Factors involved in the infection of nursing professionals in the covid-19 pandemic

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ABSTRACT

Introduction: COVID-19 is a respiratory disease caused by the SARS-COV-2 virus whose rapid spread and mortality rate, associated with the absence of immunopreventive methods, led the World Health Organization (WHO) to declare a pandemic state in 2020. As a result, health services were overloaded, and there was a large number of infections among professionals in the area. **Objective:** Identify the factors involved in the infection of nursing professionals during the COVID-19 pandemic. **Methodology:** Exploratory and descriptive field research, with a qualitative approach, developed using the snowball sampling method. Data collection was performed by applying a semi-structured electronic form to 13 nursing professionals directly involved in coping with the pandemic. Data was analyzed using the IRaMuTeQ and Voyant tools software through the flow diagram method and similarity analysis. **Results:** The reports of nursing professionals highlighted as the main contributing factors to infection by SARS-COV-2 the lack of personal protective equipment or its fragility, the absence of training, and constant hand hygiene. In addition, work overload with consequent emotional stress was also referred to as a contributing factor to the inadequate attire. **Conclusion:** The lack of personal protective equipment associated with the absence of training and updates regarding the virus generated apprehension and anxiety in professionals, which caused an impact on the care provided by them and on their mental health. Such factors were determining motivators to work as a team and maintaining the standard of care.

Keywords: COVID-19; SARS-Cov-2; Nurse practitioners; PPI; Mental Health.

INTRODUCTION

In 2019, the world was struck by the emergence of a new strain of Coronavirus, SARS-COV-2, identified on December 31 in the city of Wuhan, China[1]. This strain caused a novel disease, designated by the World Health Organization (WHO) as COVID-19. Its symptoms include fever, pneumonia, lower respiratory tract symptoms, such as cough and dyspnea, and, in severe cases, Acute Respiratory Distress Syndrome (ARDS)[1].

In March 2020, the World Health Organization (WHO) declared a pandemic due to the virus's rapid spread. According to Johns Hopkins University & Medicine's Coronavirus Resource Center, as of March 10, 2023, there had been 676,609,955 confirmed cases and 6,881,955 deaths worldwide[2]. In Brazil, the Ministry of

Health confirmed 37,949,944 cases and 706,808 deaths as of November 3, 2023[3].

The city of Belo Horizonte, Minas Gerais, was severely impacted by high rates of SARS-COV-2 contagion. Intensive Care Unit (ICU) bed occupancy grew exponentially from March 2020, peaking in March 2021. At that point, ICU bed occupancy was 100% in private hospitals and 96.6% in public hospitals. For hospital wards dedicated to patients with SARS-COV-2 infection, occupancy reached 79.3% during this period[4]. As a result, the demand placed on nursing professionals was significant, putting them in a position of both physical and mental vulnerability[5].

At the onset of the pandemic, in the absence of vaccines and effective treatments, social distancing, proper hand hygiene, and using protective equipment were essential for controlling COVID-19. In response to this need, the Belo Horizonte City Hall implemented measures to curb the spread of the virus, such as closing non-essential activities, hiring health professionals, publishing a technical note to guide the use of personal protective equipment (PPE), and mandating the removal of all health workers considered at risk for the disease[4,6,7].

Similarly, hospital protocols were necessary to reduce cross-infection rates, and the nursing staff's care was fundamental in minimizing contamination rates among staff and patients. These professionals faced daily exposure to the virus, as shown on the website of the Federal Nursing Council (COFEN), which recorded 59,298 cases of infected nursing professionals, with a total of 869 deaths across Brazil by November 27, 2021[8].

The exposure of these professionals to SARS-COV-2 was intensified by insufficient or inappropriate use of personal protective equipment (PPE) and work overload, which led to mental suffering and illness among workers, as well as organizational problems. It is worth noting that increased workload not only raised the likelihood of SARS-CoV-2 infection but also contributed to other health issues such as fatigue, mental stress, and sleep deprivation. These factors diminished self-protective measures and compromised the quality of care provided[9]. However, the variables involved in SARS-COV-2 contamination and the impact on nursing professionals' mental health remain unclear.

