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## EDITORIAL

ETHICAL CHALLENGES AND ARTIFICIAL INTELLIGENCE IN CLINICAL PRACTICE

## RESEARCH ARTICLES

CORRELATION BETWEEN THE DURATION OF CARDIOPULMONARY BYPASS (ON PUMP), MECHANICAL SUPPORT, AND LENGTH OF STAY IN THE INTENSIVE CARE UNIT: A CROSS-SECTIONAL STUDY

ASSESSING GREEK NATIONAL EDUCATIONAL PROGRAM'S EFFECTIVENESS: "BASIC PRINCIPLES OF INFECTION PREVENTION AND CONTROL"

MULTIDRUG-RESISTANT INFECTIONS IN ICU TRAUMA PATIENTS: INCIDENCE AND PROGNOSTIC IMPLICATIONS

UPTAKE OF INFLUENZA, PERTUSSIS AND COVID-19 VACCINES DURING PREGNANCY IN THE POST PANDEMIC ERA IN WESTERN GREECE

## SYSTEMATIC REVIEWS

TELEMEDICINE IN EXTREME CONDITIONS: QUALITY ASSURANCE, CHALLENGES, AND DIRECTIONS FOR IMPROVEMENT: A SYSTEMATIC REVIEW



## Assessing Greek National Educational Program's effectiveness: "Basic principles of infection prevention and control"

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## RESEARCH ARTICLE

## ASSESSING GREEK NATIONAL EDUCATIONAL PROGRAM'S EFFECTIVENESS: "BASIC PRINCIPLES OF INFECTION PREVENTION AND CONTROL"

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**Abstract**

**Background:** It is essential to train healthcare professionals, particularly nurses, on the procedure of infection prevention and control.

**Objective:** This study aimed to evaluate the effectiveness of the educational process of the Greek national educational program titled "Basic Principles of Infection Prevention and Control".

**Method and Material:** This study utilized a one-group pre-post design to evaluate the effectiveness of an educational program conducted over five cycles (September 20, 2021–November 29, 2022). Trainees completed a pre-evaluation questionnaire, including 45 multiple-choice knowledge questions, and a final 100-question exam at the program's end. The same 45 questions were used to assess knowledge improvement. Statistical analyses, included descriptive statistics and paired samples t-tests, as score differences followed a normal distribution. A significance level of  $p \leq 0.05$  was applied to determine whether trainees' knowledge significantly improved after the educational program.

**Results:** In the first five educational cycles, a total of 442 trainees completed both the pre-evaluation questionnaire (pre-test) and the final exams (post-test). Of these, 88.5% (391) showed an improvement in their performance, while 10.6% (47) saw a decline. The performance of the remaining 0.9% (4) stayed the same.

**Conclusion:** There is a marked improvement in the overall level of nurses' knowledge regarding infection prevention and control when comparing the post-implementation phase of the educational program with the pre-implementation phase. Implementing educational programs is essential for nurses to continually enhance their knowledge of infection prevention and control, reduce the incidence of healthcare-associated infections and decrease the duration and cost of hospital stays for pediatric and adult patients.

**Keywords:** Infection prevention and control, educational program, nursing education, effectiveness evaluation, infection control nurses; asynchronous education.

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## INTRODUCTION

Infection prevention constitutes a methodical endeavor to interpose a defensive barrier between susceptible hosts and microorganisms.<sup>1</sup> It encompasses all strategies, techniques, and activities purposed to curb or diminish the potential of infectious disease transmission within a healthcare setting, protecting patients, healthcare workers as well as nursing and medical students.<sup>2,3</sup>

Healthcare-Associated Infections (HAIs) are globally recognized among the leading ten causes of in-hospital fatalities.<sup>4</sup> At any given moment, out of every hundred patients admitted to a hospital, seven in developed nations and ten in underdeveloped nations will contract a minimum of one HAI.<sup>5,6</sup> These infections significantly strain healthcare systems, impacting the quality of care and patient safety.<sup>7</sup> The repercussions include prolonged hospital stays, amplified morbidity from antibiotic-resistant pathogens, heightened mortality risks, and an escalated economic burden.<sup>6</sup> Mitigating HAIs is considered a critical priority for patient safety in acute-care hospitals globally.<sup>8,9</sup>

