypt.

Materials and methods

This study relied on a questionnaire assess HCW knowledge of IPC principles which is inspired by the study that took place used to at the University Hospital in Krakow (UHK), the largest educational hospital in Southern Poland **(Żółtowska et al., 2021)**.

The questionnaire consisted of two parts: the first part collected participant information (specialty, age, years of experience, age, gender), and the second part included questions that reflected the participant's knowledge of infection control principles, such as (Do you wear any PPE while working? / Have you participated in general IPC training? / Etc.). The questionnaire was dated to IPC such as hand hygiene practices during their working hours. The questionnaire was administered anonymously, and participants were assured that their responses would be used only for research and scientific purposes, while ensuring the confidentiality of their data. Prior to the main study, a pilot test was conducted with a small group of hospital staff to assess the clarity and relevance of the questions. Minor modifications were made based on the feedback received.

The study period from October 1, 2024, to December 25, 2024**.** The study design emphasized anonymity, voluntary participation, and the inclusion of diverse professional categories to ensure a comprehensive analysis. The study was conducted in four Small Military hospitals in different governorates of Egypt (Cairo / Port Said / Zagazig / Suez) with the aim of covering a larger area that reflects whether increased awareness, training and capabilities are linked to the presence of a health facility in the capital and Port Said Governorate, which has received significant medical attention in the past 10 years, while it is less in other governorates.

This study targeted HCWs across multiple professional categories (**Ang et al., 2013)**. Cairo Governorate: A 120-bed military hospital located in the

capital serving a large population and providing a secondary level of healthcare. Port Said Governorate: A 100-bed military hospital in a province with a comprehensive health insurance system and extensive medical care it provides secondary level healthcare. Suez Governorate: A 60-bed military hospital in a coastal city it provides primary healthcare level. Zagazig Governorate: An 80 bed military hospital situated near rural areas with a high population density it provides primary care level of healthcare. The study was conducted within the hospital premises during working hours to facilitate participation and capture the working environment's influence on staff perceptions. A total of 300 HCWs across these hospitals were invited to participate, of whom 190 agreed to enroll in the study yielding a participation rate of (63.3%) The study focused on small military hospitals to determine whether there is interest in raising awareness among healthcare workers of infection control principles in these small hospitals, or whether interest is limited to large hospitals. Participation was voluntary and anonymous, and the study adhered to ethical research standards. Participants were selected from six professional categories to provide a comprehensive understanding of perspectives on infection control: [Doctors /Nurses /Pharmacists /Medical equipment engineers /Technicians (including medical equipment, radiology, and laboratory technicians) /Administrative staff (including patient affairs, accounting staff, janitors, and kitchen managers)] **(Ider et al., 2012)**.

Inclusion criteria: Full-time hospital employees (not on contract or working fixed hours) and Voluntary consent to participate in the study. Exclusion criterion: Refusal to participate in the study.

Reasons for non-participation: Absence from the hospital during the survey period (e.g., due to vacation), Unavailability (e.g., working in operating rooms, intensive care units, or outpatient clinics), Lack of interest or skepticism about the study's value, Initial willingness to participate followed by withdrawal, Perceived lack of personal benefit from participation, Belief that the research findings would not lead to meaningful change and Administrative staff expressing limited interest in the study topics**.**

Ethical considerations: The approval of the hospital administration was obtained to conduct this study in each hospital. All participants in the study provided written approvals before registering to participate in study and publishing data. Explicit, apply the approval form to agree to registration in the study and publish data and a full pledge to maintain the confidentiality and privacy of all participants in this study and not to disclose their identity or any personal information about them and not share this data with any third party or use it for any purposes other than scientific research, while taking all necessary measures to ensure safety and protection of information.

Statistical analysis

Data were tabulated and statistically analyzed using SPSS, version 20 (SPSS Inc., Chicago, IL) Quantitative data were described as mean and standard deviation, Qualitative data were expressed as frequencies (n) and percentage (%), Total knowledge scores were calculated through summation of the questionnaire statements. Independent t-test and ANOVA test were used to compare quantitative data between independent groups and P-value ≤ 0.05 was considered statistically significant.

