

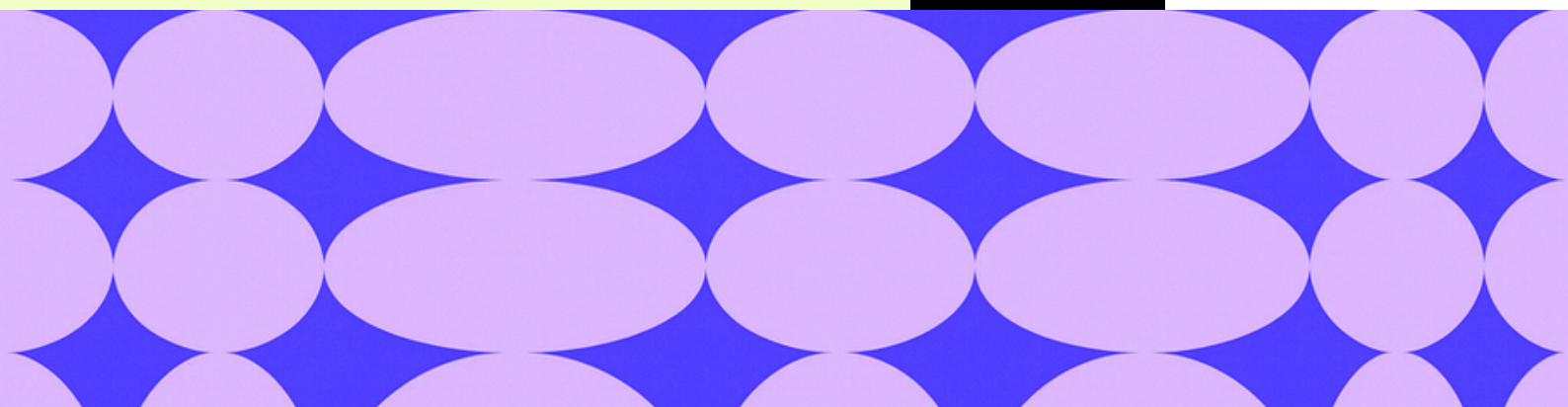
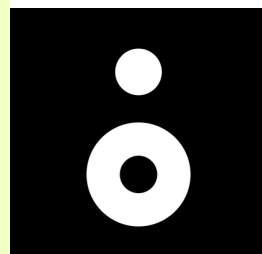
# ***CHALLENGES OF INFECTION CONTROL IN NURSING HOSPITALS DURING THE PANDEMIC: HEALTHCARE WORKERS' EXPERIENCES AND ASSESSMENTS***

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Scientific Study

Klaipėda, 2025

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**The publication was discussed at the meeting of the Academic Council of the SMK College of Applied Science and is recommended for publication (Minutes No. 3, September 26, 2025)**

Bibliographic information for the publication is available in the National Bibliographic Data Bank (NBDN) of the Martynas Mažvydas National Library of Lithuania.

ISBN 978-9955-648-88-8

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## INTRODUCTION

Infection control is one of the most important and universal principles in the functioning of the healthcare system, directly linked to patient safety, service quality, employee health, and public health protection. Although infection prevention is relevant across all levels of healthcare, it holds particular significance in long-term care facilities—nursing hospitals—where the most vulnerable members of society are treated: the elderly, individuals with chronic illnesses, cognitive or physical impairments, weakened immune systems, or those who are socially dependent. These patients often fall into high-risk groups due to limited mobility, prolonged hospitalization, frequent use of invasive procedures, and constant contact with healthcare professionals. Such conditions create a favorable environment for the spread of infections, and due to the weakened state of the body, even a common infection can lead to serious complications or death.

Effective infection control in nursing hospitals requires not only formally approved guidelines but also consistently implemented practices, where every member of the care chain plays a crucial role—from support staff to the institution's leadership. Rhee et al. (2021) emphasize that theoretical guidelines alone are insufficient—it is essential to ensure staff training, regular knowledge updates, clear protocols, and an organizational culture in which infection control is a core priority of the entire institution's operations. However, practice shows that these conditions are often not fully met. Common obstacles such as staff shortages, excessive workloads, insufficient emphasis on training, and limited material resources become key barriers that hinder the effective implementation of infection control measures.

The European Centre for Disease Prevention and Control (ECDC, 2023) states that long-term care facilities must be prepared not only to implement basic hygiene standards but also to actively plan for managing potential infectious threats. This includes the development of response plans, staff training, infection surveillance systems, and the timely transmission of data to health authorities. Such measures help reduce response time in the event of an unexpected outbreak, strengthen staff confidence in their capabilities, and improve patient survival rates.

The COVID-19 pandemic served as a significant stress test for the entire healthcare system, but it had an especially profound impact on the nursing care sector. Many nursing hospitals faced extreme challenges—rapid virus transmission, high patient mortality rates, shortages of protective equipment, lack of information, and overwhelming emotional strain on staff. Dutey-Magni et al. (2021) emphasized that institutions with underdeveloped infection control infrastructure experienced the greatest losses. This crisis exposed not only systemic shortcomings but also highlighted the crucial

importance of psychological preparedness, crisis management skills, and clear organizational leadership.

Karasneh et al. (2021) highlights the emotional resilience of healthcare workers as a critical factor determining the effectiveness of infection control measures during a crisis. Even when staff possess the necessary knowledge, they may be unable to apply it effectively if they lack psychological support or confidence in leadership. In such situations, managerial communication, the ability to quickly resolve problems, ensure the supply of protective equipment, and maintain overall institutional stability become especially important. Therefore, infection control encompasses not only medical or epidemiological aspects but also human and managerial factors.

Another pressing issue is the increasing prevalence of antibiotic-resistant bacteria. In nursing hospitals, where antibiotics are often prescribed empirically and for prolonged treatment, there is a high risk of resistance development. Basso et al. (2023) emphasize that the appropriate use of antimicrobial agents is one of the most critical elements of modern infection control. In addition to rational pharmacotherapy, access to microbiological testing, an effective infection surveillance system, isolation protocols, and staff education on antimicrobial resistance (AMR) risks are essential. Moreover, it is important to involve infection control specialists in decision-making processes, ensure interdisciplinary collaboration, and promote data-driven practices.

The culture of infection control must be fully integrated into the organization's daily operations and become a natural part of the work environment. It is not merely about rules or protocols—it represents a set of beliefs, values, and behaviors in which every staff member feels responsible for patient safety. Creating such a culture requires consistent leadership, ongoing education, open communication, employee engagement, and opportunities to reflect on practical challenges. Additionally, it is crucial to ensure that all staff—regardless of their position—have equal access to information, opportunities for learning, and appropriate support.

In summary, infection control in nursing hospitals is an extremely complex, multifaceted, and resource-intensive process, the success of which depends not only on the availability of protocols but also on how effectively they are implemented in everyday practice. Considering population aging, emerging infectious threats, antimicrobial resistance challenges, and the experience of the pandemic, it becomes clear that infection control must be an integral part of strategic healthcare planning, the promotion of staff well-being, and the consistent development of a culture of safety.

**The aim of this scientific study** is to assess the experiences and preparedness of healthcare workers in nursing hospitals in implementing infection control measures, as well as to identify the most common practical problems encountered during epidemics or pandemics.

**Research question** – How do healthcare workers in nursing hospitals perceive and implement infection control measures, and what factors most significantly influence their preparedness and effectiveness during crises?

**Hypothesis** – The preparedness of healthcare workers and adherence to infection control measures in nursing hospitals is directly dependent on continuous education, psychological support, workload, and organizational engagement. During epidemics or pandemics, infection control becomes significantly more reliant on the condition of human resources than on the formal presence of protocols.

This scientific study aims to fill the gap between theoretical recommendations and practical realities. Most of the reviewed literature is based on global or national data, but the actual experiences of staff during a crisis are scarcely documented. The survey data will provide a more objective evaluation of the workload, emotional state, information quality, training effectiveness, and challenges faced by staff during emergency situations.

# 1. CHALLENGES AND SOLUTIONS IN INFECTION CONTROL IN NURSING HOSPITALS: A REVIEW OF RECENT LITERATURE

The most common healthcare-associated infections in nursing homes are urinary tract infections, pneumonias, skin and soft tissue infections, and infections caused by *Clostridium difficile* (ECDC, 2023). The spread of antibiotic-resistant bacteria such as MRSA and VRE in nursing facilities poses a serious public health threat. According to the 2023 report by the European Centre for Disease Prevention and Control, more than 30% of long-term care facilities in Europe experience periodic outbreaks of antimicrobial resistance.

An essential component of infection control is the proper use of personal protective equipment (PPE). A study by Song et al. (2024) shows that only 68% of nursing staff properly adhere to PPE use guidelines, particularly under conditions of high workload or weak managerial supervision. This confirms that effective infection control depends not only on the availability of technical tools but also on organizational culture.

In Lithuania, the effectiveness of infection control in nursing facilities is also being assessed. According to data from the National Public Health Centre (NVSC) in 2024, protocol violations were identified in nearly half of the investigated facilities, most frequently related to environmental disinfection and improper PPE usage. This indicates that systematic and continuous audits, along with staff engagement, are essential to ensure high-quality prevention.

An interesting perspective is provided by Arzilli et al. (2023), who analyzed infection prevalence in Italian nursing homes. The study found that in facilities with continuous monitoring mechanisms (e.g., electronic infection tracking systems), infection rates were statistically significantly lower than in those where monitoring was episodic. This highlights the growing importance of technological infrastructure and data analysis in infection management.

Finally, it is relevant to mention that in 2023–2024, significant attention has been paid to environmental hygiene. In a systematic review, Baras et al. (2024) found that the cleaning and disinfection of environmental surfaces is one of the most effective, yet often overlooked, components in long-term care facilities. Improper use of disinfectants, irregular ventilation of rooms, and ineffective cleaning protocols allow pathogens to persist in the environment and pose an ongoing infection risk.

In summary, the current state of infection control in nursing homes remains a challenge. Despite many implemented measures, their practical application depends on numerous interrelated factors: infrastructure, staff motivation, technological support, and organizational culture.

Healthcare workers are the key link in the infection prevention chain in nursing homes. Their behavior, knowledge, attitudes, and practical skills directly influence the spread or control of infections. Contemporary research shows that staff training and continuous education are among the most critical factors in the successful implementation of infection control in the long-term care sector (Wang et al., 2023).

This topic is deeply explored by Yamamoto et al. (2023), who studied staff in Japanese nursing homes. The study found that employees who regularly participated in infection prevention training had significantly higher confidence in their ability to properly use PPE and adhere to aseptic procedures. Moreover, they made fewer mistakes in daily hygiene practices. In contrast, staff lacking continuous education were more likely to ignore fundamental infection control principles, even when they understood their importance.

A crucial factor is leadership attitude. In nursing facilities where infection control is treated as a strategic priority, staff engagement and job satisfaction are higher. A study by Lee et al. (2024) in South Korea showed that in institutions where managers actively participated in training alongside staff, infection rates were significantly lower, and employees better understood the importance of protocols. This suggests that leaders' personal involvement sets an example that encourages staff to adhere to strict hygiene standards.

Another relevant aspect is the emotional readiness of staff. During the pandemic, many nursing professionals experienced stress, anxiety, burnout, and decision fatigue, all of which directly affected their ability to follow safety protocols. A systematic review by Park et al. (2023) found that psychological interventions—such as stress management training or workplace psychological support—positively correlate with better compliance with protocols. This finding encourages healthcare institutions not only to provide knowledge but also to invest in strengthening emotional well-being.

In addition to training, working conditions and workload are significant factors. A study by Bae et al. (2024) revealed that staff caring for a high number of patients were more likely to neglect infection prevention measures due to time constraints. For instance, hand hygiene was often skipped in critical situations when a patient required urgent help, and PPE use was sometimes limited to "save time." This highlights that effective infection control is impossible without adequate staffing levels and working conditions.

Finally, it is important to integrate new training strategies based on technology. Virtual reality (VR) and interactive simulations are increasingly used in infection control training. Ferreira et al. (2023) demonstrated that using VR technology for hand hygiene training led to higher performance among nursing students compared to those trained through traditional lectures. This trend indicates that advanced technologies can enhance the long-term effectiveness of educational programs.

It is important to emphasize that staff training and emotional preparedness are key factors in the success of infection control in nursing homes. Management involvement, improved working conditions, and the implementation of modern training methods can significantly enhance employees' abilities and motivation to apply preventive measures in daily practice.

In recent years, technology has become an integral part of infection control in nursing homes. Digital tools, sensors, real-time data analysis, and artificial intelligence algorithms enable better monitoring of infection spread, more accurate outbreak responses, and optimized preventive measures. Traditionally less innovative than acute care hospitals, the nursing sector began actively adopting these solutions during the pandemic (Chughtai et al., 2023).

One of the most effective technological innovations is automated hand hygiene monitoring systems, which use RFID technology or sensors to detect whether staff are following hygiene protocols. A study by Bakri et al. (2024) showed that after implementing such a system in three nursing homes, compliance with hand hygiene increased by 31%, and infection rates related to hygiene decreased by 18%. This demonstrates that technology can not only monitor but also promote behavior change through feedback.

Another area is ultraviolet (UV-C) disinfection devices used to sterilize surfaces in shared spaces. A study conducted in Norway found that UV-C robots were particularly effective in reducing microbial colonies in nursing home common areas (Haugen et al., 2023). Although their use remains expensive and requires specific procedures, their long-term effectiveness is evident.

Artificial intelligence (AI) solutions are also being rapidly integrated into infection management. AI can process large volumes of electronic health records, identifying risk patterns or early signs of infection outbreaks. Liu et al. (2023) described a case in which an AI system in China analyzed data from over 100,000 patients and detected clusters of infections two weeks earlier than traditional methods. Such early warnings allow resources to be mobilized, and risk sources to be isolated more quickly than before.

Telemedicine and the use of mobile applications have also become significant. One app, used in the United Kingdom, automates employee temperature monitoring, symptom logging, and alerts about potential contact with infected patients (Bennett et al., 2023). Such systems not only help organize self-monitoring but also ensure centralized data collection, which facilitates contact tracing and risk assessment.

In addition, advanced disinfection technologies such as electrostatic spraying or ozonation are being increasingly used. These technologies allow for faster and more even application of disinfectants on surfaces compared to traditional cleaning methods. Risk analysis models show that such methods can reduce microbial concentration by up to 99%, especially in shared spaces such as dining areas or bathrooms (Qureshi et al., 2024).

However, it is important to highlight the issue of technology accessibility. In nursing homes, particularly those in smaller towns or financially constrained countries, the implementation of technological innovations is often slow. This results in a significant global disparity between facilities that have the means to invest in technology and those that are left behind (Desai et al., 2024).

Theoretical analysis reveals that technological innovations in infection control in nursing homes present significant opportunities—from improving preventive effectiveness to enabling early diagnosis. However, their impact depends directly on organizational capacity, financial resources, and staff skills to properly implement these technologies.

Infection control in nursing homes is not only a matter of clinical practice but also of health policy. Both international and national institutions publish guidelines that define standards, recommendations, and requirements for infection prevention in long-term care. Nonetheless, the existence of guidelines does not guarantee their implementation—effective management, oversight, and continuous updates in response to evolving infectious threats are essential (Gharpure et al., 2023).

The European Centre for Disease Prevention and Control (ECDC) issued new recommendations for long-term care facilities in 2023, emphasizing the systematic application of hand hygiene principles, environmental disinfection, contact tracing, and the use of personal protective equipment (PPE) (ECDC, 2023). The ECDC also recommends that national healthcare authorities conduct regular inspections, monitoring, and provide support for training and resource allocation.

The U.S. Centers for Disease Control and Prevention (CDC) updated its infection control guidelines in 2023, stating that nursing facilities must apply a combination of “Standard Precautions” and “Transmission-Based Precautions,” as well as actively implement COVID-19 and other respiratory infection management plans (CDC, 2023). These guidelines stress the importance of organizational flexibility—the ability to respond quickly to outbreaks while ensuring continuous care.

Similar positions are expressed by the World Health Organization (WHO), which in 2023 issued recommendations for the long-term care sector, emphasizing an integrated approach to infection control: procedural actions, organizational management, and the empowerment of healthcare workers. The WHO document notes that both training and systematic infrastructure are crucial to consistently implement infection control measures (WHO, 2023).

