Experiences and psychosocial predictors of professional function among intensive care nurses under the shadow of Covid-19: A mixed-methods study

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Abstract

Background: The outbreak of the Corona virus (COVID-19) pandemic led to a sharp rise in morbidity and hospitalizations, and a significant therapeutic burden fell on intensive care units (ICUs). Intensive care nurses reported physical and emotional stress in response to the extra workload caused by caring for critically ill COVID-19 patients. However, at the time of publication of the study, to the best of our knowledge there have been no studies that examined uncertainty, stress, or hope in the context of functioning among intensive care nurses.

Aim: To examine: (a) the challenges of operating and managing intensive care units during the COVID-19 pandemic among nurse managers in intensive care units, and (b) the relationships between uncertainty, stress, burnout, hope, and professional functioning among intensive care nurses during the COVID-19 pandemic.

Design: This mixed-methods study was conducted in intensive care units (ICUs) at a large tertiary medical center in Israel, during February–May 2021.

Methods: The data were collected in two phases. In the first phase, qualitative data were collected from focus groups attended by 15 senior managerial nurses. The second phase involved a cross-sectional study among 100 staff nurses working in 5 ICUs. The data were collected using a structured questionnaire.

Results: Qualitative data analysis revealed two main themes: (a) challenges of the COVID-19 pandemic and (b) positive aspects of the COVID-19 pandemic. The nurses reported high levels of burnout, emotional stress and uncertainty, but moderate State Hope Scale scores, and moderate levels of professional functioning. There were no statistical differences in study variables by exposure to COVID-19 patients. State Hope Scale levels, uncertainty, and burnout variables contributed significantly and explained 46% of the variance of the professional functioning.

Conclusions: The intensity of the experiences and psych-social phenomena, is not affected by exposure to treatment of COVID-19 patients. The relationships between the study variables emphasize the importance of initiated and ongoing interventions to reduce uncertainty, address burnout, and strengthen hope. Improvement in these indices may lead to better ICU nurses’ professional functioning and their work life well-being.
INTRODUCTION

In March 2020, the outbreak of the Coronavirus disease (COVID-19) reached Israel, followed by four further waves of the pandemic, which all differed from each other in terms of hospitalization strategy, treatment, and a number of other clinical issues. The third wave was characterized by a high prevalence of the Delta variant (more than 90% of cases) on one hand, and by an effective immunization campaign, on the other hand. With the outbreak of the pandemic and a sharp rise in morbidity and hospitalizations, a significant therapeutic burden fell on intensive care units (ICUs). Intensive care nurses reported physical and emotional stress and an increase in workload caused by caring for critically ill COVID-19 patients. This was compounded by other factors including fear of the contagious disease, difficulties in combining work and home life, and a sense of professional failure following the loss of patients, morbidity, isolations, and mortality of colleagues due to infection. The response to working in protective clothing, feelings of loneliness, exposure to complex clinical cases, and the frequent need to manage end-of-life issues, manifested in a variety of symptoms, especially at the beginning of the surge. The psychosocial and physical burdens to which the nurses were exposed led to a decline in professional functioning, quality of care, and even to suicidal thoughts (Caillet et al., 2020; Heesakkers et al., 2021; Shen et al., 2020; Yifan et al., 2020). Lack of clarity in setting policies and healthcare system difficulties related to organization of the pandemic and crisis management, added yet another challenging dimension (Moradi et al., 2021). In our hospital, nurses from other wards were moved to reinforce the ICUs and the newly established COVID-19 dedicated treatment facilities. These changes added the additional burdens and responsibilities of guiding and supervising the work of less skilled nurses who joined during the pandemic, to the load already carried by the ICU nurses.

Burnout is a significant factor in the functioning and performance of clinicians and, therefore, receives much attention in the literature. This work-related phenomenon is common in the therapeutic professions and is defined as a psychological syndrome with three components: emotional exhaustion, depersonalization, and a feeling of low personal accomplishment (Maslach et al., 1986; Woo et al., 2020). There are many reports of high levels of burnout among frontline healthcare workers, mainly physicians and nurses, in intensive care during the pandemic. Gualano et al. (2021) reviewed 11 studies on burnout among ICU caregivers during the pandemic and found a prevalence ranging between 49.3%–58%. Personal characteristics and factors such as age, gender, stigma, financial difficulties, fears of infection, family-work balance, as well as organizational factors such as workload, multitasking, working relationships with superiors, and poor management were associated with burnout (Gualano et al., 2021; Sharma et al., 2021). A Chinese study by Hu et al. (2021) reported an even higher (68.3%) level of burnout among 1289 ICU nurses, where working in general ICU, more years of experience, working night shifts, and personal comorbidities were associated with higher burnout. Similar rates of burnout in ICU nurses (68%) were reported from Belgium (Bruyneel et al., 2021), with a rate of 60.3% in ICU nurses in Italy (Stocchetti et al., 2021).