The World Health Organization (WHO) advocates for education and training as a fundamental constituent of efficacious infection prevention and control programs.<sup>10,11</sup> The practical implementation of simulation-based training for healthcare workers, offering a hands-on, bedside approach, has been demonstrated to bolster hand hygiene adherence and curtail infection rates.<sup>12</sup> Research suggests that incorporating suitable education and training programs during the early stages of professional training is essential for augmenting understanding and implementation of infection control measures. Such programs reinforce the tenets of standard precautions, thus promoting optimal infection control practices.<sup>13,14</sup> Hence, it is essential to train healthcare professionals, particularly nurses, on the procedure of infection prevention and control.<sup>15</sup> Consequently, a five-year educational program centered around infection prevention and control was launched in Greece in September 2021, with three sessions conducted annually.

The Greek national educational program titled "Basic Principles of Infection Prevention and Control" was developed in collaboration with the Collaborative Center for Clinical Epidemiology

and Outcomes Research (CLEO) and the National and Kapodistrian University of Athens (NKUA) and is implemented by the Department of Nursing of the NKUA. This educational program is part of the 5th axis of the initiative "National Program for the Prevention and Control of Hospital-Acquired Infections and Antimicrobial Resistance, as well as for the Implementation of an Infection Prevention and Control Improvement Program", which is generously and exclusively supported by the Stavros Niarchos Foundation as part of the "Health Initiative" (ratified by Greek Law No. 4568/2018, as subsequently amended by Greek Law No. 4655/2020).

This educational program aims to provide theoretical and practical training to nursing staff across all Greek hospitals. This training focuses on the fundamental principles and techniques of preventing, controlling, and managing infections. All training will align with the current general regulations of hospitals and guidelines set forth by the National Public Health Organization (NPHO). The overarching goal is to equip nursing staff with the necessary knowledge and skills to effectively manage and mitigate infection risks in their respective healthcare settings.

The training for nurses prioritized firstly for those in infection control, then those in emergency departments, intensive care units, and surgical wards, before being extended to nurses working in other types of wards, covers six key areas:

1. Understanding the basic principles of surveillance, and infection prevention and control practices.
2. Learning how to conduct surveillance, collect, and analyze data related to infections to consistently deliver safe and high-quality care.
3. Designing and developing interventions, drawing from the international literature on the subject.
4. Managing the COVID-19 pandemic, specifically aimed at preventing the nosocomial spread of the SARS-CoV-2 virus.
5. Implementing antimicrobial stewardship programs, crucial in the era of rising antimicrobial resistance.
6. Detecting outbreaks early and effectively managing them to mitigate the impact on the healthcare system and patient outcomes.

This comprehensive training aims to build a robust and effective framework for managing and preventing infections within

healthcare settings.

This educational program is facilitated through the use of the dedicated distance learning platform of the Center of Continuing Education and Lifelong Learning (K.E.DI.VI.M.) of NKUA. It comprises ten educational units and 42 sub-units, taught by doctors and nurses with recognized clinical, research, and academic achievements and extensive experience in hospital infection prevention and control.

Assessing the effectiveness of an educational program/course is crucial in ensuring its effectiveness and maximizing the educational outcomes for participants.<sup>16</sup> Thus, the aim of this study was to evaluate the effectiveness of the educational process of the Greek national educational program titled "Basic Principles of Infection Prevention and Control".

## METHOD AND MATERIAL

### *Evaluation process*

The first cycle of the educational program started on September 20, 2021, and the fifth was completed on November 29, 2022. As part of the entry process on each cycle, trainees were required to answer a pre-evaluation questionnaire, which included demographic data, attitudes questions about infection prevention and control, and 45 multiple-choice knowledge questions. Upon completing each educational cycle, trainees took a final exam to receive the Certificate of Specialized Training in Infection Prevention and Control. The 2-hour exam consisted of 100 multiple-choice questions.

To evaluate the effectiveness of the educational process, we compared the trainees' performance on the 45 knowledge questions in the pre-evaluation questionnaire with the same questions in the final exams. This comparison provided insights into the trainees' progress throughout the educational program.