Another important initiative is the Infection Prevention and Control Assessment Framework (IPCAF) developed by the WHO. This tool allows institutions to assess the level of implementation of their infection prevention policies. A global study conducted in 2024 showed that nursing homes regularly using IPCAF had lower infection rates than those that did not (Zhou et al., 2024). This confirms that policy and practice must be linked through continuous self-assessment and reporting.

On the other hand, in some countries, policy remains reactive recommendations are only updated in response to crises, rather than through a preventative approach. Long-term care institutions often lack not only resources but also regulatory clarity. As Desai et al. (2024) point out, discrepancies in legal requirements across countries lead to inconsistent levels of infection control, which is especially evident in international comparative analyses.

Furthermore, the impact of funding policy should be emphasized. In some countries, such as the United States, the Medicare and Medicaid programs in 2023 included infection control quality indicators in funding models, encouraging institutions to invest in staff training and protective equipment (CMS, 2023). This approach not only enhances quality but also creates a long-term motivational mechanism for leadership.

Thus, although numerous guidelines and policy documents exist, their real value is only realized when implementation is systematic, supported by leadership, and backed by sufficient resources. Effective infection control policy requires dynamic, evidence-based regulation aligned with international standards.

Although infection control measures are essential from an epidemiological perspective, they often negatively impact the psychosocial well-being of residents in long-term care facilities. Social isolation, restricted physical activity, visitor limitations, and heightened control measures frequently create conditions for emotional deprivation, depression, and anxiety (Meisner et al., 2023). Therefore, modern infection control should be evaluated not only through the lens of disease prevention but also through respect for human dignity and mental health.

Studies conducted during the pandemic showed that isolation protocols in nursing homes significantly affected residents' mood and social functioning. A study by Hidaka et al. (2023) in Japan revealed that over 60% of nursing home residents experienced increased feelings of loneliness, and about 40% exhibited clinical symptoms of depression. These findings indicate that even necessary measures, such as room isolation or visitor restrictions, must be applied responsibly, in conjunction with emotional support strategies.

The importance of psychosocial support systems in infection control is increasingly recognized globally. Torres et al. (2023) emphasize that nursing homes that integrated the services of psychologists, social workers, and spiritual counselors into daily care were able to maintain higher levels of resident satisfaction with quality of life, even during pandemic restrictions. This shows that even under strict hygiene regimes, the human element can be preserved through a network of emotional support.

Additionally, technology can help reduce social isolation. In many countries, nursing homes began using tablets, video calls, and social platforms to maintain connections with loved ones. A systematic review by McArthur et al. (2023) found that even brief daily virtual contacts had a positive

impact on residents' mood, cognitive condition, and overall well-being. However, the study also notes that such solutions should not replace in-person contact whenever it is safe.

Another important aspect is the communication of information to residents. When residents are involved in decision-making and when infection prevention measures are clearly and understandably presented, their cooperation increases. A study by Greenberg et al. (2024) showed that educational sessions tailored to patients with cognitive impairments increased their participation in hand hygiene practices and reduced resistance to isolation. These results demonstrate that resident education must be consistent and individualized.

Ultimately, resident autonomy and dignity should be considered fundamental elements of infection control. When protocols are implemented without explanation or without offering choices, they may be perceived as coercive. Chen et al. (2024) argue that infection prevention strategies that infringe on residents' rights—such as restricting movement or personal choices—ultimately erode trust in the care system and increase psychological stress. Therefore, it is essential to balance safety with personal rights. Infection control must be holistic addressing not only microbiological risk but also the emotional, social, and cognitive well-being of the individual. Only an integrated approach can achieve genuine safety that encompasses both physical and psychological health.

Epidemics and pandemics, such as COVID-19, expose the fundamental vulnerabilities of the long-term care sector. Nursing homes face complex challenges that affect not only management but also frontline healthcare workers, especially nurses and nursing assistants. Practical challenges during epidemics are often related to staff shortages, lack of protective equipment, physical and emotional fatigue, and expanded responsibilities (White et al., 2023).

**Shortages and inadequacies of protective equipment.** One of the most reported challenges is the lack of adequate and sufficient personal protective equipment (PPE). At the beginning of the pandemic, many long-term care facilities had not stockpiled PPE, and procurement priorities were directed toward hospitals. A study by Lee et al. (2023) in South Korea found that 72% of nursing staff reported limited availability of respirators and face shields at the peak of the pandemic. Additionally, some PPE was not suitable for prolonged use, causing discomfort, allergic reactions, or physical pain.

**Increased workload and staff shortages.** During epidemics, the demand for monitoring, isolation, and intensive care in nursing homes increases. Simultaneously, some staff fall ill or must isolate, leaving fewer staff to manage increased workloads. A study by Barros et al. (2023) in Portugal showed that the average number of working hours during the pandemic increased by 24%, with one worker often caring for 12–16 patients instead of the recommended 6–8.

**Emotional exhaustion and moral distress.** Constant stress, fear of infection or infecting family members, frequent patient deaths, and limited social support contribute to emotional burnout among staff. Moral distress is especially strong when workers are unable to provide adequate care

due to physical or organizational limitations. Kim et al. (2024) highlighted that staff often felt guilty for not spending enough time with dying patients or for having to isolate residents in ways that neglected their psychological needs.

**Lack of information and communication issues.** During epidemics, workers frequently report receiving unclear, contradictory, or delayed information. Leadership inconsistency, constantly changing guidelines, and ineffective communication increase uncertainty. A study in Germany (Grunwald et al., 2023) revealed that nursing staff most often received information from colleagues or social media rather than from official sources, contributing to the spread of misinformation.

**Insufficient psychological support in the workplace.** Despite significant emotional burdens, psychological support for workers remains fragmented or entirely absent. In many institutions, there were no dedicated support lines or internal intervention teams. Only a few organizations implemented regular supervision or stress-reduction programs (Torres et al., 2023). Staff were often left to cope with emotional consequences on their own.

**Rapid role reassignment without training.** During the pandemic, staff were forced to take on functions beyond their competencies—from coordinating infection control to making decisions about patient isolation. A study in Canada (Cameron et al., 2024) showed that nurses frequently took on managerial roles or made hospitalization decisions without adequate preparation. These situations increased stress and fears of legal liability.

In summary, during epidemics and pandemics, healthcare workers in nursing homes face not only the threat of infection but also complex practical challenges: resource shortages, emotional exhaustion, informational uncertainty, and lack of systemic support. To prepare for future crises, it is essential to integrate crisis management into staff training strategies, establish long-term psychological support systems, and strengthen rapid communication channels.

A review of the literature shows that infection control in nursing homes is a multifaceted issue requiring a systemic, interdisciplinary, and person-centered approach. Modern scientific literature highlights several key themes: implementation of preventive measures, healthcare workers' knowledge levels and preparedness, technological solutions, psychosocial challenges, and pandemic management policies. While many studies offer suggestions for optimizing infection control, there remains a lack of empirical evidence describing the actual experiences and preparedness of staff, especially within the long-term care sector.

The analysis revealed that staff knowledge often does not reflect practical skills—even when they are aware of infection risks, they do not always apply the necessary preventive measures due to excessive workloads, emotional exhaustion, or organizational barriers (Park et al., 2023; Barros et al., 2023). Moreover, during pandemics, it became evident that even when infection control protocols are in place, their implementation is often delayed or insufficiently consistent due to a lack of

information, indecision by leadership, or limited technological capacity (Grunwald et al., 2023). At the same time, it has been observed that in settings where infection control is integrated into the organizational culture, and where staff receive consistent training and psychological support, infection rates are lower and job satisfaction is higher (Kaya et al., 2023). However, these findings are often presented in a global context, highlighting the need for research that evaluates the real situation within a specific area of the healthcare system—in this case, nursing homes.

Based on the reviewed scientific literature, it can be assumed that the effectiveness of infection control practices in nursing homes largely depends on staff's practical preparedness, the adequacy of organizational measures, and emotional well-being. Having formal guidelines is not sufficient—what matters is their practical implementation, which relies on workers' knowledge, motivation, psychological condition, and the level of organizational support.

## 2. RESEARCH METHODOLOGY

### 2.1. Research Design and Sample

The research topic “*Challenges of Infection Control in Nursing Homes During the Pandemic: Experiences and Perceptions of Healthcare Workers*” focuses on analyzing the challenges faced by staff, their assessments, and the effectiveness of infection control measures in the context of a pandemic. For these research objectives, a quantitative research method is appropriate, as it allows:

1. **Objective evaluation of phenomena and trends in a large sample.** Quantitative studies enable the measurement of healthcare workers’ experiences, attitudes toward infection control measures, and the challenges faced during the pandemic using standardized tools (e.g., questionnaires with Likert scales). This facilitates generalizations and statistically based conclusions about certain phenomena across the population (Creswell & Creswell, 2018).
2. **Comparison of different groups and identification of relationships between variables.** Quantitative methods support the application of statistical analyses (e.g., correlations, tests, regression analysis), which help uncover relationships between working conditions, emotional states, and the effectiveness of infection control during the pandemic. This is particularly relevant for identifying factors contributing to protocol non-compliance or stress levels (Polit & Beck, 2021).
3. **Ensuring data reliability and result replication.** Quantitative research relies on structured, pre-prepared instruments, making the data less dependent on researcher interpretation. This ensures the reliability of the study, comparability of results, and the potential for replication in different contexts or time periods (Bryman, 2016).
4. **Responding to pressing health policy issues.** Infection control during a pandemic is both a practical and policy-related matter. Quantitative data provides evidence for decisions regarding staff support, resource allocation, training plans, and protocol adjustments. Policymakers tend to rely on quantitative evidence as it offers clear, comparable indicators (Aveyard, 2019).
5. **Suitability for research in pandemic conditions with limited contact.** Quantitative methods, especially online surveys, allow for the safe and efficient collection of data from many respondents, even under pandemic restrictions that limit direct contact (Baltar & Brunet, 2012).

The study was conducted in 2025 in Lithuanian long-term care and nursing hospitals using a quantitative research method. A total of 18 nursing hospitals participated, with a combined staff

population of 1,423. The research sample consisted of healthcare and support staff. Data was collected through an anonymous questionnaire, and 659 employees responded (response rate: 46.3%).

During the research process, the researcher formally contacted the administration of each nursing hospital to request permission to conduct the study. Upon administrative approval, a written request for consent to participate was sent to all potential respondents.

## **2.2. Research Instrument and Data Collection**

A structured questionnaire consisting of 30 statements was developed by the researcher for this study. The items were grouped into six thematic categories: (1) Infection Control, (2) Training and Preparedness, (3) Workload and Challenges, (4) Psychosocial Support, (5) Communication, and (6) Technology.

Responses were provided using a five-point Likert scale (1 – strongly disagree, 5 – strongly agree).

The questionnaire was developed based on the findings and instruments used in international studies by researchers such as Houghton et al. (2020), Liu et al. (2023), Huang et al. (2023), Iheduru-Anderson (2021), and McMullan et al. (2022). The researcher adapted the items to reflect the specific context of the Lithuanian nursing sector and incorporated feedback from a pilot test conducted in the first quarter of 2024. The pilot study involved 68 nursing professionals from three nursing hospitals.

## **2.3. Statistical Data Analysis**

The data analysis was conducted in several stages, employing both descriptive and inferential statistical methods. All analyses were performed using IBM SPSS Statistics software (version 29.0).

### **Descriptive Statistics**

Initially, descriptive statistics were used, including means and standard deviations. The mean (arithmetic average) indicates the central tendency, that is, the average response value of the participants while the standard deviation shows how evenly or unevenly the responses are distributed around the mean (Field, 2020). These indicators help evaluate the distribution of the data and guide the selection of appropriate subsequent statistical tests.

### **Friedman Test for Related Samples**

To evaluate differences between several related thematic groups (e.g., responses to similarly scaled questions under different conditions), the Friedman test was applied. This non-parametric test is the equivalent of repeated-measures ANOVA but does not require data to follow a normal distribution. It is used when the data are ordinal or when assumptions for parametric analysis are

violated (Sheskin, 2020). The Friedman test allows determination of whether there are statistically significant differences between more than two related groups.

#### **Post-Hoc Analysis with Wilcoxon Tests**

Upon identifying significant overall differences, post-hoc analysis was conducted using paired Wilcoxon signed-rank tests—a non-parametric alternative to the paired samples t-test—for comparing two dependent groups. To reduce the risk of Type I error (false positives) due to multiple comparisons, the Bonferroni correction was applied. This conservative method adjusts the significance level by dividing it by the number of comparisons performed (Field, 2020), thereby increasing the reliability of the results.

#### **Correlation Analysis**

To evaluate relationships between various variables (e.g., between different statement responses), the Spearman's rank correlation coefficient ( $\rho$ ) was used. This non-parametric correlation measure is appropriate when data are not normally distributed or when variables are ordinal. It indicates whether a monotonic relationship exists, that is, whether values of one variable increase (or decrease) consistently with the values of another (Hauke & Kossowski, 2011).

#### **Significance Threshold**

The level of statistical significance for all tests was set at  $p < 0.05$ , meaning results were considered statistically significant if the probability of occurring by chance was less than 5%. This threshold is widely recognized in scientific research as the standard for statistical significance (Cumming, 2014).

## **2.4. Ethical Principles**

This study adhered to all relevant principles of bioethics, human rights, and data protection, ensuring the safety, informed participation, and voluntariness of all research participants.

The study was conducted in accordance with the Declaration of Helsinki (last revision – 2013) of the World Medical Association, which outlines ethical principles for medical and health-related research involving human subjects. The declaration emphasizes respect for individuals, autonomy, informed consent, and the duty to maximize benefit while minimizing harm to participants.

#### **Informed Consent**

All participants were clearly informed, prior to completing the questionnaire, about the purpose of the study, the identity of the researcher, the intended use of the data, confidentiality assurances, and their right to withdraw at any time. Consent to participate was given voluntarily, without any external pressure or institutional obligation.

### **Confidentiality and Anonymity**

Data collection was conducted in complete anonymity, without recording any personally identifiable information. Responses were processed statistically in a way that prevented the identification of individual participants or their institutions. The data were stored securely and were accessible only to the research team.

### **Personal Data Protection**

The study fully complies with the General Data Protection Regulation (GDPR, Regulation (EU) 2016/679) of the European Union. Since no sensitive or personally identifiable data were collected, the information was considered non-personal and did not fall under the category of special data.

### **Principle of non-maleficence**

The questionnaire was designed to avoid causing discomfort, psychological pressure, or ethical dilemmas for respondents. All questions were formulated in a neutral and ethically acceptable manner.

### **Principle of Justice**

All staff members in the nursing facilities were eligible to participate in the study, regardless of their position, education level, or work experience. This approach ensured inclusivity and social equity, avoiding any form of discrimination or selective sampling.

### **Research Transparency**

The research process, methods of analysis, and interpretation of results were based on objectivity and academic integrity. All results are presented in an aggregated form, with no possibility of drawing conclusions about individual participants or specific institutions.

Adherence to the principles of the Declaration of Helsinki reinforced the ethical foundation of the study and ensured that participants were treated with respect, dignity, and safety throughout all phases of the research.

### 3. RESEARCH RESULTS

#### 3.1. Correlation Analysis: Relationships Between Infection Control, Staff Preparedness, and Organizational Factors in the Context of Pandemics

A Spearman correlation analysis was conducted to examine the relationships between items related to infection control practices. The analysis revealed several statistically significant associations ( $p < 0.05$ ) between key variables.

It was found that self-reported knowledge of infection control protocols had a weak but significant negative correlation with adherence to hand hygiene under high workload conditions ( $r = -0.28, p < 0.001$ ). This result may indicate a discrepancy between theoretical knowledge and practical behavior—employees who are well-informed about protocols do not always manage to follow them in challenging circumstances (see Table 1).

In contrast, there was a weak positive correlation between protocol knowledge and perceived organizational response to outbreaks ( $r = 0.18, p < 0.001$ ), suggesting that higher staff awareness is associated with more favorable evaluations of the institution's readiness to respond to infectious threats (see Table 1).

A strong positive correlation was identified between hand hygiene compliance and the consistent implementation of infection control measures ( $r = 0.56, p < 0.001$ ). This confirms that clear and systematic organizational infection prevention supports individual compliance with hygiene requirements. However, at the same time, a strong negative correlation was observed between hand hygiene adherence and rapid institutional response to outbreaks ( $r = -0.55, p < 0.001$ ). This may suggest that employees who strictly follow hygiene routines, even under pressure, are more critical of the facility's ability to respond promptly (see Table 1).