Results

Distribution of specialization percentages

72 doctors were offered to participate, 40 of them agreed and 32 of them refused,

and the percentage of doctors' participation was 55.6%, 134 nursing staff were offered to participate, 80 nurses agreed to participate and 54 nurses refused to participate, and the participation rate of nursing staff was (59.7%), 34 pharmacists as they provide treatment and medications to treat patients through nursing staff so they deal directly with the nursing staff who are the most vulnerable to infection. were offered to participate, 21 pharmacists agreed to participate and 13 pharmacists refused to participate, and the participation rate of pharmacists was (61.8%), 8 medical equipment engineers were offered to participate, 8 doctors agreed to participate and none of the medical equipment engineers refused to participate, and the participation rate of medical equipment engineers was (100%), 24 technical staff were offered to participate, 24 technicians agreed to participate and none refused, and the participation rate of technical staff was (100%) and 28 administrators (including Quality inspectors, cleaners, kitchen workers and food servers) who by the nature of their work come into direct contact with patients. were offered to participate, 17 administrators agreed to participate and 11 administrators refused to participate and the participation rate of administrators was (60.7%).

Distribution statement to hospitals

For Cairo Governorate Hospital: The total number of those who were offered to participate in the survey was 94 (55 participated, and 39 refused to participate). The participation rate was (59%) as showed in **(Table .1)**.

Table 1. Distribution statement for Cairo Governorate Hospital

Specialization	Specializations that the participation was offered	Participate	Refuse to participate
Doctor	24	10	14
Clinical engineer	2	2	0
Pharmaceutical	12	8	4
Nurse	42	24	18
Technicians	6	6	0
Administrative Staff	8	5	3
Total	94	55	39

For Port Said Governorate Hospital: The total number of those who were offered to participate in the survey was 68 (39 participated and 29 refused to participate), the participation rate was (57.4%) as showed in **(Table .2)**.

Table 2. Distribution statement for Port Said Governorate Hospital

Specialization	Specializations that the participation was offered	Participate	Refuse to participate
Doctor	16	7	9
Clinical engineer	2	2	0
Pharmaceutical	8	5	3
Nurse	30	16	14
Technicians	6	6	0
Administrative Staff	6	3	3
Total	68	39	29

For Zigzag Governorate Hospital: The total number of those who were offered to participate in the survey was 76 (53 participated, and 23 refused to participate) the participation rate was (69.7%) as showed in **(Table .3)**.

Table 3. Distribution statement for Zigzag Governorate Hospital

Specialization	Specializations that the participation was offered	Participate	Refuse to participate
Doctor	18	11	7
Clinical engineer	2	2	0
Pharmaceutical	8	5	3
Nurse	34	24	10
Technicians	6	6	0
Administrative Staff	8	5	3
Total	94	55	39

For Suez Governorate Hospital: The total number of those who were offered to participate in the survey was 62 (36 participated, and 26 refused to participate) the participation rate was (58%) as showed in as showed in **(Table .4)**.

Table 4. Distribution statement for Zigzag Governorate Hospital

Specialization	Specializations that the participation was offered	Participate	Refuse to participate
Doctor	14	6	8
Clinical engineer	2	2	0
Pharmaceutical	6	3	3
Nurse	28	15	13
Technicians	6	6	0
Administrative Staff	6	4	2
Total	62	36	26

Demographic characteristics of HCWs including the number of participants, their percentages, specializations, ages, gender and experience in their field of work as showed in **(Table .5).**

Table 5. Socio-demographic characteristics of the studied HCWs

Variables		N=190	%
Specialization	**Doctor**	40	21.1%
	Nurse	80	42.1%
	Pharmaceutical	21	11.1%
	Technicians	24	12.6%
	Administrative Staff	17	8.9%
	Clinical engineer	8	4.2%
Gender	**Male**	94	49.5%
	Female	96	50.5%

Age	**From 25 to 35**	117	61.6%
	From 36 to 50	68	35.8%
	More than 50	5	2.6%
Work experience	**Less than year**	21	11.1%
	From 1 to 5 years	96	50.5%
	More than 5	73	38.4%

Knowledge about IPC in this study: Of the respondents, 85 (44.63%) were found to be knowledgeable about IPC, 57 (30%) were found to be moderately knowledgeable about IPC and 48 (25.37%) were found to have no knowledge about IPC as showed in **(Table .6).**