Nursing professionals make up most of the multidisciplinary hospital care team and have prolonged and close contact with infected patients[10]. This study, therefore, aimed to identify the factors contributing to the infection of nursing professionals during the COVID-19 pandemic, highlighting the impact on their mental health in hospital care.

METHOD

This is an exploratory and descriptive field study with a qualitative approach, conducted in Belo Horizonte, Minas Gerais. The study included nurses, nursing technicians, and nursing assistants infected by SARS-COV-2 between March 2020 and August 2021. Data collection began in April 2021, using a semi-structured questionnaire with nine subjective questions applied through the Google Forms online tool, due to physical contact limitations imposed by the pandemic. The questionnaire was developed by the study's author and was submitted and validated through the Brazilian Research Ethics Platform. The form was distributed to professionals directly treating infected patients through social media platforms such as WhatsApp, Instagram, and Facebook.

The study adhered to ethical principles, according to Resolutions 466/2012 and 510/2016 of the Brazilian National Health Council, which regulate research with human subjects in Brazil. It was approved by the Ethics Committee of the Faculdade de Ciências

Médicas de Minas Gerais under the Certificate of Ethical Appreciation Presentation (CEAP, CAAE in Portuguese) 39427120.1.0000.5134. Participants were assured of the confidentiality and anonymity of their responses through a Free and Informed Consent Form (FICF, TCLE in Portuguese), which comprised the first part of the questionnaire. Professionals could proceed to answer the questions only after accepting the terms.

The sampling methodology adopted was the snowball sampling method, a non-probabilistic sampling technique that builds referral chains from people who share specific characteristics of interest[11]. Thus, individuals easily reachable by the researchers were chosen to be the "seeds" of the study[12]. They were asked to respond to the questionnaire and forward it to others who met the participant profile. Subsequently, these new participants were asked to refer additional individuals for the study. In this way, the sample expanded with each response until saturation was achieved[11].

A total of 12 participants were included, and to ensure the reliability of the analyses and a better understanding of the results, the IRaMuTeQ (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires) software was used. IRaMuTeQ is a textual analysis software that allows for the study of language-based material, enabling the use of statistics in qualitative research[13].

IRaMuTeQ qualitatively demonstrates how words are structured in a text, their connections, and the primary indicators identified[14]. Among the various analyses available, similarity analysis was chosen to identify relationships between terms in a text and define word co-occurrences[13]. This analysis allows for the identification of the structure and specificities of the text by demonstrating connections between words[13].

Additionally, the online application Voyant Tools, another textual analysis tool, was used to build a multiplicity of connections between words in the text through mining techniques[15]. This tool provided linguistic and statistical information in visual formats such as graphs and tables[16]. Among the techniques available, the flow diagram model was selected, a visualization method that demonstrates the frequency increase of terms in textual content[16].

The qualitative method was chosen to focus on a small number of cases, emphasizing the meaning of the data through an intensive investigation of them, both in breadth and depth. Despite its flexibility regarding collection techniques, this methodology was directed toward understanding the phenomenon under study, which is connected with the feelings and thoughts of the studied population[17].

With the questionnaires digitally collected, the analysis was conducted in three phases. Initially, a first reading of the responses was done to understand the meanings conveyed by the participants in their writing. Then, ideas, phrases, and paragraphs that highlighted the professionals' convergences and divergences on the study topic were selected. Finally, similarities and differences in responses were organized and mapped through successive and exhaustive re-readings, enabling the initial ideas and categories to emerge, answering the research questions. Textual analysis followed Laurence Bardin's interpretive framework, in three stages: pre-analysis, material exploration, and treatment of results and interpretation[18]. Questionnaire responses were labeled as follows: P1: Professional 1; and [...] pause.

RESULTS

After data saturation, participants who answered "yes" to the question about previous SARS-COV-2 infection were included, as this was the criterion for response

selection in the analysis. The sample was composed of women with an average age of 36, including six nursing technicians, three nurses, and four nursing assistants.

Figure 1 represents a morphological analysis, which highlighted that the focus of the study was on systems directly related to keywords, with the most frequent terms being patient, contact, mask, and glove.