A weak but significant positive correlation was also found between the availability of personal protective equipment (PPE) and the perceived responsiveness of the facility during outbreaks ( $r = 0.17, p < 0.001$ ), indicating that staff with adequate PPE tend to evaluate the institution's response more positively (see Table 1).

Interestingly, a negative correlation was observed between the consistent implementation of infection control measures and the organization's perceived response to outbreaks ( $r = -0.10, p = 0.009$ ). Although weak, this statistically significant association may reflect differences in staff perceptions: some institutions may have well-structured infection control systems but still be viewed as slow to react during crisis situations (see Table 1).

**Table 1.** Associations Between Healthcare Workers' Infection Control Practices and Organizational Environment

Statements		Spearman's r	p-value
I know and understand the basic infection control protocols	I always follow hand hygiene requirements, even under high workload.	-0.28*	0.000
I know and understand the basic infection control protocols.	During an outbreak, our facility promptly implements infection control actions.	0.18*	0.000
I always follow hand hygiene requirements, even under high workload.	Infection control measures are implemented clearly and consistently.	0.56*	0.000
I always follow hand hygiene requirements, even under high workload.	During an outbreak, our facility promptly implements infection control actions.	-0.55*	0.000
Personal protective equipment is always sufficiently available in my facility.	During an outbreak, our facility promptly implements infection control actions.	0.17*	0.000
Infection control measures are implemented clearly and consistently.	During an outbreak, our facility promptly implements infection control actions.	-0.1*	0.009

Note:  $p < 0.05$  – statistically significant correlation.

Spearman correlation analysis within this group revealed significant but mixed-direction associations between healthcare workers' experience with infection control training, their evaluations of training relevance, and their perceived preparedness.

It was found that the organization of regular training in the facility was significantly but negatively correlated with staff perceptions of the relevance and practical applicability of those trainings ( $r = -0.18$ ,  $p < 0.001$ ). This result may suggest that frequent training is not always perceived as high-quality or focused on practical aspects—frequency does not necessarily reflect effectiveness (see Table 2).

A positive, though weak, correlation was found between training frequency and perceived preparedness for infectious crises ( $r = 0.11$ ,  $p < 0.01$ ), indicating that staff who undergo regular training tend to feel slightly more prepared. In addition, a moderate positive correlation between training frequency and managerial encouragement ( $r = 0.35$ ,  $p < 0.001$ ) suggests that the leadership initiative may be one of the driving forces behind regular training sessions (see Table 2).

There was also a weak but significant positive correlation between training frequency and confidence in one's knowledge after training ( $r = 0.20$ ,  $p < 0.001$ ), supporting the idea that regular training may enhance employees' sense of competence (see Table 2).

However, the analysis also revealed several negative statistically significant correlations that merit discussion. For example, the negative correlation between training relevance/practicality and managerial encouragement ( $r = -0.27$ ,  $p < 0.001$ ) suggests that in facilities where management strongly promotes training, employees do not always perceive it as relevant. This may indicate a formal or mandatory nature of training, without clear communication of its real value (see Table 2).

Similarly, perceived preparedness for crisis was negatively correlated with both managerial encouragement ( $r = -0.18$ ,  $p < 0.001$ ) and post-training confidence ( $r = -0.10$ ,  $p = 0.008$ ). This

indicates that even staff who feel somewhat prepared may not necessarily view formal training as useful—perhaps relying on prior experience or self-directed learning. A negative correlation between managerial encouragement and post-training confidence ( $r = -0.13$ ,  $p = 0.001$ ) was also observed, which may suggest that employees’ self-confidence is shaped independently of administrative pressure or formal initiatives (see Table 2).

**Table 2.** *Interrelations Between Staff Evaluations of Infection Control Training and Preparedness for Epidemics*

Statements		Spearman's r	p-value
Infection control training is held regularly in my facility.	Infection control training is relevant and applicable in practice.	-0.18*	0.000
Infection control training is held regularly in my facility.	I am sufficiently prepared to respond to an infectious crisis.	0.11*	0.006
Infection control training is held regularly in my facility.	The management encourages participation in training and provides opportunities for it.	0.35*	0.000
Infection control training is held regularly in my facility.	After the training, confidence in my knowledge increases.	0.2*	0.000
Infection control training is held regularly in my facility.	I am adequately prepared to respond to an infectious crisis.	0.3*	0.000
Infection control training is held regularly in my facility.	The management encourages participation in training and provides opportunities for it.	-0.27*	0.000
Infection control training is relevant and practically applicable.	The management encourages participation in training and provides opportunities for it.	-0.18*	0.000
Infection control training is relevant and practically applicable.	After the training, confidence in my knowledge increases.	-0.1*	0.008
Management encourages and enables participation in training.	After the training, confidence in my knowledge increases.	-0.13*	0.001

Note: \*  $p < 0.05$  – statistically significant correlation.

Spearman correlation analysis revealed significant relationships between respondents’ evaluations regarding workload, the nature of tasks, staff shortages, and emotional exhaustion during epidemics. These results provide important insights into healthcare workers’ experiences during crisis situations.

The strongest correlation was identified between non-compliance with hygiene standards and physical or emotional exhaustion ( $r = 0.59$ ,  $p < 0.001$ ). This result indicates that increased workload and associated psychological stress directly impact adherence to infection prevention measures – overworked staff are more likely to neglect hygiene requirements, thereby increasing the risk of infection (see Table 3).

A strong negative correlation was also observed between tasks beyond one's competence and burnout ( $r = -0.49$ ,  $p < 0.001$ ), as well as between increased workload and exhaustion ( $r = 0.48$ ,  $p < 0.001$ ). These associations highlight that not only the volume of work, but also psychologically demanding or undefined tasks – particularly those outside the scope of one’s competence – significantly contribute to emotional burnout among staff. This may have long-term consequences for their mental health and work quality (see Table 3).

A weak but statistically significant positive correlation was found between staff shortages and exhaustion ( $r = 0.17, p < 0.001$ ), indicating that employees perceive a direct link between insufficient staffing and increased emotional burden (see Table 3).

An interesting finding is the negative correlation between workload and tasks beyond one's competence ( $r = -0.32, p < 0.001$ ). This may be interpreted as a dual reality: some employees experience strain due to an increased quantity of tasks, while others are affected by the qualitative aspect – unclear or inappropriate responsibilities.

Additionally, the negative correlation between tasks outside one's competence and non-compliance with hygiene practices ( $r = -0.29, p < 0.001$ ) may suggest that when employees are forced to perform duties beyond their role, they are less able or more likely to neglect standard infection control procedures (see Table 3).

The positive correlation between workload and non-compliance with hygiene requirements ( $r = 0.17, p < 0.001$ ) further confirms that physical burden negatively impacts adherence to infection control – a critical factor during epidemics (see Table 3).

**Table 3.** Associations Between Workload, Role Mismatch, and Psychological Strain in the Context of Pandemics

Statements		Spearman's r	p-value
During epidemics, my workload increases significantly.	During work, I often must perform tasks that are beyond my competence.	-0.32*	0.000
During epidemics, my workload increases significantly.	During epidemics, there is often a staff shortage in the institution.	-0.19*	0.000
During epidemics, my workload increases significantly.	Due to a high workload, I fail to comply with all hygiene requirements.	0.17*	0.000
During epidemics, my workload increases significantly.	Working conditions during epidemics often cause physical or emotional exhaustion.	0.48*	0.000
During work, I often have to perform tasks that are beyond my competence.	Due to a high workload, I fail to comply with all hygiene requirements.	-0.29*	0.000
During work, I often have to perform tasks that are beyond my competence.	Working conditions during epidemics often cause physical or emotional exhaustion.	-0.49*	0.000
During epidemics, my workload increases significantly.	Working conditions during epidemics often cause physical or emotional exhaustion.	0.17*	0.000
Due to the high workload, I do not follow all hygiene requirements.	Working conditions during epidemics often cause physical or emotional exhaustion.	0.59*	0.000

Note: \*  $p < 0.05$  – statistically significant correlation.

The analysis of psychosocial aspects in the context of epidemics revealed numerous statistically significant but nuanced correlations between emotional well-being, anxiety, institutional support, and access to counseling. These associations help uncover deeper patterns of emotional responses among healthcare workers during crises.

The strongest correlation observed in the entire group was between stress due to insufficient patient support and perceived emotional support from management ( $r = 0.72, p < 0.001$ ). This very strong positive correlation suggests that employees experiencing greater moral distress due to

professional limitations are also more likely to perceive the support from management as adequate. This may indicate that management recognizes psychological strain and responds more actively (see Table 4).

Meanwhile, anxiety about infecting family members – a key psychosocial factor during epidemics – was associated with several variables. A positive correlation was observed between anxiety and perceived psychological support from the institution ( $r = 0.49, p < 0.001$ ), as well as between anxiety and actual emotional assistance received ( $r = 0.39, p < 0.001$ ). This may suggest that employees experiencing greater anxiety are more likely to seek or receive emotional support (see Table 4).

However, several significant negative correlations were also found: anxiety was negatively correlated with management’s efforts to ensure emotional well-being ( $r = -0.47, p < 0.001$ ) and with stress due to patients ( $r = -0.29, p < 0.001$ ). This may reflect a differentiation in emotional tension – some employees worry more about their families, while others are more concerned about patients. Additionally, those experiencing higher anxiety might be more critical of management’s actions, even while actively seeking support (see Table 4).

A negative correlation was found between declared institutional support and actual help received ( $r = -0.11, p = 0.005$ ), suggesting that systemic support does not always translate into individual involvement in support processes. Moreover, a significant negative association between management’s reported care for employees’ emotional state and the help actually received ( $r = -0.25, p < 0.001$ ) indicates a potential mismatch between institutional image and real support provided (see Table 4).

A weak but statistically significant positive correlation between stress due to patient care and receiving counseling ( $r = 0.16, p < 0.001$ ) may indicate that this particular form of emotional strain more frequently triggers the search for or offer of psychological support (see Table 4).

**Table 4.** *Associations Between Psychological Stress, Institutional Support, and Emotional Well-Being in the Context of Epidemics*

Statements		Spearman’s r	p-value
During epidemics, I feel anxious about the possibility of infecting my family members.	My institution provides psychological support to employees during a crisis.	0.49*	0.000
During epidemics, I feel anxious about the possibility of infecting my family members.	I feel stressed when I am unable to provide comprehensive support to a patient.	-0.29*	0.000
During epidemics, I feel anxious about the possibility of infecting my family members.	The management takes care of employees' emotional well-being during an epidemic.	-0.47*	0.000
During epidemics, I feel anxious about the possibility of infecting my family members.	I have received support or counseling for emotional difficulties during work.	0.39*	0.000
My institution provides psychological support to employees during a crisis.	I feel stressed when I am unable to provide comprehensive support to a patient.	-0.21*	0.000
My institution provides psychological support to employees during a crisis.	I have received support or counseling for emotional difficulties during work.	-0.11*	0.005

I feel stressed when I am unable to provide comprehensive support to a patient.	The management takes care of employees' emotional well-being during an epidemic.	0.72*	0.000
I feel stressed when I am unable to provide comprehensive support to a patient.	I have received support or counseling for emotional difficulties during work.	0.16*	0.000
The management takes care of employees' emotional well-being during an epidemic.	I have received support or counseling for emotional difficulties during work.	-0.25*	0.000

Note: \*  $p < 0.05$  – statistically significant correlation.

A strong positive correlation was observed between trust in informal sources of information (colleagues or social networks) and overall awareness of the situation and potential threats ( $r = 0.57$ ,  $p < 0.001$ ). This may be explained by the fact that formal communication within the institution is not always sufficient, prompting employees to actively seek additional information from colleagues or online sources, which subjectively enhances their sense of being informed (see Table 5).

However, a negative correlation was also found between the clarity/timeliness of information and the effectiveness of communication channels ( $r = -0.35$ ,  $p < 0.001$ ). At first glance, this may seem paradoxical, but it likely indicates that even when communication channels between management and staff are functioning, frequent changes or complex guidelines create confusion. This is further supported by a positive correlation between guideline ambiguity and perceived effectiveness of communication channels ( $r = 0.31$ ,  $p < 0.001$ ), which can be interpreted as a critical employee assessment: when communication channels are active, the focus shifts from the quantity of content to its quality and consistency (see Table 5).

The use of informal sources also correlates with the effectiveness of communication channels ( $r = 0.38$ ,  $p < 0.001$ ), indicating that even with a formal structure in place, employees tend to supplement or verify information through other means. Although this behavior increases the sense of awareness, it can contribute to inaccuracies or the spread of misinformation, especially in rapidly changing situations (see Table 5).

In addition, a weak but significant negative correlation was found between the clarity and timeliness of information and the search for information through colleagues or social networks ( $r = 0.12$ ,  $p = 0.003$ ). This confirms the trend that employees, even when receiving official information, still seek informal sources, raising questions about trust in formal communication channels (see Table 5).

An effective communication channel between management and staff positively correlates with the sense of being informed ( $r = 0.15$ ,  $p < 0.001$ ), though the relationship is weak. This suggests that the mere existence of communication channels does not guarantee adequate content or relevance – the quality, clarity, and timeliness of information play a more significant role (see Table 5).

**Table 5.** Associations Between Communication Effectiveness, Information Sources, and Awareness in the Context of Epidemics

Statements		Spearman's r	p-value
During epidemics, information about new directives is clear and provided in a timely manner.	I often must rely on information from colleagues or social networks.	0.12*	0.003
During epidemics, information about new directives is clear and provided in a timely manner.	My institution has an effective communication channel between management and staff.	-0.35*	0.000
Guidelines often change and are insufficiently explained.	I often must rely on information from colleagues or social networks.	0.09*	0.025
Guidelines often change and are insufficiently explained.	My institution has an effective communication channel between management and staff.	0.31*	0.000
I often must rely on information from colleagues or social networks.	My institution has an effective communication channel between management and staff.	0.38*	0.000
I often must rely on information from colleagues or social networks.	I feel informed about the situation and potential threats.	0.57*	0.000
My institution has an effective communication channel between management and staff.	I feel informed about the situation and potential threats.	0.15*	0.000

Note: \*  $p < 0.05$  – statistically significant correlation.

The implementation of technology in healthcare institutions is considered one of the key components of modern infection control. However, this analysis revealed contradictory but statistically significant correlations, highlighting the complexity of employees' evaluations and possible discrepancies between the presence of technologies and their actual effectiveness or practical application.

It is notable that most correlations are negative, suggesting that employees who evaluate one aspect of technology positively often view others more skeptically. For example, a moderate negative correlation was found between the general assessment that technology helps manage infection risk and the statement that technological tools (e.g., hand hygiene monitoring) are effective ( $r = -0.40$ ,  $p < 0.001$ ). This may indicate that the “presence” of technology does not necessarily correlate with its “effective functioning” — employees may notice system flaws even if they acknowledge their importance (see Table 6).

Similarly, a negative correlation was observed between the perception that technologies help control infections and statements about employee training ( $r = -0.15$ ,  $p < 0.001$ ), as well as with the impact of technology on daily work ( $r = -0.25$ ,  $p < 0.001$ ). This suggests that while technologies may be formally implemented, if employees are not adequately trained or if technologies are not tailored to their work specifics, their usefulness is viewed with skepticism.

At the same time, a positive correlation was found between the use of technologies for infection control and the institution's encouragement of innovative solutions ( $r = 0.24$ ,  $p < 0.001$ ), indicating that institutional support and innovation policies are important factors in shaping attitudes toward the benefits of technology (see Table 6).

An interesting result is the negative correlation between the evaluation of tools (e.g., monitoring systems) as effective and the level of employee training ( $r = -0.37, p < 0.001$ ). This may indicate that employees who are not sufficiently trained perceive technologies as less effective, or conversely, that those who are trained become more critical of their actual performance (see Table 6).

A weak but significant positive correlation was observed between the perceived usefulness of technology in daily work and its effectiveness ( $r = 0.17, p < 0.001$ ), suggesting that technologies that help enforce protocols may be evaluated more positively when they are clear and practically beneficial (see Table 6).