### *Statistical analysis*

Means, standard deviations (SD), medians, and interquartile ranges (IQR; Q1-Q3) were calculated for the quantitative variables. Differences between each person's pre-evaluation (pre-test) and final exam (post-test) scores have been calculated (one-group pre-post study design). Comparisons between pre

and post-test were performed using a paired samples t-test because the differences between participants' total scores on the 45 multiple-choice questions before and after the educational program follow a normal distribution. A nominal significance level of  $p \leq 0.05$  was set for all statistical analyses. Analyses were performed using the statistical software Statistical Package for Social Science (SPSS) version 28.0 (IBM, Corp., Armonk, NY).

## RESULTS

In the first five educational cycles, a total of 442 trainees completed both the pre-evaluation questionnaire (pre-test) and the final exams (post-test). The 442 trainees were infection control nurses working in public hospitals in Greece, as well as nurses working in high-risk departments for healthcare-associated infections (HAIs), such as Intensive Care Units and Operating Rooms, regardless of age or years of experience. Of these, 88.5% (391) showed an improvement in their performance, while 10.6% (47) saw a decline. The performance of the remaining 0.9% (4) stayed the same. Out of the 391 who showed improvement in their performance, 268 (68.5%) demonstrated a performance improvement greater than 30% post-test compared to the pre-test.

**Table 1** presents the average (mean) and median total scores of trainees attending the educational program per educational cycle before (pre-test) and after (post-test). In all educational cycles, the trainees' performance statistically significantly improved ( $p < 0.001$ ). The third educational cycle noticed the most substantial improvement (20.4 versus 34; mean difference 13.1).

## DISCUSSION

The primary aim of the present study was to evaluate the effectiveness of the educational process of the Greek national educational program titled "Basic Principles of Infection Prevention and Control". This is the first educational program centered around infection prevention and control that was launched in Greece.

This study discovered a statistically significant improvement in the trainees' performance across all educational cycles. This result aligns with the findings of previous studies.<sup>10,17,18,19,20</sup> A study conducted in Egypt found a significant increase ( $p <$

0.0001) in total knowledge score ( $65.4 \pm 13.9$  versus  $80.2 \pm 13.2$ ), and total practices score ( $65 \pm 11.3$  versus  $108 \pm 7.9$ ) regarding infection control measures among the participants after the intervention compared to before.<sup>10</sup> Another study published in 2017 reported a 41.66% improvement in knowledge levels following training using WHO's hand hygiene multimodal campaign at all public hospitals and the University Clinical Center in Kosovo.<sup>17</sup> Abd-Elhamid et al. conducted a study showing an improvement in nurses' overall knowledge and practice related to infection control. There was a highly statistically significant difference in infection control measures between the pre- and post-program phases and the pre-follow-up program phase.<sup>18</sup> In Iran, another study demonstrated that the knowledge of the experimental nurses about standard precautions improved from  $15 \pm 2.47$  at pre-test to  $19 \pm 2.65$  and  $19.53 \pm 0.92$  at follow-ups.<sup>19</sup> Finally, Galal et al. found a significantly higher level of knowledge post-intervention compared to pre-intervention concerning the types of HCAs (94.4 vs. 76.8%,  $p < 0.001$ ), the groups at risk for acquiring infection (95.2 vs. 86.4%,  $p = 0.035$ ), and the measures taken to control HCAs (89.6 vs. 68%,  $p < 0.001$ ).<sup>20</sup>

This educational program has strengths and limitations. The most important strength is that it is provided to the trainees free of charge, leading to great participation that will improve the quality of patient care. Another strong point is that the educational program is carried out remotely using the method of asynchronous education, where in each educational unit a recorded presentation is provided along with the presentation file. This leads to increased participation. Another advantage of the educational program is that for trainees to earn their certification, they must correctly answer 70 out of 100 multiple-choice questions in the final exams drawn from a question bank. This approach encourages trainees to study the educational material systematically. Additionally, the question bank enhances the reliability of the exams. The question set changes with each educational cycle, beyond the 45 questions that remain consistent between the pre-assessment questionnaire and the final exams. The educational program does have a few limitations that need to be acknowledged. The primary limitation is the potential for cheating, as the certification exams are conducted online. How-

ever, to mitigate this risk, the exams are scheduled for a predetermined day and time and have a strict duration of two hours. Lastly, another limitation is the lack of direct communication between trainers and trainees due to the program's use of asynchronous learning. Any questions or issues arising during the material study can only be addressed through email. There is a potential delay as trainers might not be able to respond to trainees immediately.