Table 6. Description of HCWs' knowledge about IPC

Variables		**N=190**	**%**
Are you aware of the "5 Moments for Hand Hygiene" as recommended by the World Health Organization?	**No**	91	47.9%
	To some extent	66	34.7%
	Yes	33	17.4%
Do you know the appropriate personal protective equipment (PPE) for your work?	**No**	0	0.0%
	To some extent	54	28.4%
	Yes	136	71.6%
Do you wear any PPE while working?	**No**	0	0.0%
	To some extent	56	29.5%
	Yes	134	70.5%
Have you received training on the use of PPE?	**No**	99	52.1%
	To some extent	0	0.0%
	Yes	91	47.9%
Do you follow standard IPC precautions when coming into contact with any patient?	**No**	41	21.6%
	To some extent	126	66.3%
	Yes	23	12.1%
Have you participated in general IPC training?	**No**	100	52.6%
	To some extent	0	0.0%
	Yes	90	47.4%
Have you participated in COVID-19 specific training?	**No**	0	0.0%
	To some extent	0	0.0%
	Yes	190	100.0%
Do you know the procedures for responding to an infectious disease outbreak?	**No**	91	47.9%
	To some extent	66	34.7%
	Yes	33	17.4%
Do you understand the hospital's epidemic/pandemic preparedness plan?	**No**	91	47.9%
	To some extent	66	34.7%
	Yes	33	17.4%

IPC Knowledge Total Score: This score reflects HCWs understanding of IPC measures, including hand hygiene, use of PPE, sterilization procedures and protocols for preventing HAIs. Higher scores indicate a more comprehensive and accurate knowledge of IPC guidelines and practices as showed in **(Table .7).**

Table 7. Description of HCWs ' knowledge about IPC total score.

Variables	Mean ± Standard deviation	Minimum – Maximum
knowledge about IPC total score	10 ± 4.98	4 – 18

Knowledge about IPC total score in relation to socio-demographic characteristics of the HCWs participated in the study as showed in **(Table .8).**

Table 8. Relation between Knowledge about IPC and demographic characteristics

Variables		Knowledge about IPC total score
		Mean ± Standard deviation
Specialization	**Doctor**	12 ± 4.47
	Nurse	12 ± 4.26
	Pharmaceutical	11 ± 3.48
	Technicians	4 ± 0
	Administrative Staff	4 ± 0
	Clinical engineer	11 ± 3.74
Gender	**Male**	9 ± 5.08
	Female	11 ± 4.6
Age	**From 25 to 35**	11 ± 4.95
	From 36 to 50	10 ± 4.78
	More than 50	12 ± 7.67
Work experience	**Less than year**	12 ± 4.97
	From 1 to 5 years	11 ± 4.86
	More than 5	9 ± 4.96

Discussion

IPC is a critical aspect of healthcare delivery, essential for safeguarding both patients and HCWs from HAIs. The effectiveness of IPC practices depends heavily on the knowledge, attitudes, and behaviors of HCWs across all levels of the healthcare system. Numerous studies have shown that HCWs generally possess a basic understanding of IPC principles, such as hand hygiene, use of PPE, and safe injection practices. However, knowledge levels can vary significantly based on factors such as professional role, years of experience, education, and access to training. For instance, nurses and physicians often demonstrate higher IPC knowledge compared to auxiliary staff, primarily due to differences in formal education and training exposure. HCWs knowledge and application of IPC principles are among the most important factors in reducing the risk of infection transmission, especially during epidemics and pandemics. Therefore, HCWs must receive appropriate training, accurate, up-to-date, and relevant scientific information, and follow sound practices. Without adequate IPC and patient safety practices, both HCWs and patients are at risk of serious infection, as has occurred in the COVID-19 pandemic. Recent studies indicate that proper and consistent application of current IPC practices can reduce the incidence of some HAIs by up to 70% **(Hosseinialhashemi et al., 2015)**.

IPC practice is fundamental to quality of care and essential to protect HCWs, patients and communities from tremendous risks. (**Lai et al., 2020)**. In this study, (44.63%) of the respondents were found to be knowledgeable about IPC and (55.37%) were found to have poor knowledge about IPC. The specialties with the highest awareness of infection control were doctors and pharmacists, nursing and medical

equipment engineers had average knowledge and the least aware specialties were technical and administrative staff. The study results indicated that HCWs in the public healthcare facilities studied lack evidence-based knowledge and appropriate scientific information about IPC. Our Study was in line with similar studies, A Study in Southeast Ethiopia **(Geberemariyam et al., 2018)**, a facility-based cross-sectional study, the proportion of HCWs who were knowledgeable about IPC to be 53.7%. This finding indicated that a percentage of respondents 46.3% in the healthcare facilities studied demonstrated inadequate knowledge about IPC. Study in South India **(Thazha et al., 2022)** IPC awareness, attitudes, and practices among healthcare professionals in South India A lower percentage of respondents who received IPC training and knew it well (46.2%), compared to those who did not receive such training (53.8%), had poor knowledge of infection control and prevention. A study in sub-Saharan Africa **(Rothe et al., 2013)** the proportion of HCWs who were knowledgeable about IPC (54.2%), this finding indicated that a percentage of respondents 45.8% of HCWs had inadequate knowledge about IPC.