The COVID-19 pandemic caused significant disruption in all spheres of life in general, and in healthcare, in particular. Lack of information, threats of a new and contagious virus, social distancing and restrictions on the public, chaotic work environment, poor professional support, and rapid changes in public policies at various levels, all contributed to a dynamic, fluctuating, and unstable reality accompanied by high state of uncertainty (Bergman et al., 2021; Shen et al., 2020). Uncertainty is a state of discomfort defined as a situation of ambiguity about the future, characterized by difficulties in predicting results (Mishel, 1990; Penrod, 2002). This may develop because of a failure to create cognitive schemata (Mishel, 1990). Providing explanations, information, and structured knowledge may reduce uncertainty and its negative consequences. The literature refers to uncertainty in the COVID-19 pandemic as an inevitable consequence of the situation, and includes extensive discussion about the possible negative impacts on both the quality of care and the performance of caregivers, together with recommendations to address the issue (Koffman et al., 2020a, 2020b; Rutter et al., 2020). However, following a comprehensive search of the literature (April 2021), using acceptable search engines (PubMed, CINAHL, Web of Science, and Google Scholar) and a variety of keywords (uncertainty, ambiguity, unpredictability, vagueness and doubt), we did not find any empirical studies examining a nurse’s sense of uncertainty during the pandemic. In this context then, this study is innovative and adds its unique contribution to the body of knowledge on the subject.

Positive motivational factors play an important role in the ability to deal with challenging situations at work. Some are based on personality traits while others are situational. One of the protective motivational constructs related to a better psychosocial state and performance, is a sense of hope. Hope represents a positive response to the cognitive appraisal of stressful situations and helps to achieve goals more effectively. Higher levels of hope have a positive effect on a nurses’ health and may reduce the negative consequences of working in stressful situations (Simmons & Nelson, 2001; Snyder et al., 1996; Snyder, 2000). While a number of studies have examined hope among the public in different countries, very few studies have considered hope among physicians and nurses during the pandemic. Kotera et al. (2021) described hope as one of the significant predictors of mental health among healthcare workers during the COVID-19 pandemic in Japan. In another study among physicians and nurses in China, a higher value on the State Hope Scale (SHS)
was associated with lower depression (Lijuan & Rong, 2021). We did not find any studies on hope (aspiration, desire) and its effects among ICU nurses working in the COVID-19 pandemic.

There has been much investigation of how frontline nurses cope with the challenges of treatment of COVID-19 patients, but relatively few studies have focused on intensive care nurses. Moreover, we did not find any studies on the relationships between cognitive-motivational characteristics such as uncertainty and hope with nurses’ performance during the pandemic. With the aim of examining this aspect of performance in a comprehensive way, we decided to address these issues on two organizational levels of practice, namely nurse managers and staff nurses working in the same clinical setting. The study is designed to consider the overall situation experienced by nurses in intensive care units, when faced with the challenges of the COVID-19 pandemic.

**Aim:** This study was designed to examine: a) the challenges faced by nurse managers in operating and managing intensive care units, and b) the relationships between uncertainty, stress, burnout, hope, and professional functioning among intensive care nurses during the COVID-19 pandemic.

**METHODS**

**Design and participants**

This mixed-methods study was conducted in intensive care units (ICUs) at a large tertiary medical center in Israel, during February–May 2021 (third wave of the pandemic). Our ICU division comprises five intensive care units: respiratory (16 beds) with Covid-19 sub-unit (4 to 8 beds), surgical (14), neurosurgical (6), cardiac (10), and cardio-thoracic surgical (10) with extracorporeal membrane oxygenation (ECMO) machines. Most coronavirus patients in a severe condition were treated in respiratory ICU and dedicated COVID-19 treatment sites that were set up over the preceding year. The cardio-thoracic surgery ICU treated cases requiring ECMO. The cardiac, surgical and neurosurgical ICUs were not designated for the care of thoracic surgery ICU treated cases requiring ECMO. The cardiac, treatment sites that were set up over the preceding year. The cardio-thoracic surgical (10) with extracorporeal membrane oxygenation (4 to 8 beds), surgical (14), neurosurgical (6), cardiac (10), and

The data were collected in two phases. In the first phase, qualitative data were collected using two focus groups including ICU nurse managers, deputy nurse managers, and nurse team leaders. This phase was also used to validate the variables and to identify the need to add variables to the study tool that was used in the second phase. In the second quantitative phase, a cross-sectional study among ICU nurses was conducted using an anonymous structured questionnaire.

**The first phase** All the nurse managers in the ICU division were invited to attend the focus groups on a voluntary basis. The aim of the groups was to identify key work-related challenges and issues in the COVID-19 pandemic, and to share the experiences of dealing with these challenges. As the study was conducted at the end of the third wave of the pandemic, it was possible to summarize a year of dealing with COVID-19 in our ICUs. Nursing supervisor introduced the rationale and purpose of the focus groups at nursing management meetings held approximately two weeks before the focus groups commenced. In order to reduce social desirability and data bias, the supervisor, who was among the principal investigators of the study (IW), did not participate in the groups.