## CONCLUSION

In conclusion, there is a marked improvement in the overall level of nurses' knowledge regarding infection prevention and control when comparing the post-implementation phase of the educational program "Basic Principles of Infection Prevention and Control" with the pre-implementation phase. Therefore, implementing educational programs is essential for nurses to continually enhance their knowledge of infection prevention and control, reduce the incidence of HCAs, and decrease the duration and cost of hospital stays for pediatric and adult patients.

## ETHICAL APPROVAL

The study was carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki).<sup>21</sup> The Greek National Educational Program "Basic Principles of Infection Prevention and Control" is part of the 5th axis of the initiative "National Program for the Prevention and Control of Hospital-Acquired Infections and Antimicrobial Resistance", which is generously and exclusively supported by the Stavros Niarchos Foundation as part of the "Health Initiative" (ratified by Law 4564/2018 (Government Gazette A170)). The evaluation of the effectiveness of this educational program is an agreed component of the reporting process to the Stavros Niarchos Foundation; therefore, no ethical approval was required. The participants' personal data remained anonymous at all stages of the study.

## Informed consent

Participants were informed upon enrolment in the program that they would undergo a performance evaluation both before and after completing the educational program. By enrolling, they

agreed to adhere to all procedures of the program. Study publication procedures did not require participants' approval.

### Conflicts of interest

No author has any relevant conflicts of interest to declare related to this article.

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## ANNEX

**TABLE 1.** Mean and median total score of trainees before (pre-test) and after (post-test) attending the educational program, per educational cycle.

		Pre-assessment questionnaire (pre-test)			Final exams (post-test)			Difference between the two tests	
		Mean (SD)	Median (IQR)	Range	Mean (SD)	Median (IQR)	Range	Mean Difference (95% CI)	p-value (paired t-test)
<b>First educational cycle (N=72)</b>	<b>Score at 45</b>	22.6 (5.6)	23 (19-27)	10-35	30.4 (5.8)	30.5 (27-34)	16-44	7.8 (6.4-9.2)	<0.001
	<b>Score at 100</b>	50.3 (12.5)	51.1 (42.2-60)	22.2-77.8	67.5 (12.8)	67.8 (60-75.6)	35.6-97.8	17.3 (14.1-20.4)	<0.001
<b>Second educational cycle (N=78)</b>	<b>Score at 45</b>	20.5 (6.3)	20 (16-24)	9-43	29.9 (7.5)	31 (23-37)	16-45	9.4 (7.8-11.0)	<0.001
	<b>Score at 100</b>	45.6 (14.1)	44.4 (35.6-53.3)	20-96	66.4 (16.7)	69 (52-82)	35.6-100	20.8 (17.3-24.4)	<0.001
<b>Third educational cycle (N=72)</b>	<b>Score at 45</b>	20.4 (5.8)	19 (17-23.5)	12-43	33.6 (4.9)	34 (30-36.5)	25-45	13.1 (11.8-19.9)	<0.001
	<b>Score at 100</b>	45.4 (12.9)	42.2 (37.8-52.2)	26.7-95.6	74.6 (10.9)	75.6 (66.7-81.1)	55.6-100	29.2 (26.2-32.1)	<0.001
<b>Fourth educational cycle (N=121)</b>	<b>Score at 45</b>	20.2 (5.2)	20 (17-24)	11-35	26.2 (6.1)	25 (22-31)	14-43	5.98 (4.40-7.55)	<0.001
	<b>Score at 100</b>	44.9 (11.5)	44.4 (37.8-53.3)	24.4-77.8	58.2 (13.5)	55.6 (48.9-68.9)	31.1-95.6	13.29 (9.80-16.78)	<0.001
<b>Fifth educational cycle (N=99)</b>	<b>Score at 45</b>	19.0 (5.5)	18.0 (15.0-23.0)	8.0-32.0	28.3 (7.4)	29.0 (24.0-34.0)	9.0-41.0	9.34 (8.00-10.68)	<0.001
	<b>Score at 100</b>	42.2 (12.2)	40.0 (33.3-51.1)	17.8-71.1	63.0 (16.5)	64.4 (53.3-75.6)	20.0-91.1	20.76 (17.78-23.74)	<0.001