A Study in-Nigeria **(Tobin et al., 2013)**: Knowledge and practice of infection control among health workers in a tertiary hospital in Edo State, Nigeria. (50.3%) of the respondents had good knowledge, and (49.7%) had inadequate knowledge. Our results were different from similar studies. A Study in Addis Ababa city **(Sahiledengle et al., 2018)** this study attempted to assess IPC practice of HCWs, (66.1%) of HCWs had good IPC practices, and (33.9%) of HCWs had poor knowledge about IPC practices. This result is higher than the results of our study and other previous studies. A Study in Uyo, Southern Nigeria **(Johnson et al., 2012)**: Knowledge and practice of universal precautions among professionals in public and private health facilities in Uyo, Southern Nigeria-a comparative study. A total of 360 respondents participated in the study, 240 (66.7%) from the public and 120 (33.3%) from the private facilities. Overall, (64.2%) of the health workers in the public facilities had good knowledge.

The possible reasons for the low results in the current studies may be: lack of training in IPC. HCWs' knowledge of IPC was positively correlated with training. The vast majority of HCWs in the study areas had not received IPC training and had insufficient knowledge of IPC, Lack of updating of HCWs' knowledge of IPC principles and the change of old understandings could have led to poor scores on the knowledge questions. A significant proportion of workers had little work experience; the low scores could be explained by HCWs' lack of adherence to IPC principles (the principles suggested by the questions directed to workers) in the studies. HCWs in capital cities gained better work experience and were given opportunities to receive various trainings in IPC, the likelihood of having better prevention practice will be higher than HCWs residing in the country-side, Weak basic knowledge of IPC principles and finally. Lack of supportive oversight from the IPC committee and other forms of organizational support.

Factors that may lead to inconsistencies or differences with the results of other studies: Differences in the study environment (country location, available medical facilities, etc.), Differences in study variables, as some previous studies focused only on one or two components of IPC, not all of them, such as hand hygiene, infection control of specific diseases, disinfection of medical instruments, use of personal protective equipment, and handling of healthcare waste, Difference in practice could be attributable to the difference in study

settings, composite scoring and sampling technique, Differences in the nature of healthcare facilities where the study was conducted (university hospital, government hospital, private hospital), Differences in the years of experience of study participants, Differences in the definition of satisfactory practice, and other methodological considerations, Differences in the academic qualifications of HCWs participating in the studies, Differences in the level of knowledge of HCWs about IPC, Differences in training and awareness of IPC, Another factor significantly associated with safe IPC practices is occupation, Some studies have found differences in reported IPC practices among different healthcare professionals. This may be due to differences in training and the practical definition of practice from one study to another,

The variation in job descriptions of different healthcare professionals may be another factor in this discrepancy, There is a relationship between hand hygiene practice and work experience, Significant differences in IPC practice were found between HCWs who received IPC training and had IPC guidelines in their work department and those who did not receive training and Finally, HCWs with IPC guidelines available and trained in IPC were three times more likely to practice safely compared to HCWs who were untrained and did not have IPC guidelines.

Conclusion

Effective implementation of IPC is critical to ensuring the safety of patients and HCWs. This assessment highlights the critical role of HCWs' knowledge and practices in achieving IPC goals. While many HCWs in Egypt are well versed in the basic principles of IPC, a significant number remain insufficiently informed. Consequently, significant gaps exist between knowledge and consistent evidence-based practice. These gaps are often attributed to factors such as lack of training, limited resources and weak institutional enforcement of IPC protocols. Addressing these challenges requires a multifaceted approach that includes regular and structured training programs, improved access to IPC supplies, and enhanced institutional support and oversight.