Finally, the negative correlation between training in technology use and institutional encouragement of innovation ( $r = -0.30, p < 0.001$ ) raises questions about the consistency of the institution's strategy – innovations may be encouraged formally but not always supported by adequate employee training (see Table 6).

**Table 6.** Associations Between the Effectiveness of Technological Tools, Training, and Innovation Promotion in the Context of Infection Control

Statements		Spearman's r	p-value
The technologies used in my institution help manage infection risks more effectively.	Technological tools (e.g., hand hygiene monitoring) are effective.	-0.4*	0.000
The technologies used in my institution help manage infection risks more effectively.	I have been trained in using technological solutions related to infection control.	-0.15*	0.000
The technologies used in my institution help manage infection risks more effectively.	Technologies make daily work easier and help ensure better adherence to protocols.	-0.25*	0.000
The technologies used in my institution help manage infection risks more effectively.	My institution encourages the implementation of new infection prevention solutions.	0.24*	0.000
Technological tools (e.g., hand hygiene monitoring) are effective.	I have been trained in using technological solutions related to infection control.	-0.37*	0.000
Technological tools (e.g., hand hygiene monitoring) are effective.	Technologies make daily work easier and help ensure better adherence to protocols.	0.17*	0.000
I have been trained in using technological solutions related to infection control.	My institution encourages the implementation of new infection prevention solutions.	-0.3*	0.000

Note: \*  $p < 0.05$  – statistically significant correlation.

In summary, the correlation analysis revealed that employees' readiness to implement infection control measures is influenced not by isolated factors but by interconnected elements — information, emotional climate, organizational structures, working conditions, and technological resources. Statistically significant relationships help identify critical areas where interventions could be most effective. These findings also indicate that the implementation of formal measures (such as training, technologies, and communication systems) must be aligned with employees' real experiences, active involvement, consultation, and continuous feedback.

### 3.2. Differentiation of Thematic Infection Control Implementation Assessments in the Healthcare Workers' Survey

To determine whether healthcare workers assess aspects of infection control implementation differently, a non-parametric comparison of means was conducted using the Friedman test. This method was chosen because the evaluations involved the same respondent groups across different thematic areas, and the data did not meet the assumptions of normality.

*7 table. Means and Standard Deviations of Thematic Infection Control Aspects According to Healthcare Workers' Evaluations*

Thematic group	Mean	Standard Deviation
Infection control	3.5	0.36
Training and preparedness	3.48	0.31
Workload and challenges	3.85	0.35
Psychosocial support	3.67	0.36
Communication	3.2	0.5
Technologies	2.83	0.33

The results revealed statistically significant differences between the thematic groups ( $\chi^2(5) = 819.21, p < 0.001$ ), indicating that respondents assess infection control, preparedness, workload, emotional support, communication, and technological application in significantly different ways. These findings underscore the need to analyze each thematic group separately to understand which areas are the strongest and which require targeted systemic improvements (see Table 7).

The analysis of the provided data reflects healthcare workers' evaluations of infection control implementation practices, based on five key aspects related to knowledge, behavior, resource availability, and organizational preparedness.

The highest-rated statement was: *"There is always a sufficient supply of personal protective equipment in my institution"* (M = 4.19; SD = 0.74), suggesting that most respondents consider PPE availability to be adequate — a crucial factor in ensuring a safe work environment during epidemics (see Table 8).

The statement *"I know and understand the main infection control protocols"* also received a relatively high rating (M = 3.77; SD = 0.83), indicating that employees feel they have sufficient theoretical knowledge of preventive measures. However, having knowledge does not necessarily translate into consistent practice (see Table 8).

This is supported by the lower score for the statement *"I always follow hand hygiene requirements, even under high workload"* (M = 3.12; SD = 1.00), which reflects variations in behavior depending on work conditions. The high standard deviation indicates a wide range of responses — some employees consistently adhere to protocols, while others do not (see Table 8).

The statement *"Infection control measures are implemented clearly and consistently"* was rated less favorably (M = 2.82; SD = 0.89), suggesting that organizational decisions on implementing measures often lack structure or are not communicated effectively to staff (see Table 8).

A moderately rated statement was *"In case of an outbreak, our institution quickly adapts infection control measures"* (M = 3.59; SD = 0.49), indicating that employees generally view the institution's responsiveness positively, although they may still observe gaps in practical execution (see Table 8).

**Table 8.** Healthcare Workers' Evaluations of Infection Control Aspects by Means and Standard Deviations

No.	Statement	Mean	Standard Deviation
1	I know and understand the main infection control protocols	3.77	0.83
2	I always follow hand hygiene requirements, even under high workload	3.12	1.0
3	There is always a sufficient supply of personal protective equipment in my institution	4.19	0.74
4	Infection control measures are implemented clearly and consistently	2.82	0.89
5	In the event of an outbreak, our institution quickly adapts infection control measures	3.59	0.49

The lowest-rated statement, *"Infection control training is held regularly in my institution"* (M = 2.48; SD = 0.74), indicates that a significant portion of employees believe such training is not conducted frequently enough. This may reflect a lack of systemic consistency or unequal access to training across institutions or departments (see Table 9).

Meanwhile, the statement *"Infection control training is relevant and applicable in practice"* (M = 3.14; SD = 0.73) received a slightly higher, but still only moderate, rating. This suggests that even when training is provided, its content may not always align with employees' real needs or daily challenges (see Table 9).

The statement *"I am sufficiently prepared to respond to an infectious crisis"* was rated relatively high (M = 3.89; SD = 0.66), indicating employees' confidence in their abilities, which may be based not only on training but also on professional experience or independently acquired knowledge (see Table 9).

The statement *"The management encourages participation in training and provides opportunities for it"* (M = 3.41; SD = 0.69) reflects a moderate level of managerial involvement — employees recognize the encouragement, though it may be formal or inconsistently implemented (see Table 9).

The highest-rated statement was *"After the training, confidence in my knowledge increases"* (M = 4.48; SD = 0.60), indicating that when training does occur, its impact on employees' self-confidence and sense of preparedness is significant. This underscores the importance of training in strengthening professional readiness (see Table 9).

**Table 9.** Means and Standard Deviations of Infection Control Training and Preparedness Evaluations

No.	Statement	Mean	Standard Deviation
6	Infection control training is held regularly in my institution	2.48	0.74
7	Infection control training is relevant and applicable in practice	3.14	0.73
8	I am sufficiently prepared to respond to an infectious crisis	3.89	0.66
9	The management encourages participation in training and provides opportunities for it	3.41	0.69
10	After the training, confidence in my knowledge increases	4.48	0.6

An analysis of respondents' answers by key thematic groups revealed significant differences in the evaluation of infection control implementation aspects. The highest mean score ( $M = 3.85$ ;  $SD = 0.35$ ) was found in the *“Workload and Challenges”* thematic group, suggesting that during epidemics, healthcare workers are most affected by excessive workloads, task mismatches with their competencies, and the resulting physical and emotional exhaustion.

The *“Psychosocial Support”* area also received a relatively high evaluation ( $M = 3.67$ ;  $SD = 0.36$ ), indicating elevated levels of anxiety, stress, and moral distress among employees. However, their assessments of emotional support from management remain critical (see Table 10).

**Table 10.** Means and Standard Deviations of Workload and Epidemic-Related Challenge Evaluations

No.	Statement	Mean	Standard Deviation
11	During epidemics, my workload increases significantly	4.35	0.6
12	During work, I often have to perform tasks that are beyond my competence	2.64	1.04
13	During epidemics, there is often a staff shortage in the institution	4.12	0.61
14	Due to a high workload, I fail to comply with all hygiene requirements	3.9	0.87
15	Working conditions during epidemics often cause physical or emotional exhaustion	4.26	0.78

The highest mean score was recorded for the statement *“During epidemics, I feel anxious about the possibility of infecting my family members”* ( $M = 4.59$ ;  $SD = 0.49$ ), indicating an almost unanimous emotional sensitivity and strong stress among respondents, tied to their sense of responsibility not only in the workplace but also for the safety of their loved ones. This is one of the most significant psychosocial factors affecting employees' emotional well-being during pandemics (see Table 11).

The statement *“I feel stressed when I am unable to provide comprehensive support to a patient”* also received a high score ( $M = 4.15$ ;  $SD = 0.60$ ), reflecting strong moral distress stemming from professional limitations or resource shortages, which directly impact emotional balance (see Table 11).

The statement *“I have received support or counseling for emotional difficulties during work”* was rated at a moderate level ( $M = 3.72$ ;  $SD = 0.77$ ); however, this does not necessarily indicate

adequate support — the wide spread of responses suggests varying experiences with access and effectiveness (see Table 11).

Lower mean scores were recorded for two statements related to organizational support: “*My institution provides psychological support to employees during a crisis*” (M = 3.21; SD = 0.96) and “*The management takes care of employees’ emotional well-being during an epidemic*” (M = 2.68; SD = 0.87). These results suggest that institutional support is often perceived as insufficient, even when some forms of assistance are present. The particularly low rating for management’s involvement in emotional well-being raises concerns about the level of leadership sensitivity and empathy during crisis situations (see Table 11).

**Table 11.** Means and Standard Deviations of Psychosocial Support and Emotional Well-Being Evaluations in the Context of Epidemics

No.	Statement	Mean	Standard Deviation
16	During epidemics, I feel anxious about the possibility of infecting my family members	4.59	0.49
17	My institution provides psychological support to employees during a crisis	3.21	0.96
18	I feel stressed when I am unable to provide comprehensive support to a patient	4.15	0.6
19	The management takes care of employees' emotional well-being during an epidemic	2.68	0.87
20	I have received support or counseling for emotional difficulties during work	3.72	0.77

It is noteworthy that the lowest mean scores were recorded in the “*Communication*” (M = 3.20; SD = 0.50) and “*Technology*” (M = 2.83; SD = 0.33) groups. This suggests that employees frequently face difficulties with unclear information transfer, rapidly changing guidelines, and a lack of trust in formal communication channels. The low technology rating implies that, although certain digital or automated systems may be in place, they are not perceived as sufficiently effective or practically useful in daily work. This may indicate a lack of technological readiness, training, or user interface effectiveness (see Table 12).

The lowest-rated statement was “*During epidemics, information about new directives is clear and provided in a timely manner*” (M = 2.39; SD = 0.79). This indicates that a significant number of respondents experience a lack of timely or sufficient information, which may hinder their ability to quickly adapt to changing infection control requirements (see Table 12).

In contrast, the statement “*Guidelines often change and are insufficiently explained*” received a high rating (M = 3.71; SD = 0.68), reflecting respondents' uncertainty and potential confusion caused by constantly changing instructions. This may contribute to ineffective infection management when staff lack clear direction on how to act in specific situations (see Table 12).

One of the highest mean scores was observed for the statement “*I often have to rely on information from colleagues or social networks*” (M = 3.95; SD = 1.05). This raises concern, as it indicates, the dominance of informal—and potentially unreliable—sources of information, which

could lead to poor decision-making or even the spread of misinformation during pandemics (see Table 12).

The statement *“My institution has an effective communication channel between management and staff”* received a low score (M = 2.71; SD = 0.79), suggesting that formal communication channels are often perceived as ineffective. This points to a systemic lack of communication between management and employees (see Table 12).

Finally, the statement *“I feel informed about the situation and potential threats”* received a moderate score (M = 3.25; SD = 1.10), but the relatively high standard deviation reveals significant variation in responses — while some employees feel well-informed, others do not feel informed at all (see Table 12).

**Table 12.** Means and Standard Deviations of Communication Quality and Awareness Evaluations During Epidemics

No.	Statement	Mean	Standard Deviation
21	During epidemics, information about new directives is clear and provided in a timely manner	2.39	0.79
22	Guidelines often change and are insufficiently explained	3.71	0.68
23	I often have to rely on information from colleagues or social networks	3.95	1.05
24	My institution has an effective communication channel between management and staff	2.71	0.79
25	I feel informed about the situation and potential threats	3.25	1.1

The lowest-rated statement was *“My institution encourages the implementation of new infection prevention solutions”* (M = 2.25; SD = 0.92). This result indicates that employees rarely perceive active institutional initiative in innovation, which may hinder the integration of technologies into daily practice. Similarly low was the evaluation of the statement *“The technologies used in my institution help manage infection risks more effectively”* (M = 2.35; SD = 0.81), reflecting skepticism about the actual usefulness of technology in the context of infection control (see Table 13).

The statement *“Technologies make daily work easier and help ensure better adherence to protocols”* was also rated low (M = 2.54; SD = 1.22), and the high standard deviation suggests a wide range of responses — indicating diverse employee experiences and differing perceptions of the impact of technology depending on specific work environments (see Table 13).

A somewhat better rating was given to the statement *“I have been trained to use technological solutions related to infection control”* (M = 3.03; SD = 0.92), though the mean still reflects only moderate confidence in preparedness, which may limit practical technology application (see Table 13).

One statement stood out with a high rating: *“Technological tools (e.g., hand hygiene monitoring) are effective”* (M = 3.98; SD = 0.61). This indicates that certain specific technologies are

viewed favorably, but this positive assessment does not extend to a broader view — likely due to systemic or organizational barriers (see Table 13).

**Table 13.** Means and Standard Deviations of Technology Application Evaluations for Infection Control

No.	Statement	Mean	Standard Deviation
26	The technologies used in my institution help manage infection risks more effectively	2.35	0.81
27	Technological tools (e.g., hand hygiene monitoring) are effective	3.98	0.61
28	I have been trained to use technological solutions related to infection control	3.03	0.92
29	Technologies make daily work easier and help ensure better adherence to protocols	2.54	1.22
30	My institution encourages the implementation of new infection prevention solutions	2.25	0.92

After conducting the Friedman test and confirming that the thematic group means differed significantly, pairwise Wilcoxon tests with Bonferroni correction were applied to determine which specific thematic areas differed from one another. The post-hoc analysis revealed that nearly all pairwise group combinations differed significantly (adjusted  $p < 0.05$ ) (see Table 14).

Among the most notable differences were the evaluations for the “*Infection Control*” group, which significantly differed from all other thematic areas: workload and challenges ( $p < 0.001$ ), psychosocial support ( $p < 0.001$ ), communication ( $p < 0.001$ ), technologies ( $p < 0.001$ ), and even training and preparedness (adjusted  $p = 0.041$ ). These differences suggest that employees perceive infection control as a distinct and uniquely evaluated area, with relatively higher ratings in terms of perceived importance and implementation (see Table 14).

Similarly, the “*Training and Preparedness*” group significantly differed from all other thematic groups (all adjusted  $p$ -values  $< 0.001$ ), except for infection control, where the difference was also significant but weaker. This confirms that employees view training as a separate domain — while closely related to infection control knowledge, its practical impact and implementation are assessed differently (see Table 14).

The “*Workload and Challenges*” group significantly differed from all others — especially from communication and technology groups. These differences highlight that employees clearly separate their practical and emotional burdens from other organizational or systemic issues. Strong differences were also found between “*Psychosocial Support*” and both “*Communication*” and “*Technology*” topics (adjusted  $p < 0.001$ ), indicating that the emotional well-being dimension is experienced differently than information dissemination or technological implementation (see Table 14).

Finally, the significant difference between “*Communication*” and “*Technology*” ( $p < 0.001$ ) showed that employees perceive these two lowest-rated areas as independent and uniquely

problematic — one related to the human aspect of information transmission, the other to systemic tools and their effectiveness (see Table 14).

**Table 14.** Analysis of Differences Between Thematic Groups Using the Wilcoxon Test with Bonferroni Correction

<b>Thematic Group (1)</b>	<b>Thematic Group (2)</b>	<b>p value</b>	<b>p (corrected)</b>	<b>Significant</b>
Infection control	Workload and Challenges	0.0	0.0	*
Infection control	Psychosocial Support	0.0	0.0	*
Infection control	Communication	0.0	0.0	*
Infection control	Technologies	0.0	0.0	*
Training and Preparedness	Workload and Challenges	0.0	0.0	*
Training and Preparedness	Psychosocial Support	0.0	0.0	*
Training and Preparedness	Communication	0.0	0.0	*
Training and Preparedness	Technologies	0.0	0.0	*
Workload and Challenges	Psychosocial Support	0.0	0.0	*
Workload and Challenges	Communication	0.0	0.0	*
Workload and Challenges	Technologies	0.0	0.0	*
Psychosocial Support	Communication	0.0	0.0	*
Psychosocial Support	Technologies	0.0	0.0	*
Communication	Technologies	0.0	0.0	*
Infection control	Training and Preparedness	0.0027	0.0412	*

The significant differences observed between all thematic groups indicate that healthcare workers perceive the implementation of infection control as a complex phenomenon composed of many distinct, independently experienced factors. These results highlight the necessity of applying multilayered interventions that focus not only on training and technology but also on improving emotional well-being, communication clarity, and working conditions.