The frequency of these terms allowed for the identification of the primary challenges faced by the nursing team. Representative responses revealed certain critical points, especially concerning cases where infection occurred due to misuse or absence of PPE, as depicted in Figure 2.

> Misuse of PPE […] (P2); Lack of PPE and/or improper use […] excessive heat with full PPE […] N95 mask causing facial injuries (P7); Inadequate use and even non-use of PPE […] (P8); […] Not using adequate PPE; fragile PPE exposing professionals to the contaminated environment (P9).

Another difficulty reported by professionals was the inadequate triage of patients suspected or confirmed to have COVID-19.

> […]patients in non-COVID areas without prior testing […] (P7); Exposure to patients with confirmed or suspected cases (P8); I was infected by an asymptomatic patient; it was an emergency, and the COVID test result was pending, with only contact precautions taken. Despite wearing a surgical mask, I was infected (P11); […] Contact with infected patients (P12).

Work overload was also highlighted, a theme linked to the challenges faced by nursing professionals and associated with their exposure to infection.

> High workload (P1); […] Work overload due to the high number of cases attended […] (P8); I believe that extended hours and working multiple shifts exacerbate this situation. Many professionals hold

multiple positions, performing the same demanding routine of caring for COVID-19 patients. This work requires not only what nursing professionals can provide but also a holistic perspective to intervene before a patient's condition deteriorates or to assist in a way that reduces the risk of adverse events in critical care settings (P7); […] On days when you are more overwhelmed, there is a higher chance of slipping at some point, increasing the risk of infection (P11);

Moreover, although not part of the study's primary focus, the term "emotional" was prominent in participants' responses, especially regarding the mental health of these workers during the pandemic period.

> The emotional state affects the implementation of preventive measures (P1); […] Sometimes we forget to properly don and doff PPE, especially in stressful situations involving critically ill patients (P2); With compromised mental health, we might overlook a harmful action and unintentionally harm ourselves (P7);

Additionally, terms like "training" and "inadequate" were mentioned by nursing professionals.

> [...] Lack of training (P2); Lack of up-to-date, continuous training on the virus […] (P8); Inadequate doffing process; errors or haste in donning PPE.

Terms like "hands" and "contact" were also highlighted in the flow diagram, underscoring the theme of proper hand hygiene.

> [...] lack of consistent hand hygiene, especially when moving between patients (P8).