References

- **Albano L, Matuozzo A, Marinelli P, DiGiuseppe G. (2014).** Knowledge, attitudes and behaviour of hospital health care workers regarding influenza A /H1N1 a cross-sectional survey. BMC Infect Dis, 14(1):1–7.
- **Alhumaid S, AlMutair A, AlAlawi Z, Alsuliman, Ahmed GY, Rabaan AA, et al. (2021)**. Knowledge of IPC among HCWs and factors influencing compliance a systematic review. Antimicrobial resistance and infection control, 10 (1): 86-118.
- **Ang SH, Bartram T, McNeil N, Leggat SG, Stanton P. (2013)**. The effects of high-performance work systems on hospital employees' work attitudes and intention to leave a multilevel and occupational group analysis. The International Journal of Human Resource Management, 24 (16): 3086-3114.
- **Geberemariyam BS, Donka GM, Wordofa B. (2018)**. Assessment of knowledge and practices of HCWs towards IPC and associated factors in healthcare facilities of West Arsi District Southeast Ethiopia a facility based cross sectional study. Archives of Public Health, 76: 1-11
- **Haines A, Kuruvilla S, Borchert M. (2004)**. Bridging the implementation gap between knowledge and action for health. Bulletin of the World Health Organization, 82 (10): 724-731.
- **Hosseinialhashemi M, Kermani FS, Palenik CJ, Pourasghari H, Askarian M. (2015)**. Knowledge

attitudes and practices of health care personnel concerning hand hygiene in Shiraz University of Medical Sciences hospitals. American journal of infection control, 43 (9): 1009-1011.

- **Ider BE, Adams J, Morton A, Whitby M, Clements A. (2012)**. Perceptions of healthcare professionals regarding the main challenges and barriers to effective hospital infection control in Mongolia a qualitative study. BMC infectious diseases, 12: 1-10.
- **Johnson OE, Asuzu MC, Adebiyi AO. (2012)**. Knowledge and practice of universal precautions among professionals in public and private health facilities in Uyo Southern Nigeria a comparative study. Ibom Medical Journal, 5 (1): 9-19.
- **Lai X, Wang X, Yang Q, Xu X, Tang Y, Liu C, et al. (2020).** Will HCWs improve IPC behaviors as COVID 19 risk emerges and increases in China. Antimicrobial Resistance and Infection Control, 9: 1-9 .
- **Lam SK, Kwong EW, Hung MS, Pang SM. (2016)**. Bridging the gap between guidelines and practice in the management of emerging infectious diseases a qualitative study of emergency nurses. Journal of clinical nursing, 25 (20): 2895-2905.
- **Magill SS, Edwards JR, Bamberg W, Beldavs ZG, Dumyati G, Kainer MA, et al. (2014).** Multistate point-prevalence survey of health care–associated infections. New England Journal of Medicine, 370(13): 1198-1208.
- **Manchanda V, Suman U, Singh N. (2018)**. Implementing IPC programs when resources are limited. Current Treatment Options in Infectious Diseases, 10: 28-39
- **Murthy S, Adhikari NK. (2013)**. Global health care of the critically ill in low resource settings. Annals of the American Thoracic Society, 10(5): 509-513.
- **Rothe C, Schlaich C, Thompson S. (2013)**. Healthcare associated infections in sub–Saharan Africa. Journal of Hospital Infection, 85(4): 257-267.
- **Sahiledengle B, Gebresilassie A, Getahun T, Hiko D. (2018)**. IPC practices and associated factors among HCWs in governmental healthcare facilities in Addis Ababa. Ethiopian journal of health sciences, 28 (2): 177-186.
- **Safdar N, Abad C. (2008).** Educational interventions for prevention of healthcare associated infection a systematic review. Crit Care Med, 36(3):933-40.
- **Shah N, Castro-Sánchez E, Charani E, Drumright LN, Holmes AH. (2015)**. Towards changing HCWs' behavior a qualitative study exploring noncompliance through appraisals of IPC practices. Journal of Hospital Infection, 90 (2): 126-134.
- **Thazha SK, Cruz JP, Alquwez N, Scaria B, Rengan SS, Almazan JU. (2022)**. IPC awareness, attitudes, and practices among healthcare professionals in South India. The Journal of Infection in Developing Countries, 16 (04): 659-667.
- **Tobin EA**, **Asogun DA, Odia I, E Grace. (2013)**. Knowledge and practice of infection control among health workers in a tertiary hospital in Edo state Nigeria. Direct Res J Health Pharm, 1 (2): 20-27.
- **Ward DJ. (2011).** The role of education in the prevention and control of infection review of the literature. Nurse Educ Today, 31(1):9–174.
- **Whitby M, Pessoa-Silva C, McLaws ML, Allegranzi B, Sax H,**

Larson E, et al. (2007). Behavioural considerations for hand hygiene practices the basic building blocks. J Hosp Infect, 65(1):1–8.

- **Żółtowska B, Barańska I, Szczerbińska K, Różańska A, Mydel K, Sydor, et al. (2021)**. Preparedness of health care workers and medical students in university hospital in krakow for COVID-19 pandemic within the CRACoV project. Journal of Clinical Medicine, 10 (16): 3487-3502.