The study revealed that healthcare workers' preparedness and experience in implementing infection control measures in nursing hospitals is a multifaceted phenomenon shaped by theoretical knowledge, practical conditions, emotional climate, institutional support, communication effectiveness, and technological integration. Correlational analysis showed that employees' behavior often does not align with their declared knowledge — theoretical understanding of protocols does not always translate into adherence, especially under increased workload or emotional exhaustion. Crucial links emerged between infection control measures and organizational structure, showing that employees view institutional response more positively when appropriate protective equipment is available and hygiene requirements are implemented clearly and consistently.

The analysis of training and preparedness demonstrated that frequent training does not necessarily correlate with perceived value or employee confidence. In some cases, negative correlations between training relevance and management encouragement were found, suggesting the dominance of formal but ineffective initiatives. This underlines the need to reorient training content toward practical applicability and personalized delivery.

The workload and challenges domain exhibited strong correlations related to physical and emotional exhaustion, hygiene non-compliance, and task-competency mismatches. These factors

clearly contribute to reduced effectiveness of infection control and pose risks not only to employee health but also patient safety. Psychosocial indicators were closely linked to anxiety levels, stress, and the evaluation of management support, indicating that employees' emotional well-being during epidemics is inseparable from the quality of institutional response.

The communication domain revealed employees' reliance on informal information sources — colleagues or social networks — which may result from inadequate trust in official channels or the incomprehensibility of frequently changing guidelines. Although formal communication structures exist, the study showed they do not always ensure quality, relevance, or timeliness of content delivery.

The assessment of technologies was especially contradictory — mostly negative but significant correlations were found among various technological aspects. This suggests that the mere presence of technologies is insufficient — their effectiveness, proper employee training, and user-friendly integration must be ensured. Otherwise, technologies become an additional challenge rather than an aid.

Summarizing the quantitative data, employees rated workload and challenges the highest, and technologies and communication the lowest. The Friedman test showed statistically significant differences among all thematic groups ( $\chi^2(5) = 819.21, p < 0.001$ ), and post-hoc analysis further revealed that all pairwise group comparisons differ significantly ( $p < 0.05$ ). This confirms that employees evaluate each dimension of infection control implementation differently and that these evaluation differences are systematic.

Overall, the study supports the view that the effectiveness of infection control strategies depends not only on formal decisions but also on their real-world application, employees' psychosocial well-being, inclusion, and inter-institutional cooperation. To respond effectively to infectious threats, it is necessary not only to strengthen the foundation of training and technologies but also to consistently invest in employees' emotional support, communication culture, and improvement of working conditions.

## DISCUSSION

The study identified a significant discrepancy between healthcare workers' self-reported knowledge of infection control protocols and their actual behavior, especially under increased workload. A negative correlation between knowledge and hygiene compliance ( $r = -0.28$ ) suggests that theoretical knowledge does not necessarily ensure behavioral change in practice. This finding aligns with previous research; for example, Erasmus et al. (2010) found in a systematic review that although workers were aware of the importance of hand hygiene, the median compliance rate was only about 40%, revealing a clear gap between knowledge and behavior. Similar trends were noted by Alzyood et al. (2020), who emphasized that knowledge is necessary but insufficient for ensuring hygiene practices.

The literature highlights several factors contributing to this gap: workload, stress, organizational support, and the physical environment. The WHO (2009) stresses that hand hygiene in healthcare settings requires not only knowledge but also favorable structural conditions: easily accessible supplies, time, consistent reminders, and cultural reinforcement. In the current study, participants rated the implementation of infection control measures relatively low (mean 2.82), possibly explaining the insufficient alignment of behavior with theory.

A strong positive correlation was found between clearly implemented infection control measures and employees' hand hygiene behavior ( $r = 0.56$ ). This is consistent with Aboelela et al. (2007), who showed that clear organizational procedures (e.g., clearly marked hygiene zones, availability of disinfectants) significantly increase compliance with preventive measures. These data indicate that the organizational environment plays a crucial role in sustaining behavior — as also confirmed by Pittet et al. (2000), who demonstrated that infrastructural solutions (e.g., installation of alcohol-based hand rub dispensers) can double compliance rates even without additional training.

Conversely, a negative correlation between hand hygiene compliance and institutional response to outbreaks ( $r = -0.55$ ) may reflect a more critical attitude among more conscientious employees. A similar pattern was observed by Rowe et al. (2021), where workers adhering to preventive measures expressed greater distrust in institutional preparedness for emergencies, especially when information was unstable or management responded inconsistently. This suggests that hand hygiene adherence is related not only to knowledge but also to personal responsibility and critical thinking.

A weak but significant positive correlation between availability of personal protective equipment (PPE) and organizational response to outbreaks ( $r = 0.17$ ) aligns with findings from other studies. Kim et al. (2018) highlighted that availability of supplies is one of the most important factors influencing employee trust in institutional support. Their study in South Korean hospitals showed that

even a small risk of PPE shortage significantly reduces employee engagement in infection control activities. These findings demonstrate that employees perceive infection control efforts holistically — considering not only formal actions but also accessibility and practical usefulness.

The training and preparedness domain revealed the importance not only of training frequency but also of quality. A negative correlation between training frequency and perceived relevance ( $r = -0.18$ ) reflects that frequent but irrelevant or formally conducted trainings may not only be unhelpful but also cause frustration among employees. Chughtai et al. (2020) similarly reported that frequent, monotonous, or unreflective training during COVID-19 led to fatigue and resistance among staff, especially when content did not reflect real clinical practice.

A positive correlation between training frequency and confidence in knowledge ( $r = 0.20$ ) indicates that training remains important if delivered contextually and interactively. Houghton et al. (2020) emphasized in a systematic review that practical training methods (e.g., simulations, case analyses) are significantly more effective than purely theoretical seminars or lectures. Studies show that employee competence is strengthened not only by content volume but also by relevance and practical applicability.

Despite management efforts to encourage training ( $r = 0.35$ ), a negative correlation between management encouragement and employees' perception of training relevance ( $r = -0.27$ ) suggests a system of formal but ineffective trainings. Similar conclusions were drawn by Moyo et al. (2022), who studied nursing staff attitudes toward management-initiated COVID-19 trainings in Zimbabwe. Their data showed that compulsory training, regardless of staff experience or context, were met with skepticism, while voluntary, personalized education induced long-term behavioral changes.

Negative correlations were also found between training, preparedness, and confidence — suggesting that some employees rely more on self-directed preparation or practical experience than formal education. This trend is supported by Brandt et al. (2021), who noted that during the pandemic, many employees acquired knowledge not from official sources but through colleagues' experiences, informal discussions, and practical trials.

The study found a strong positive correlation between non-compliance with hygiene requirements and physical or emotional exhaustion ( $r = 0.59$ ,  $p < 0.001$ ), indicating that fatigued employees are less likely to adhere to infection control rules. These findings align with previous international studies. For example, Wang et al. (2021) reported that nursing staff experiencing burnout and fatigue were less likely to comply with standardized protective measures, especially during the pandemic. Their study of 512 nurses in China showed that emotional exhaustion reduces concentration in hygiene activities, increasing the risk of hospital-acquired infections.

Cohen et al. (2020) also noted that exhaustion causes not only behavioral but also value priority changes — employees tend to focus on life-saving tasks while neglecting preventive measures such as proper PPE use or surface disinfection.

Another important aspect is the impact of tasks that do not match employees' competencies on their emotional state and infection control. The study found a strong negative correlation between tasks outside one's competence and emotional exhaustion ( $r = -0.49$ ,  $p < 0.001$ ), as well as between such tasks and non-compliance with hygiene requirements ( $r = -0.29$ ,  $p < 0.001$ ). This suggests that employees forced to perform unfamiliar functions not only experience stress but also pay less attention to infection control.

This association is supported by international research. A UK study with NHS workers (Cousins et al., 2022) showed that frequent role changes between departments during the pandemic and task-qualification mismatches significantly contributed to errors in infection control and reduced patient trust in staff.

Similar findings were presented by Muller et al. (2021), who studied hospitals in 14 European countries: employees who felt inappropriately assigned to tasks were nearly twice as likely to ignore protocol requirements for protective equipment.

Furthermore, increased workload, as revealed by Lithuanian study data ( $r = 0.48$ ,  $p < 0.001$ ), is directly linked to exhaustion and thus a higher risk of infection spread. This trend is characteristic not only for nursing but also for intensive care units. For example, an Italian study (Sperling et al., 2020) found that up to 60% of nurses felt so exhausted that they could not properly perform all infection control procedures, especially during long shifts.

This study also revealed complex but statistically significant relationships between employees' psychosocial well-being and their perceptions of institutional support effectiveness. One of the most important findings is a very strong correlation between stress due to insufficient patient support and management's emotional support ( $r = 0.72$ ,  $p < 0.001$ ), indicating that moral distress is not an isolated emotional state but directly related to the organization's ability to respond to a crisis concerning employees.

These data align with Chen et al. (2021) study conducted in Singapore public hospitals, where employees experiencing moral distress from inadequate patient care during the pandemic rated organizational support as significantly more important. The study emphasized that emotional support can compensate for certain objective service quality deficiencies if employees feel their psychological state is a priority for the organization.

However, Lithuanian data also showed significant negative correlations, especially between anxiety about infecting family members and management's emotional well-being assurance ( $r = -0.47$ ,  $p < 0.001$ ), as well as between declared institutional support and actual help received ( $r = -0.11$ ,

$p = 0.005$ ). These results reflect employees' critical view of publicly declared institutional actions, which do not always translate into real assistance. A similar situation was recorded in Germany, where a study (Schug et al., 2022) showed that only 42% of respondents felt they had "truly received" promised emotional support from management, although institutions declared well-developed support systems.

Another important aspect is the availability of emotional support and its relation to employees' emotional state. The Lithuanian study found a positive correlation between received emotional help and experienced anxiety ( $r = 0.39$ ,  $p < 0.001$ ), which may be explained by more vulnerable employees seeking support more frequently. This connection is reinforced by international data. For example, a South Korean study (Lee et al., 2020) reported that high anxiety levels were one of the main predictors of employees seeking psychological counseling during the pandemic. However, these results also show that receiving emotional support is not automatically associated with anxiety reduction — it is necessary to assess not only service availability but also quality, timeliness, and fit to individual needs.

Special attention should be paid to differentiating sources of anxiety. The Lithuanian study showed that anxiety about family members' health and stress due to patient care are not uniform phenomena — a negative correlation was found between them ( $r = -0.29$ ,  $p < 0.001$ ), consistent with foreign research findings. For example, a Canadian study (El-Hage et al., 2021) revealed that employees internalize pandemic impacts differently — some worry mostly about professional duties, others about personal life, and these groups require different types of interventions.

Another significant observation is that counseling and emotional support initiatives do not always originate from the institution. The Lithuanian study noted a negative correlation between received help and management's care ( $r = -0.25$ ,  $p < 0.001$ ), suggesting that initiatives often come from employees themselves. Such a trend was observed in Sweden (Ekman et al., 2021), where up to 60% of healthcare workers sought psychological support privately or via informal channels rather than through their employer. These findings show that the mere presence of psychosocial support systems in an organization does not guarantee their effective functioning.

The relationship between workload, psychological burnout, and adherence to infection control is widely discussed in empirical studies. The significant correlation found between physical and emotional exhaustion and non-compliance with hygiene requirements aligns with trends seen in international literature. A study conducted during the COVID-19 pandemic in Spanish healthcare facilities found that high workload, resource shortages, and prolonged emotional tension significantly increased the risk of hand hygiene violations (González-Gil et al., 2021). This phenomenon relates not only to physical fatigue factors but also to moral distress, which arises when employees face professional limitations or unattainable tasks.

The negative correlation between tasks not matching employees' competencies and their emotional state — as well as the direct link to hygiene non-compliance — also corresponds with observations by other authors. For example, Brooks et al. (2020) demonstrated that employees experiencing task shifting beyond their competency were more likely to omit essential safety protocols because they did not know how to behave in unfamiliar situations, and managerial support was often insufficient. Such conditions create an “organizational insecurity” environment that weakens trust both in one's own work and in the institution's preparedness to respond to crises.

A statistically significant relationship between staff shortages and employee fatigue confirms the importance of structural issues. A Canadian study showed that imbalances in healthcare workforce numbers during crises are associated with increased risk of work errors and emotional exhaustion, especially in long-term care facilities (Smaggus et al., 2021). These findings indicate that infection control cannot be considered separately from human resources policies, it is an integral part of the system requiring sustainable, pre-planned strategies.

An interesting insight from the correlation analysis was the negative association between workload and task-competency mismatch. This dichotomy allows distinguishing two different employee groups: some feel challenged by the volume of tasks, others by the nature of tasks. This duality is also observed in studies from other countries. For example, Jankelová et al. (2022) found that during the pandemic, employees assigned unclear or improperly distributed tasks showed significantly lower emotional resilience and were more likely to violate control procedures.

These connections clarify that infection control is not merely a matter of training or information. It is a multifaceted issue where psychosocial, organizational, and professional factors interact, influencing employees' decision quality, risk perception, and practical behavior. It is especially important to recognize that effective infection control requires consistent monitoring of employee psychological health and comprehensive psychosocial interventions.

The importance of psychological well-being and institutional support for healthcare workers' resilience during infectious outbreaks is increasingly recognized internationally. The strong correlation found between stress due to insufficient patient support and management's emotional support ( $r = 0.72$ ,  $p < 0.001$ ) is particularly significant—it confirms that employees facing moral distress view emotional support as a key protective factor. Similar findings were reported by Greenberg et al. (2020), who, summarizing COVID-19 experiences in the UK, emphasized that moral distress—feeling unable to provide adequate care due to systemic barriers—often causes long-term emotional discomfort, whose management depends on psychological support availability and organizational culture.

A positive correlation between employees' anxiety about infecting family members and seeking emotional support within the institution ( $r = 0.39$ – $0.49$ ,  $p < 0.001$ ) reveals that this type of

anxiety can be an important motivating factor driving employees to seek help. This is consistent with studies conducted in Italy at the pandemic's start, where healthcare workers experiencing strong family-related anxiety more frequently used emotional support resources (Di Tella et al., 2020). However, a significant negative correlation between anxiety and management's actions assessment ( $r = -0.47, p < 0.001$ ) shows that anxious employees may be more critical of institutional actions. This dual phenomenon was also observed in South Korean studies, which noted that emotional tension raises employee expectations toward management (Kang et al., 2021).

Another important aspect is the negative relationship between declared organizational support and actual help received ( $r = -0.11, p = 0.005$ ), suggesting formalism of organizational measures. This issue often arises when help offered to employees is theoretically available but not tailored to real needs. Similar tendencies were highlighted by a US study with hospital staff, where official support programs were often criticized as inadequate for the emotional difficulties faced by employees (West et al., 2020).

The communication domain also showed significant results. A strong positive correlation between trust in informal sources (colleagues or social networks) and awareness of threats ( $r = 0.57, p < 0.001$ ) indicates that employees actively seek alternative information when formal sources are considered unreliable or inaccessible. This phenomenon, called the “compensatory mechanism of information decentralization,” was described during the COVID-19 pandemic in Israeli and US contexts (Miller et al., 2021; Chen et al., 2020). While such behavior may increase the sense of awareness, it also poses risks of inaccuracies and misinformation spread.

A negative correlation between communication channel effectiveness and information clarity ( $r = -0.35, p < 0.001$ ) suggests that the existence of effective communication structures does not guarantee content quality. This aligns with findings from a Danish study emphasizing that employees value not the quantity but the consistency and practical applicability of information (Hølge-Hazelton et al., 2021). Additionally, a positive correlation between guideline ambiguity and formal communication channel effectiveness ( $r = 0.31, p < 0.001$ ) shows that frequent unexplained changes in guidelines cause confusion even when a structure exists.