Figure 1 - Similarity analysis showing the main words identified in the responses. Belo Horizonte, MG, Brazil, 2021.
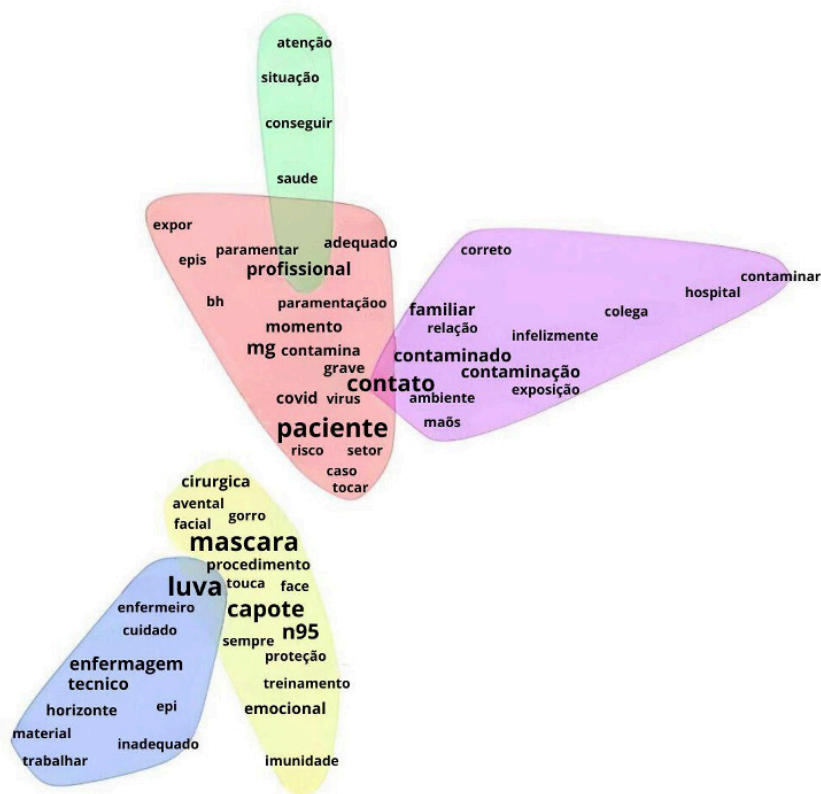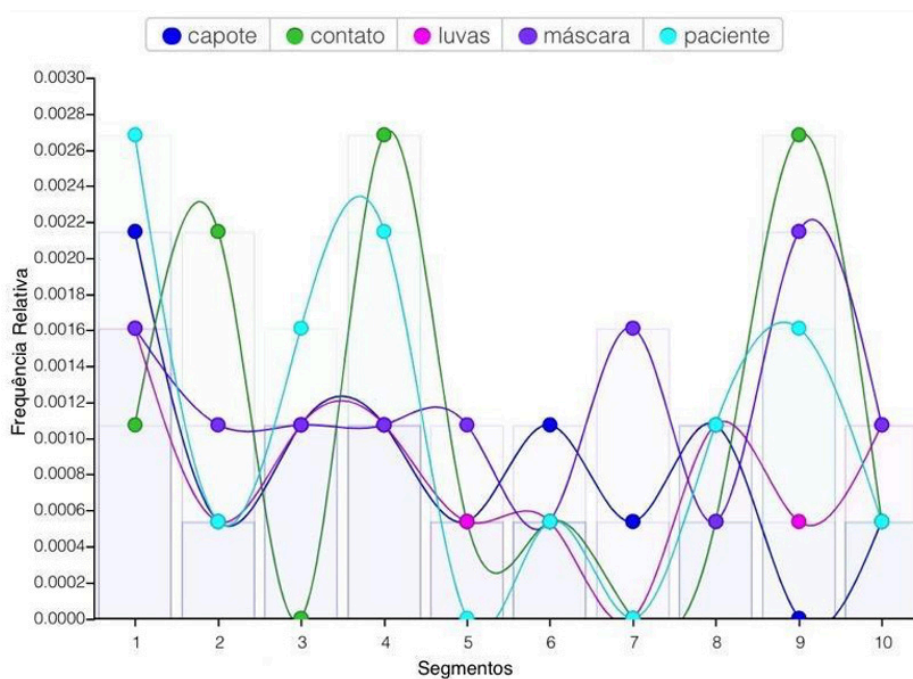

Figure 2 - Analysis of word frequency in participants' responses. Belo Horizonte, MG, Brazil, 2021.

ILastly, the form included a space for professionals to add comments regarding the infection and deaths of nursing professionals due to COVID-19 in Brazil.

> The competent authorities (President of the country and ministers) downplayed the situation, did not invest in healthcare as they should have (this has been ongoing for years); they left the country's entry and exit points open, which allowed the virus to spread more efficiently (P9); A tragedy for our profession, being so exposed, sometimes with inadequate PPE, and having nothing to protect us in this regard (P11); Unfortunately, there were a large number of cases because we are one of the largest professional categories in terms of numbers, and since we are on the front line, the chance of infection is much higher (P12).

DISCUSSION

The collected evidence confirms that nursing professionals belong to one of the highest-risk groups for SARS-COV-2 infection. This occurs due to their direct exposure to the virus, stemming from the lack or improper use of PPE and their close contact with infected patients, which leaves them vulnerable to high viral loads. Furthermore, during this period, they faced significant emotional stress due to the responsibility of caring for critically ill patients, fear of contracting the disease and potentially infecting family members, as well as inadequate working conditions[19].

According to Rocha et al., 2021, factors that contribute to healthcare workers' vulnerability, particularly among nursing professionals, include 46.8% due to the lack of PPE, such as gloves, masks, syringes, and other necessary materials. Additionally, 51.2% of the reasons are related to the emotional strain imposed by high-volume workloads[20].