Notable and significant associations were found between formal channel effectiveness and the sense of awareness ( $r = 0.15, p < 0.001$ ), but their weakness reveals that trust in formal means remains low. These results emphasize the need to strengthen not only technical communication tools but also the emotional aspect—employees must feel that the information provided is understandable, relevant, and conveyed with empathy.

Negative correlations between the presence of technologies and their subjectively perceived benefits allow important conclusions about the quality of integration of these solutions. A negative correlation between the perception that technologies help manage infection risks more effectively and

trust in technological tools such as hand hygiene monitoring systems ( $r = -0.40, p < 0.001$ ) reveals a trust crisis between the theoretical advantage of innovations and their real benefit in practice. Such a problem was identified in a Japanese study, which showed that healthcare workers were skeptical about the effectiveness of hygiene monitoring sensors if their principles and purposes were not explained (Fujita et al., 2021).

A significant relationship between the effectiveness of technological equipment and training level ( $r = -0.37, p < 0.001$ ) also indicates a gap between the implementation of technological solutions and the preparedness of human resources to apply them. The less trained the employees feel, the less effective they consider the tools. This finding is supported by other studies—for example, Singh et al. (2022) analyzed the integration of artificial intelligence solutions in infection control in India and concluded that technological tools do not create added value without sufficient attention to employee training and clear adaptation of work processes.

A positive correlation was also found between employees' evaluation of technologies and institutional promotion of innovation ( $r = 0.24, p < 0.001$ ), indicating that workers' attitudes are sensitive to organizational support. When an institution actively promotes innovation and communicates its benefits, employees tend to view technology use more favorably. Similar results were reported by Lee et al. (2021) in South Korean hospitals, where institutions conducting innovation integration campaigns received significantly higher employee trust scores in technologies compared to those implementing solutions quietly or formally.

A negative correlation between how much technologies ease daily work and their impact on infection control quality ( $r = -0.25, p < 0.001$ ) may be explained by the fact that solutions are not adapted to the specific workflows of nursing hospitals. This aligns with findings by Lavin and Harper (2020), who showed that technology effectiveness decreases when user interfaces do not align with real nursing practice environments.

Another critical issue is the negative correlation between employee training and institutional encouragement to implement innovations ( $r = -0.30, p < 0.001$ ), suggesting that some institutions introduce digital solutions without providing adequate training to use them. These results highlight a dangerous paradox: innovations are formally integrated but do not fulfill their function effectively due to neglect of the human factor. This problem was discussed in German healthcare systems (Haesner et al., 2021), where employee resistance—stemming from lack of knowledge and distrust—was identified as the main barrier to innovation.

Finally, although a weak but significant positive correlation was observed between the daily usefulness of technologies and their effectiveness ( $r = 0.17, p < 0.001$ ), this link is insufficient to claim comprehensive technological support for infection prevention. This confirms the trend that

technologies often function as auxiliary tools but are not seen as critical success factors—except when carefully integrated, tailored to employees’ needs, and clearly explained to them.

Study data revealed that workload and challenges are among the most significant factors affecting adherence to infection control in nursing facilities. This conclusion aligns with many international studies stating that increased workload during pandemics is a key contributor to gaps in infection control (Labrague & De los Santos, 2021). The strong correlation between physical or emotional exhaustion and hygiene non-compliance ( $r = 0.59$ ,  $p < 0.001$ ) indicates that even employees with theoretical knowledge are not always able to apply necessary measures due to psychophysical fatigue.

This phenomenon can be explained by the Job Demand–Resources model, which posits that employee behavior depends on the balance between resources and demands (Demerouti et al., 2001). When workload exceeds organizational and personal capacity, there is a risk that even essential safety rules will be ignored. For example, a study during the COVID-19 pandemic in the UK showed that doctors and nurses working long shifts without adequate rest were significantly more likely to violate hygiene standards (Shaw et al., 2022).

Another pronounced problem—task-competency mismatch—emerged as a significant factor contributing to burnout. The negative correlation between such tasks and exhaustion ( $r = -0.49$ ,  $p < 0.001$ ) confirms that employees performing activities outside their professional competence experience greater stress and emotional discomfort. Similar results were found in Italy, where nurses assigned to infection control or administrative tasks outside their usual roles experienced stronger psychological pressure and more frequently neglected preventive actions during the pandemic (Bagnasco et al., 2021).

Not only task nature but also staff shortages appeared as a factor increasing emotional burden ( $r = 0.17$ ,  $p < 0.001$ ). Nurses perceiving insufficient colleagues were more prone to exhaustion, which correlates with non-compliance with infection control protocols. This is supported by a systematic review by Galehdar et al. (2020), which summarized that burnout and staff shortages are interrelated and cause a chain of organizational failures in infection management.

An interesting indirect association is the negative correlation between workload and task-competency mismatch ( $r = -0.32$ ,  $p < 0.001$ ), possibly indicating two different problems—some employees feel overloaded by quantity, others by the qualitative mismatch of tasks. This dual burden is often overlooked when planning infection control activities but directly affects decision quality and behavior (Tan et al., 2020).

Another important aspect is the decline in hygiene compliance directly linked to exhaustion ( $r = 0.59$ ) and task mismatch ( $r = -0.29$ ). This means employees forced to perform tasks outside their competence are less able or willing to follow standard procedures. This tendency was confirmed by

Chen et al. (2022), who found in China that employees working in “multifunctional roles” more often missed hand hygiene or PPE use requirements.

Considering all these connections, formal training or technology integration alone is insufficient—systematic management of workload, task allocation according to competence, and psychosocial support are necessary to ensure infection control is effectively implemented rather than merely declared.

The study results showed that employees’ emotional state is inseparable from their ability to adhere to infection control requirements. This link is especially evident given the strong correlation between emotional distress caused by insufficient patient care and management’s emotional support rating ( $r = 0.72$ ,  $p < 0.001$ ). This suggests that employees facing moral stress become more sensitive to institutional responses—if support is felt, their evaluations are more positive.

Similar trends were revealed by studies in other countries. For example, a US study showed that moral distress arising from inability to ensure quality care during the pandemic was closely linked to emotional exhaustion and anxiety levels, and supportive management significantly mitigated this negative effect (Kisely et al., 2020).

Another significant aspect is anxiety about infecting family members, which correlated both organizational psychological support ( $r = 0.49$ ) and actual emotional help received ( $r = 0.39$ ). This indicates that the epidemic poses not only professional but also personal challenges for employees, and availability of psychological support is a crucial factor for their resilience. Data from Singapore showed that during the COVID-19 pandemic, healthcare workers were often more afraid of infecting loved ones than of their own health (Tan et al., 2020).

However, the analysis also revealed significant negative correlations reflecting gaps in institutional support. Anxiety negatively correlated with management efforts to ensure emotional well-being ( $r = -0.47$ ), suggesting that anxious employees may be more critical of organizational communication and support. This result aligns with literature indicating that when employees do not feel empathy or real support from management, their subjective emotional discomfort deepens even if formal support structures exist (Spoorthy et al., 2020).

Moreover, a significant negative correlation between declared institutional support and actual help received ( $r = -0.11$ ) suggests a mismatch between institutional communication and real assistance. This reflects the “support facade” phenomenon—when an organization formally declares care for employees, but subjective experiences show that support is inaccessible, bureaucratic, or ineffective. This phenomenon was described by Greenberg et al. (2020), who argued that emotional support effectiveness depends not on its existence but on the quality of implementation.

A strong correlation between stress related to patients and access to counseling ( $r = 0.16$ ) suggests that the direct connection to patient suffering is one of the factors motivating healthcare

workers to seek psychological help. This aligns with a study in South Korea where specialists caring for COVID-19 patients identified patient death and the inability to help as the primary stressors prompting the need for psychological intervention (Lee et al., 2020).

Equally important is the dissonance between the emotional support declared by management and its actual implementation. A negative correlation between management's care for employee well-being and the help received ( $r = -0.25$ ,  $p < 0.001$ ) implies that in some institutions employees distrust management's intentions or fail to see real actions matching those declarations.

In summary, psychosocial support must be an integral part of infection control strategies. Its absence or inadequacy not only weakens employees' psychological resilience but also reduces their engagement in adhering to safety measures. Therefore, it is essential not only to establish institutional support systems but also to ensure their quality, individualized, and easily accessible implementation.

Study results showed that communication between management and healthcare workers during epidemics is often fragmented and does not meet employee expectations. A significant positive correlation was found between trust in informal sources (colleagues or social media) and employees' awareness of the situation and possible threats ( $r = 0.57$ ,  $p < 0.001$ ). This suggests that when formal information transfer is insufficient, employees tend to rely on alternative, unofficial sources, which are not always reliable.

Similar tendencies are confirmed by international studies. De Brún et al. (2021) analyzed communication practices during the COVID-19 pandemic in the Irish health system and found that employees who did not receive timely information from management increasingly relied on colleagues' opinions or social networks. Such practices can pose risks — unofficial information is often incomplete or inaccurate, potentially leading to inappropriate responses to infectious outbreaks.

Another aspect of the study was a negative correlation between clarity/timeliness of information and communication channel effectiveness ( $r = -0.35$ ,  $p < 0.001$ ). At first glance, this may seem contradictory, but the explanation lies in content complexity: even if communication structures exist, the information they provide may be too abstract, frequently changing, or insufficiently explained. This phenomenon was described by Reynolds and Seeger (2005), who argued that crisis communication must be clear, consistent, and trust-based; otherwise, it increases confusion.

Data also showed that guideline ambiguity correlates positively with effectiveness ratings ( $r = 0.31$ ,  $p < 0.001$ ), and information seeking through colleagues correlates with distrust of formal channels ( $r = 0.12$ ,  $p = 0.003$ ). This reflects employees' tendency to seek alternative explanations when official communication does not meet their needs. Wray et al. (2008) analyzed this phenomenon in detail, emphasizing that technical information delivery alone is insufficient — emotional acceptance, contextualization, and two-way dialogue are also necessary.

Although a positive but weak correlation was found between the existence of formal communication channels and awareness ( $r = 0.15$ ,  $p < 0.001$ ), this confirms that structure alone does not guarantee effectiveness. According to Vaughan and Tinker (2009), effective crisis communication must not only convey information but also build trust, clearly explain decision logic, and engage employees in the overall operational context.

The study showed that formal communication infrastructure alone cannot be considered sufficient for shaping employee awareness and behavior. Communication quality, consistency, and adaptability to rapidly changing circumstances are critical factors for effective infection control. Insufficiently clear or contradictory information may encourage the use of unofficial sources, increasing the risk of misinformation.

Thus, forming effective communication should include:

1. Clear, structured, and visually comprehensible guidelines.
2. Employee involvement in communication processes — via feedback and Q&A sessions.
3. Building a culture of trust — information must be accurate, reliable, and empathetic.
4. Consistency and coordination across different management levels — reducing conflicting messages.

Study data show that healthcare workers' evaluation of technologies is ambivalent and often negatively correlates with their practical use or employees' readiness to use them. A significant negative correlation was found between the general assessment that technologies help control infection risk and the statement that specific technological tools (e.g., hand hygiene monitoring systems) are effective ( $r = -0.40$ ,  $p < 0.001$ ). This may reflect a problem of presence but non-functionality or inadequate use of technologies.

This trend is not region-specific. For example, a US study found that automatic hand hygiene monitoring systems were installed in many hospitals but had little impact on actual compliance unless combined with continuous feedback and training (Tschudin-Sutter et al., 2020). This means that technologies, though implemented, do not produce the desired effect without context and human factors.

A negative correlation between employees' training to use technologies and their evaluation ( $r = -0.15$ ,  $p < 0.001$ ) suggests that insufficient preparation is a major reason why technologies are not perceived as useful tools. Mahmood et al. (2021) found similar results analyzing nurses' attitudes toward electronic health systems — only those properly trained and provided with clear instructions rated and used the systems positively and effectively.

Also notable was a moderate negative correlation between technology evaluation and its impact on daily work ( $r = -0.25$ ,  $p < 0.001$ ). This indicates that employees often consider technologies an extra workload rather than a helping tool, especially if integration is not optimized or requires

additional time, effort, or learning. Podolsky and Zangaro (2022) revealed that automated infection monitoring systems were effective only in institutions with clear automation processes and IT support from management. Otherwise, employees felt burdened and skeptical about technological solutions.

However, the study also showed some positive aspects. A positive correlation was found between institutional encouragement of innovation and technology evaluation ( $r = 0.24, p < 0.001$ ), indicating that institutional support can foster a more favorable employee attitude toward innovations. Similarly, a positive link between technology effectiveness and daily usefulness ( $r = 0.17, p < 0.001$ ) shows that when technologies are clear, intuitive, and genuinely help comply with protocols, they are viewed more positively.

These results align with Bates et al. (2020), who argued that successful technology integration in healthcare depends on four main components: (1) employee involvement in implementation, (2) adequate training infrastructure, (3) simplification of technology use, and (4) implementation of feedback mechanisms.

Study results revealed significant relationships between increased workload, exhaustion, and failure to comply with infection control requirements. A strong correlation between hygiene non-compliance and emotional or physical exhaustion ( $r = 0.59, p < 0.001$ ) indicates a clear causal link between workload intensity and breaches in infection control behavior. This trend is typical worldwide — COVID-19 studies highlighted that burned-out healthcare workers more frequently ignore or fail to comply with infection control standards (Denning et al., 2021).

Another important finding was a strong negative correlation between tasks outside employees' competence and exhaustion ( $r = -0.49, p < 0.001$ ). This reveals that when employees are forced to perform functions beyond their qualifications, they experience additional emotional pressure, reduced self-confidence, and increased risk of errors. Chen et al. (2022) emphasized that during the pandemic nurses often worked outside their direct specialization, leading not only to emotional exhaustion but also to neglect of infection control protocols, especially in situations where they felt unprepared.

The increase in workload also positively correlates with fatigue ( $r = 0.48, p < 0.001$ ), which is not only a matter of psychological well-being — exhausted employees have less ability to focus on details, more frequently miss important hygiene steps, or forget to use personal protective equipment. An international meta-analysis found that fatigue significantly increases the risk of non-compliance with hand hygiene and other protective measures (Shah et al., 2021). This suggests that infection control must be considered not only through the lens of protocols or training but also at the levels of human resource management and psychosocial environment quality.

An interesting finding of the study is the negative correlation between workload and task-competency mismatch ( $r = -0.32, p < 0.001$ ), which can be interpreted as a dual experience: some employees feel burdened by the volume of work, others by the qualitative nature of tasks, i.e., unclear

or poorly allocated functions. According to Al Thobaity et al. (2020), excessive workload without clear structure during the pandemic often resulted in “functional chaos,” where employees did not understand their responsibilities, directly impacting preventive behavior.

Equally important is the negative correlation between tasks outside competency and hygiene non-compliance ( $r = -0.29$ ,  $p < 0.001$ ). This can be explained by employees lacking adequate knowledge or skills who are more often failing to comply with standard safety rules not out of negligence but due to insufficient preparation or unawareness of how to act in specific situations. Crossing competency boundaries increases feelings of insecurity, further weakening preventive behavior (Kim & Lee, 2022).

Finally, a significant positive correlation between workload and hygiene non-compliance ( $r = 0.17$ ,  $p < 0.001$ ) additionally confirms that even with theoretical knowledge or implemented measures, physical exhaustion is a major barrier to effective infection control. It is also important to note that high workload can reduce employee motivation to adhere to safety protocols, especially when they feel fatigued or emotionally drained (Keller et al., 2021).

The study results revealed that psychosocial support for healthcare workers during epidemics is a significant factor influencing their emotional state, stress, and ability to implement infection control actions. Particularly notable was the strong correlation between moral distress — stress caused by inability to provide comprehensive patient care — and emotional support provided by management ( $r = 0.72$ ,  $p < 0.001$ ). This highlights the important role of institutional response in maintaining employees’ emotional well-being.

Moral distress was one of the most prominent emotional phenomena among healthcare workers during the pandemic. Studies show that staff often felt helpless due to resource shortages, workload, or decisions that conflicted with their professional and ethical values (Morley et al., 2020). These factors contributed to increased anxiety, burnout, and even depressive symptoms, which are known to be associated with lower adherence to preventive measures (Kisely et al., 2020).

Indicators of anxiety about infecting family members also correlated with institutional support — both psychological support ( $r = 0.49$ ) and individually received counseling ( $r = 0.39$ ). This reflects employees’ vulnerability not only in the professional but also in the personal sphere. Such double pressure was especially common among nursing staff who already had higher emotional exhaustion levels before the pandemic (Schlak et al., 2021). This dependency between anxiety and receiving support indicates that employees with higher psychological burden more frequently seek help but may also be more sensitive to the lack of institutional support.

However, interesting and paradoxical results showed that anxiety about loved ones’ safety and management’s declared concern for employee emotional well-being correlated negatively ( $r = -0.47$ ,  $p < 0.001$ ). This can be interpreted as a trust issue in institutions: when employees feel anxious, they

become more critical of organizational actions, even if objective help exists. Such ambivalence was also identified by Greenberg et al. (2020), who found that during the pandemic, employees often did not associate with formal psychological support and felt emotionally “left out” due to communication gaps or impersonal approaches.

A negative correlation between declared institutional support and actual help received ( $r = -0.11$ ,  $p = 0.005$ ), as well as between management’s emotional support and individual help received ( $r = -0.25$ ,  $p < 0.001$ ), suggests that formally expressed support often does not correspond to real actions. This result aligns with other studies showing that healthcare institutions often lack mechanisms allowing employees to safely, anonymously, and effectively receive emotional support (Cabarkapa et al., 2020).

A weak but significant correlation between stress related to patients and receiving consultations ( $r = 0.16$ ,  $p < 0.001$ ) indicates that the search for emotional support is primarily triggered by moral distress arising not from personal risks (e.g., fear of infection) but from professional insecurity and ethical dilemmas. This highlights the need for psychological support content that is not only general or "emotional" but oriented toward professional realities and decision-making support (Williamson et al., 2020).

This analysis suggests that psychosocial support in the context of infection control is not merely a wellbeing measure – it is a necessary condition for fostering safe, responsible, and sustainable behavioral models. Institutional decisions should encompass not only formal consultations but also cultural changes within organizations: reducing stigma related to seeking help, developing emotional literacy among leadership, and ensuring that employees can trust that their emotional responses are understood and accepted.

Communication is an essential link in effective infection control, and its shortcomings can have a direct impact on healthcare workers’ behavior, especially during extreme situations such as pandemics. The study results revealed that workers often rely on informal information sources – colleagues’ opinions or information on social networks – and this strongly correlates with their subjective level of awareness about the situation ( $r = 0.57$ ,  $p < 0.001$ ). This phenomenon is often interpreted as "compensating for information gaps," where employees do not trust official channels and seek alternative ways to obtain information.

Such reliance on informal sources in the pandemic context has been observed in other studies as well. For example, Kuhlmann et al. (2021) emphasize that healthcare system workers frequently interpret official information through colleagues’ experiences or social media narratives, especially when clear, structured, and timely communication solutions are lacking. This poses a dual risk: on one hand, a distorted perception of the hierarchy of trusted sources develops; on the other, inaccurate or distorted information spreads, which can affect employees’ behavior.

A negative correlation between clarity/timeliness of information and the perceived effectiveness of communication channels ( $r = -0.35$ ,  $p < 0.001$ ) allows us to infer that even with functioning formal communication structures, their quality may be insufficient. This paradox reveals that merely having communication channels does not guarantee trust – it is necessary that the content conveyed is clear, contextualized, and consistent. The CDC (Centers for Disease Control and Prevention, 2020) stresses that effective crisis communication requires not only frequency but also comprehensibility, flexibility, and empathy toward employees.

Additionally, the correlation between guideline ambiguity and the assessment of communication channel effectiveness ( $r = 0.31$ ,  $p < 0.001$ ) shows that even with functioning communication, the content of information may be misleading or inadequately explained. This phenomenon was also identified by Allen et al. (2022), who highlighted that during the pandemic, workers faced constantly changing guidelines that were not adequately justified or explained, leading them to be perceived as illogical or contradictory. This caused frustration, decreased trust in leadership, and encouraged reliance on unofficial information channels.

Use of informal sources also significantly correlated with workers' evaluations of communication channel effectiveness ( $r = 0.38$ ,  $p < 0.001$ ), indicating that employees see formal and informal information as interacting systems – not as alternatives, but as complementary or even competing systems. This dynamic was thoroughly described by Dzieciolowska et al. (2021), whose study found that workers recognized social networks as faster and more convenient sources of information than official announcements or meetings.

The study also revealed that clarity and timeliness of information weakly but significantly correlate with seeking information through informal channels ( $r = 0.12$ ,  $p = 0.003$ ). This indicates a persistent dissatisfaction with the quality of information, prompting employees to actively search for additional sources themselves. Such a communication gap can create an "information vacuum," which, according to Malecki et al. (2021), is one of the greatest risks in crisis management – it not only promotes the spread of misinformation but also creates uncertainty, weakens organizational control, and causes psychological discomfort among employees.

Finally, although an effective communication channel between management and employees is weakly but significantly correlated with the sense of awareness ( $r = 0.15$ ,  $p < 0.001$ ), this relationship shows that organizational structure alone does not ensure a high level of awareness. The critical factor remains not the technical efficiency of the channel but the adaptation of content to the audience – clarity, contextualization, and interactivity.

Healthcare technologies – especially information systems, monitoring equipment, and automated solutions – have been regarded as an integral part of quality infection prevention over the past decade (Collins et al., 2020). However, the conducted study revealed a contradictory attitude

among employees towards the implementation of technologies in nursing facilities. Although technological tools such as hand hygiene monitoring systems were rated fairly high ( $M = 3.98$ ), the overall assessment that technologies help to manage infection risk more effectively was much lower ( $M = 2.35$ ), and correlations between these aspects were negative ( $r = -0.40$ ,  $p < 0.001$ ).

These results suggest that the mere presence of technology does not guarantee the perception of its effectiveness or practical application. A similar trend was noted in Bisset et al. (2022), where nurses expressed doubts about the usefulness of technologies during the pandemic, indicating that many systems were not adapted to working conditions, were difficult to use, or interfered with routine activities.

A moderate negative correlation was also found between employee training on the use of technological solutions and their evaluation of the effectiveness of these solutions ( $r = -0.37$ ,  $p < 0.001$ ). This may indicate two possible trends: on the one hand, insufficient training reduces trust in technology; on the other hand, well-trained employees become more critical because they can assess technological solutions not only as innovations but also as real help or hindrance in work. As Saxena et al. (2021) emphasize, nursing staff accept technological innovations only when they do not burden them with additional functions or uncertainties but genuinely optimize work.

A weak but statistically significant positive correlation was observed between evaluations of the usefulness of technology in daily work and their effectiveness ( $r = 0.17$ ,  $p < 0.001$ ). This relationship suggests that technologies clearly adapted to employee needs and workflows are more valued and integrated into practice faster. This aligns with Chow et al. (2020), who concluded that the most important criterion for successful technology implementation is user experience and ergonomics.

Negative correlations between employee training on technology use and institutional encouragement to implement innovations ( $r = -0.30$ ,  $p < 0.001$ ) raise questions about institutional strategic consistency. Organizations that declare a commitment to innovation often fail to provide sufficient resources or time for quality employee preparation. As De Carvalho et al. (2022) note, institutions often prioritize investments in infrastructure but neglect human capital development – this limits innovation effectiveness and provokes resistance to its implementation.

Finally, a low overall technology rating ( $M = 2.83$ ) indicates that, although technological tools exist, they are not always integrated into infection control practices in a way that employees perceive them as necessary or useful. This gap between infrastructure and perception was thoroughly analyzed by Mortell et al. (2021), concluding that without proper engagement and information processes, technologies remain "dead systems" that contribute little to real outcomes.

The results obtained indicate that infection control is not an isolated process dependent solely on theoretical knowledge or physical measures. Effectiveness relies on a complex set of interrelated

factors—personal, professional, organizational, and structural—that either reinforce or neutralize each other. This approach aligns with the modern healthcare quality model, which emphasizes that quality service delivery is inseparable from employee wellbeing, inclusion, and working environment conditions (WHO, 2021).

One of the most notable observed trends is the discrepancy between theoretical knowledge and practical behavior. As the study results showed, employees' knowledge of infection control protocols does not always reflect their behavior in real situations, especially under high workload conditions ( $r = -0.28$ ,  $p < 0.001$ ). This discrepancy can be associated with the so-called “knowledge-behavior gap,” discussed by Broom et al. (2020), who emphasize that even a high level of knowledge about infection control measures does not guarantee proper adherence if the environment, support, or emotional resilience is lacking.

A similar tendency was recorded by Loveday et al. (2019), who conducted a study in the United Kingdom. Their results showed that nursing staff behavior was strongly dependent on the institutional microclimate: when employees felt burned out or undervalued, their adherence to hygiene protocols decreased, even if they had sufficient knowledge or resources.

This study's analysis revealed that psychosocial factors—particularly anxiety, patient-related stress, and emotional exhaustion—have a significant impact on infection control behavior. Strong correlations between emotional strain and non-compliance with hygiene requirements ( $r = 0.59$ ,  $p < 0.001$ ), as well as between workload and burnout ( $r = 0.48$ ,  $p < 0.001$ ), confirm that emotional state affects not only personal health but also professional behavior.

Regarding organizational support, it is important to note that participants who felt emotional support from management more frequently reported a positive attitude towards institutional actions during the pandemic. This corresponds with observations by García-Fernández et al. (2021), who found that staff receiving genuine rather than formal emotional support were less prone to burnout, more likely to comply with work protocols, and less likely to criticize institutional decisions.

On the other hand, heavy reliance on informal information sources indicates a communication crisis within organizations. The study results showed that employees who more frequently used social networks or colleagues' information felt better informed about the situation ( $r = 0.57$ ,  $p < 0.001$ ), yet this reveals a problem—lack of trust in formal channels. This issue was detailed by Park et al. (2021), who studied nursing staff in South Korea and found that insufficiently coordinated, delayed, or confusing communication encouraged employees to seek other information sources, even if those were not always reliable.

A separate important topic is workload. The data clearly reveal that during the pandemic, staff shortages and task-competency mismatches were key factors contributing to physical and emotional burnout. These results align with conclusions from the International Council of Nurses (ICN, 2022),

which indicate that inadequate staffing and workload planning are among the main causes of infection outbreaks in nursing settings.

The study results suggest that infection control policies in healthcare institutions cannot be assessed merely as formal protocol sets. They must be adapted to the real working environment, staff psychosocial needs, and the cultural context of the institution. International practice confirms that the most effective infection prevention strategies are those that incorporate employee voices, engage them in decision-making, and support long-term learning (Chughtai et al., 2020).

One of the most important aspects of the study is communication quality and consistency. Low employee trust in official information sources and frequent reliance on informal channels ( $r = 0.57, p < 0.001$ ) may not only cause misinformation but also inadequate infection control decisions. A systemic analysis of the UK NHS after the COVID-19 pandemic showed that clear, timely, and two-way communication between management and clinical staff was a critical factor influencing protocol adherence and emotional stability (Kirkpatrick et al., 2022).

Regarding training, it is important to emphasize not only frequency but also content quality. According to the study data, while management encourages employees to participate in training ( $r = 0.35, p < 0.001$ ), employees critically evaluate their relevance ( $r = -0.18, p < 0.001$ ). Similar results were observed in a Finnish study, where training value was linked not to quantity but to contextual relevance, interactivity, and applicability in real situations (Turunen et al., 2021).

The relationship between employees' emotional state and adherence to infection control is also pronounced. Anxiety, moral distress, and exhaustion correlate with reduced compliance with procedures ( $r = 0.59, p < 0.001$ ). A Canadian study conducted in long-term care facilities emphasized that institutions providing systematic emotional support reduce employee burnout and indirectly improve patient safety and decrease infection prevalence (Schwendimann et al., 2021).

The evaluation results of technologies were contradictory: employees were skeptical about their effectiveness, especially when proper training was lacking or tools were poorly integrated into workflows. For example, when employees were not trained to use monitoring systems, they were more likely to consider them ineffective ( $r = -0.37, p < 0.001$ ). These findings align with Aiken et al. (2021), who concluded that implementing innovations without employee involvement, pilot testing, and training may have the opposite effect—disrupting rather than strengthening processes.

Attention should also be given to the problem of workload and competency mismatch. Many employees experienced burnout due to tasks assigned outside their professional responsibility. This situation reduces not only work quality but also motivation to comply with additional safety requirements (Ulrich et al., 2022). Therefore, it is essential to ensure clarity of functions and division of labor according to competencies, especially during epidemics or crises.

Finally, an exceptionally important aspect is institutional preparedness for outbreak response. Although employees acknowledged the existence of protocols, they did not always trust their effective implementation ( $r = -0.10$ ,  $p = 0.009$ ). These results suggest that crisis preparedness must be not only documented but also continuously practiced through simulations, interdepartmental collaboration, and real scenario reviews, as recommended by the ECDC (European Centre for Disease Prevention and Control, 2020).

## CONCLUSIONS

This scientific study enabled a comprehensive assessment of healthcare workers' experience and preparedness to implement infection control measures in nursing homes during the pandemic, as well as the identification of key practical challenges hindering effective application of preventive measures. The results indicate that infection control in such institutions remains highly complex, depending not only on formal regulatory frameworks but also on the quality of human and organizational resources.

Considering the study's objective, it can be stated that nursing home staff experiences during the pandemic are closely related to their workload, organizational support, psychological state, and ability to apply acquired knowledge in practice. The study showed that despite sufficient theoretical knowledge of infection control, employees often struggle to apply this knowledge in real pandemic situations. Physical and emotional exhaustion, task-to-competency mismatch, and inadequate organizational preparedness for extreme situations significantly influence this. These data suggest that formal employee training alone is insufficient to ensure high infection control quality. Comprehensive solutions are needed, encompassing both emotional well-being support and improvements in actual working conditions.

In response to the research question—how healthcare workers in nursing homes perceive and implement infection control measures and which factors most influence their preparedness and effectiveness during crises, the study revealed that key factors include workload, staffing shortages, psychological condition, management support, training structure, and availability of resources. Employee emotional resilience is particularly important—the study found a strong correlation between emotional burnout and non-compliance with infection prevention measures. This means that even with adequate knowledge and resources, burned-out or exhausted employees are more likely to neglect hygiene requirements, directly increasing infection transmission risk.

The hypothesis that the effectiveness of infection control measures in nursing homes during pandemics depends more on the state of human resources than on the formality of protocols was confirmed. Employee preparedness to act effectively in crisis situations is closely linked to continuous professional development, meaningful training, clear organizational structure, and active management engagement. Empirical data showed that where infection control is an organizational priority, management actively supports staff, and stable training and information dissemination mechanisms exist, infection control levels are significantly higher.

It is noteworthy that most barriers to infection control are related to systemic organizational factors that can be anticipated and managed through proper personnel preparation and resource allocation. For example, employee involvement in decision-making, clarity of communication

channels, and management's example directly correlate with greater trust and adherence to infection prevention measures. Conversely, insufficient information dissemination or formally organized training may have the opposite effect—reducing motivation and increasing mistrust. This means prevention policies must be adapted not only to the organizational but also to the individual level.

Another important finding is the necessity to integrate emotional and psychological support into infection control strategies. Psychological fatigue, anxiety, uncertainty, and decision fatigue during epidemics are no less significant than physical workload. Proper psychological wellbeing care, regular supervision models, or emotional resilience strengthening programs should be incorporated into the daily activities of nursing institutions. Such practices could help prevent burnout and increase employee resilience, ultimately improving infection control effectiveness and patient safety.

In summary, effective infection control in nursing homes is inseparable from a holistic approach that includes not only clinical and technical aspects but also employee wellbeing, leadership roles, organizational culture, and systematic crisis preparedness. An integrated approach where infection control becomes part of the organizational daily routine rather than just an administrative obligation is a necessary condition for achieving real patient and staff safety.

## SYSTEMIC RECOMMENDATIONS: FROM ANALYSIS TO PRACTICE

Based on the correlations and respondent evaluations identified in the study, several key directions can be highlighted as critically important for improving infection control in nursing and long-term care facilities. International scientific literature indicates that effective infection control measures require an integrated, multifaceted approach encompassing not only technological or organizational measures but also social, psychological, and communication aspects (World Health Organization, 2022).