The Ministry of Health emphasizes that the correct use of PPE is crucial to preventing the transmission of COVID-19, with recommended items including N95 masks, gowns, gloves, caps, face shields, and goggles[21]. The importance of using PPE was demonstrated in a case report of a COVID-19 patient in a Singapore ICU. In this case, 41 healthcare professionals were exposed to aerosol-generating procedures for at least 10 minutes at less than two meters from the patient. All workers wore N95 masks during care, and none were infected, illustrating the effectiveness of using masks along with other recommended PPE[22].

The exponential demand for PPE during the peak of the pandemic contributed to an increased risk of infection due to challenges in acquiring these materials. This was a scenario reported worldwide, including the professionals participating in this study[23]. Within this context, the likelihood of infection was attributed to an insufficient supply of PPE.

In addition to this scarcity, incorrect use and inadequate doffing procedures further increased infection risk[19]. Even with extensive training, it was common to observe lapses in nurses' adherence to protective measures when assisting COVID-19 patients[9]. Such lapses primarily stemmed from the pressure placed upon them and the exhaustion following extended work shifts.

The pandemic also highlighted the need for increased attention to the mental health of healthcare professionals. Symptoms of anxiety, depression, sleep disturbances, increased substance use, psychosomatic symptoms, and fear of infection or of transmitting the virus to family members became more prevalent[23]. Proximity to patient suffering or death, coupled with the distress of patients' families, lack of medical supplies, uncertain information, and isolation, were additional aspects contributing to healthcare workers' mental suffering and psychological distress[22].

The primary risk factors for SARS-COV-2 infection identified in the literature align with the findings

of this study, including unprotected direct contact with the secretions and excretions of infected patients, extended working hours, insufficient PPE, lack of training, and fear in the face of frequent changes in protocols and workflows. Other factors cited were the overcrowding of healthcare facilities, shortages of patient support equipment, such as ventilators, and a lack of hospital beds[24, 25].

In this context, it is evident that SARS-COV-2 infection had a profound impact on healthcare workers, with various factors affecting these professionals' mental health, such as work demands, emotional strain, and the risks to their own health[20]. However, beyond examining the factors contributing to infection, it is essential to recognize the broader consequences of infection itself. Many professionals were infected while working on the front lines, leading to high rates of absenteeism and a subsequent decrease in the availability of qualified nursing staff to manage this challenging situation[26, 27, 28].

It is worth mentioning that this study has limitations, including the absence of a broader approach that could be achieved by analyzing a greater number of statements, as participants' responses were relatively concise. This limitation arose from the necessity of using an online questionnaire, which was required due to social distancing measures during the pandemic.

Despite these limitations, this study is valuable as it demonstrates important aspects related to hospital planning, risk management, training in protective measures, proper PPE use, and the mental health of nursing professionals. Furthermore, since the 12 participants came from different institutions, their responses indicate that similar conditions were prevalent across various workplaces.

Thus, the sample size is significant and represents the studied population, providing a clearer understanding of Brazil's response to the COVID-19 pandemic, a scenario that brought about considerable changes in global health.

CONCLUSION

The shortage of material resources necessary for patient care calls for a deeper reflection on the need for more rigorous adherence to planning guidelines, resource management, and strategic actions during crises such as a pandemic. These factors directly contributed to the infection of nursing professionals by SARS-COV-2. The accounts analyzed in this study underscore the physical and emotional toll on nursing professionals and highlight the impact of these factors on the quality of care provided, making it less qualified and more impersonal due to the demotivation and devaluation felt within the profession.

Qualitative research enables a more in-depth exploration of the studied phenomenon and its interconnected factors. However, it is subject to certain limitations. Since data collection continues until theoretical saturation is achieved, the sample size may be relatively small. Therefore, it is crucial that participants accurately represent the studied population to avoid overly broad generalizations. Additionally, this methodology requires an experienced interviewer capable of eliciting comprehensive information from respondents[29]. In this study, pandemic-related restrictions on physical contact required the use of online questionnaires, which limited the study by preventing the personal interaction that interviews might otherwise provide.

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