**Behavior Change Interventions.** The study identified a discrepancy between theoretical protocol knowledge and practical adherence ( $r = -0.28$ ), reflecting a widely documented issue—knowledge alone does not guarantee behavior change. Behavior science-based methods are needed, such as motivational interviewing, nudging strategies, or strengthening social norms within teams (Michie et al., 2011). For example, a randomized trial in a hospital showed that employees receiving individualized feedback on hygiene compliance significantly improved their practice within six weeks (King et al., 2016).

**Continuous Learning Instead of Episodic Training.** The effectiveness of training directly depends on its content, method, and frequency. The study found that training frequency correlates with confidence ( $r = 0.20$ ), but practical usefulness is evaluated skeptically ( $r = -0.18$ ). Therefore, there is a need to shift from periodic theoretical lectures to “in situ” training models—short, practical sessions at the workplace integrated into daily tasks. Research shows that such formats—especially just-in-time training—enhance knowledge retention and help reduce errors (Gurses et al., 2019).

**Strengthening Psychological Support Systems.** High levels of anxiety and moral distress recorded in the study (e.g., mean 4.59 for fear of infecting family members) reveal employees’ psychological vulnerability. Other pandemic studies indicate that emotional support interventions (e.g., accessible psychological counseling, peer support models) significantly reduce depression and burnout levels (Greenberg et al., 2021). It is therefore recommended that institutions not only ensure access to psychological help but also actively inform employees about these options and strengthen leadership’s emotional sensitivity competencies.

**Improving Communication Channel and Content Quality.** Results showed that even with formal communication channels, employees do not always perceive them as sufficiently clear and timely ( $r = -0.35$ ). Similar problems were identified in other European countries: communication during epidemics was often too centralized, slow, and not adapted to end users—clinical staff (Raurell-Torredà et al., 2021). Effective communication practices include two-way interaction, brief visually presented messages, and regular information updates. Institutions are recommended to use

both digital channels (e.g., WhatsApp groups, internal portals) and live feedback via managers or team leaders.

**Changing Technology Implementation Strategies.** Technologies will not become effective tools if they are not used. The study revealed a paradox—although technologies were implemented, their benefit was viewed skeptically by employees ( $r = -0.40$  with effectiveness). Similar trends were noted in systematic reviews of health technology evaluations—organizations often rush to implement solutions without adequate testing and staff preparation (Berg & Aarts, 2020). It is recommended to apply user-centered design principles and conduct pilot phases before broad integration to ensure technologies fit workflows.

## STRATEGIC IMPLICATIONS AND INTERNATIONAL CONTEXT

Analyzing the study results, it becomes evident that infection control in nursing homes is a complex phenomenon dependent on decisions at the micro-level (individual behavior), meso-level (institutional arrangements), and macro-level (health policy). This multilayered nature aligns with the theoretical paradigm of “resilient healthcare” proposed by P. Reason and J. Hollnagel, which suggests that healthcare systems must not only respond to hazards but also adapt, learn, and anticipate risks (Hollnagel et al., 2013).

The observed reliance of employees on informal information sources, emotional burnout, technology rejection, and skepticism toward training signal a possible systemic shortfall — the inability of healthcare organizations to involve staff in decision-making. This corresponds with experiences in other countries. For example, a study in Germany demonstrated that employee participation in infection control decisions was significantly associated with higher hygiene compliance and lower moral distress (Pfaefflin et al., 2022).

Employee emotional wellbeing, especially during the pandemic, becomes a strategic resource — not only from an ethical standpoint but also from a systemic perspective. Organizations that invested in psychosocial support measures during the pandemic achieved not only higher employee satisfaction but also reduced morbidity and staff turnover (Chersich et al., 2020). Therefore, the study results can be interpreted as a signal to strengthen not only hygiene infrastructure but also organizational culture — leadership, empathy, and mutual trust.

Another important implication of the study is the low evaluation of technologies despite their physical presence. This highlights the “technology gap” paradox widely discussed in e-health research. According to systematic reviews, only about 30–50% of health sector innovations achieve operational integration into daily practice due to user interface issues, training deficits, or workflow integration barriers (Carayon et al., 2015). This means that policymakers need to reconsider innovation implementation strategies — they must come not only “top-down” but also “bottom-up,” involving employees as co-creators.

It is also important to note the study’s finding of a discrepancy between declared institutional support and received help ( $r = -0.11$ ). Such data indicate a risk of “institutional disconnect,” where employees do not feel their needs are genuinely addressed, even if support systems formally exist. International occupational safety studies emphasize that only authentic, systematic support can foster a culture of trust (Shanafelt et al., 2020).

## STUDY LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The data from this study provide valuable insights into the challenges of infection control in long-term care and nursing homes; however, like any scientific work, it has certain limitations.

First, the study was based on self-reported questionnaire assessments, and such methodology can lead to a social desirability bias—respondents may report more “acceptable” behavior than what reflects actual practice (Krumpal, 2013). This is especially relevant for evaluations of hand hygiene or emotional state.

Second, the study was conducted in a specific context—long-term care and nursing homes, which have distinct organizational and personnel management characteristics. While the results reveal broadly relevant problems, they should be interpreted cautiously within the wider healthcare system context. Future research should include various types of healthcare institutions, particularly acute care, rehabilitation, and primary care sectors—to assess the generalizability of the findings to other settings.

Third, data were collected at a single point in time, so causal inferences cannot be made—correlational relationships show associations but not their direction or cause. Future studies could employ longitudinal designs to observe how infection control behavior or psychosocial factors change over time, especially following organizational changes or interventions.

Fourth, although a large sample (659 respondents) was collected, attention must be paid to the voluntary participation principle. Such sampling may lead to self-selection bias, as more motivated or emotionally affected employees might be more likely to participate. More accurate assessments require mixed methods, including not only questionnaires but also objective data (e.g., hygiene monitoring indicators, staff turnover statistics, or infection prevalence data).

Further research could also delve deeper into qualitative aspects of employees’ experiences using interviews or focus groups. This would help uncover subtler reasons for the gap between declared knowledge and behavior, or why certain technologies are perceived as ineffective by staff despite their functionality.

# PRACTICAL RECOMMENDATIONS FOR HEALTH POLICY, ADMINISTRATION, AND STAFF TRAINING

Based on the results of the conducted analysis and the international scientific research base, several practical directions can be formulated that may be relevant for health policymakers, institution administrators, and nursing staff training program developers.

## 1. Implementation of Multilayered Infection Control Strategies

One of the key aspects revealed by the study is that formal infection control protocols are insufficient without their integration into daily practice, especially under high workload or emotional pressure. This conclusion is supported by studies from other countries—for example, King et al. (2020) emphasized that healthcare workers' behavior requires clear organizational support, including leadership modeling, improvement of working conditions, and employee empowerment.

It is recommended to:

- Ensure that infection control guidelines are not only formally in place but are consistently implemented across all work levels.
- Pay attention to psychological support as an integral part of infection prevention.
- Foster a culture based on employee involvement where decisions are made collaboratively.

## 2. Practical and Targeted Training Programs

The study revealed contradictory employee evaluations of training effectiveness. Although training frequency correlated with a certain sense of preparedness, many respondents considered trainings irrelevant or merely formal. This tendency is confirmed by Phianhasin et al. (2021) in Thailand, who note that effective training should be based on real situations, simulations, interactive methods, and analysis of staff needs.

Recommendations:

- Focus shift training from information delivery to practical skill development.
- Include situational simulations, case analyses, and emotional preparedness components.
- Evaluate each training cycle's impact on behavior, not just knowledge levels.

## 3. Optimization of Work Organization During Epidemics

Considering that one of the strongest risk factors was workload, staff shortages, and task-to-competency mismatch, it is recommended to undertake organizational measures to reduce these pressures. For example, Jung et al. (2022) in South Korea showed that staff rotation, mobile infection control units formed during crises, and emotional support teams helped prevent burnout.

Suggested measures:

- Apply pre-prepared “crisis plans” with clear responsibility structures during epidemics.
- Ensure tasks are assigned according to employees’ competencies.
- Implement fatigue prevention programs including not only rest periods but also psychological state monitoring.

#### **4. Strengthening Psychosocial Environment**

Results revealed that even employees experiencing anxiety or moral distress often did not receive adequate emotional support. At the same time, a connection between anxiety and seeking help independently was observed. International studies show that structured psychological support during epidemics not only reduces anxiety but also positively affects protocol adherence (Brooks et al., 2020).

Recommendations:

- Develop psychological resilience programs tailored for the healthcare sector.
- Implement anonymous emotional support channels and regular emotional state assessments.
- Train management to recognize signs of emotional exhaustion and respond promptly.

## SUMMARY AND SCIENTIFIC INSIGHTS

The study results and their comparison with the international scientific literature revealed that infection control implementation in nursing homes during epidemics is a multifaceted phenomenon influenced by numerous interconnected factors. The contribution of this study to scientific literature is expressed through several key aspects:

### 1. **Knowledge-Behavior Gap**

The data indicates that even with high theoretical knowledge of infection control protocols, employees' behavior in real crisis situations may not align with standards. This discrepancy correlates with other authors' conclusions that behavior change requires more than information—it requires behavior support strategies (Barrett et al., 2021). This allows the conclusion that knowledge is necessary but insufficient for effective infection control.

### 2. **Emotional Health as an Infection Control Factor**

The study highlighted a direct link between emotional exhaustion and adherence to hygiene procedures, showing that psychological wellbeing is a factor not only for employee welfare but also for patient safety. This insight complements the growing scientific discussion on the impact of burnout on infection spread (Denning et al., 2021).

### 3. **Communication Complexity During Epidemics**

Conflicting correlations between information clarity and informal source use revealed that even when communication channels exist, their effectiveness depends on content consistency and timeliness. This aligns with Puro et al. (2020) observations regarding information dissemination imbalance in the COVID-19 context.

### 4. **Importance of Institutional Structures**

Clear and consistent procedures, available protective equipment, and leadership engagement correlate with positive employee evaluations and more effective infection control. This finding is directly related to the influence of organizational culture on healthcare quality (Braithwaite et al., 2017).

### 5. **Practical Recommendations for Value Creation**

Based on the study results, targeted and evidence-based practical recommendations were provided. They can be applied not only in nursing homes but also in other long-term care institutions to improve epidemic preparedness, strengthen employee wellbeing, and enhance patient safety.

## 6. **Contribution to Research Methodology**

The use of correlational analysis allowed identification of indirect yet significant relationships between organizational and individual factors. This methodological approach complements previous quantitative studies that often relied on single-factor models.

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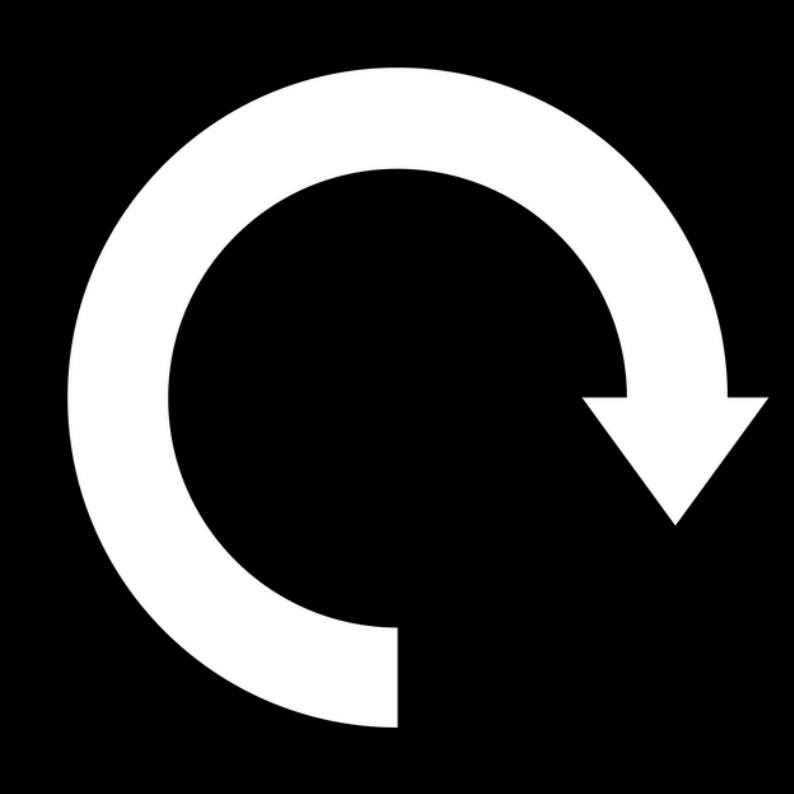
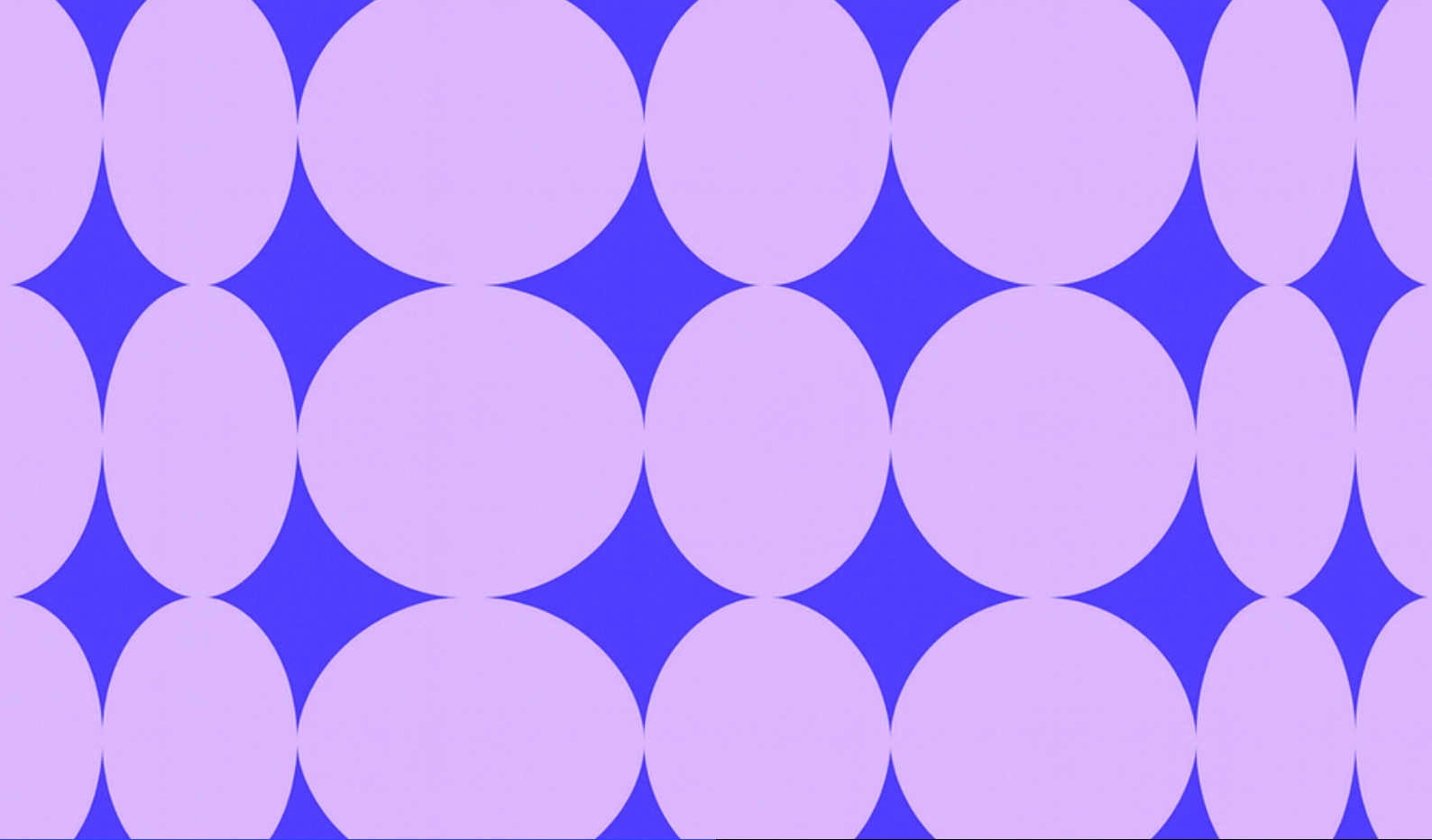
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**SMK**