The focus groups attended two weekly sessions, each lasting 90 min, which were held in December 2020–January 2021 during morning shifts, and were communicated online using the ZOOM platform (https://zoom.us/). One of the authors (IK, male), who does not work at the hospital, guided the sessions. Nurse Managers participated in the first session. The second session included deputy nurses and team leaders. Of the 19 senior nurses working in the ICUs, 15 participated in the groups (79%). The sessions were recorded and the recordings were transcribed and then deleted. Each session included a short introduction addressing ethical aspects and participants’ rights, followed by participants’ self-presentation, brainstorming, and discussion, and a summary of the meeting.

**The second phase** was a cross-sectional study conducted among staff ICU nurses. The data were collected after a pilot study in 10 nurses from the cardiac ICU. Two researchers (IW; NL) distributed 145 questionnaires. A total of 100 completed questionnaires (69%) were returned to a nurse manager who transferred them to the study investigators.

**Tools**

**Qualitative data** were obtained by analysis of the group meetings. The groups focused on four key questions. The first question was: How can the first year of coping with the challenges of the COVID-19 pandemic be summarized? The second question dealt with managerial challenges: “What were the main managerial challenges in leading the ICU over the past year?” The third question focused on the difficulties reported by nurses: “What difficulties did the nurses report? What did they complain about? What helped them overcome their difficulties?” The last two questions were designed to open additional topics: “What other issues arose? What did you learn from this period?”

**Quantitative data** were collected by a self-administered questionnaire, which examined: (a) socio-demographic characteristics, (b) emotional stress, (c) burnout, (d) state hope, (e) professional function, and (f) two open-ended questions. All sections of the questionnaire were based on existing well-known validated and
reliable tools that were modified for the purpose and the population of the study. Six experts, all senior nurses who work in designated COVID-19 departments and services, validated the final version of the tool. The nurses were asked to check whether the questions were consistent with the objectives. Statements that did not receive a full consensus approval were removed or restructured.

*Personal and socio-demographic characteristics* included gender, age, seniority, religion, country of birth, marital status, education, type of ICU, night shifts per week, managerial or clinical position, and type of employment. Another question examined the extent of the nurse’s involvement in treating COVID-19 patients (hours a week). Three more items addressed COVID-19 morbidity, isolation due to the exposure or illness, and vaccination against the virus.

*Professional functioning* was examined using the 7-item perceived professional functioning scale (Melnikov et al., 2013). The participants were asked to rank the statements on a scale from 1 (strongly disagree) to 5 (strongly agree). A high mean score reflects high functioning. The reliability of the questionnaire by Cronbach’s alpha was 0.79.

*Emotional stress at work* was measured by one question “To what extent have you experienced emotional stress at work, during the last three months?” answered on a scale between 1 (not at all) to 5 (very much). Higher scores represent higher levels of emotional stress at work. This measure was previously validated in a study among physicians (Wilf Miron et al., 2019).

*Nurses’ uncertainty* was measured using a 7-item tool that was constructed by Kagan et al. (2004), and shortened by Melnikov et al. (2012). The tool assesses uncertainty related to significant events. For this study, the questionnaire was adapted to the unique situation of the COVID-19 pandemic. During the validation process, the panel of experts disagreed on items 4 and 7. Both items were removed so that the final version comprised five items. Participants were asked to respond to the statements on a scale of 1 (‘Not at all’) to 5 (‘Very much’). A higher mean score represents higher uncertainty. The Cronbach Alpha score for this section was 0.81.

*Burnout* was measured using a short 9-item version of the Shirom-Melamed Burnout Measure (Shirom & Melamed, 2006) that was recently used in a national burnout survey (Ministry of Health (MOH), 2018). Respondents were asked to rank statements on a scale of 1 (almost never) to 7 (almost always), with higher scores indicating higher burnout. Cronbach’s alpha was 0.94.

*Nurses’ hope* was measured using the 6-item State Hope Scale (Snyder et al., 1996) that was back translated and validated in Hebrew by Schwartz-Attias (2017). The tool addresses the individual’s determination and belief in their ability to achieve a goal under various circumstances (Simmons & Nelson, 2001). A higher mean score represents a higher level of hope. Cronbach’s alpha for this tool was previously reported as 0.90 (Schwartz-Attias, 2017), while the value in this study was 0.94.

Qualitative data from the staff nurses was collected using two open-ended questions addressing options for improving the situation during the COVID-19 pandemic: “From your own experience, what helped you to relieve stress during the pandemic?” and “What are your recommendations for other intensive care nurses on the COVID-19 front line?”

**Ethics statement**

The Helsinki Committee of the hospital, where the study was conducted, approved the study. The approval included an exemption from signing an informed consent form in order to ensure anonymity and improve participants’ compliance.

**Data analysis**

**Qualitative analysis**

The qualitative methodology was performed using constant comparative analysis to identify repeated content (Glaser & Strauss, 1967). A peer debriefing process in which one of the researchers, who is specialized in qualitative research methods, presented the findings to the other researchers, was used to validate the trustworthiness of the findings. The researchers discussed the findings until they reached a mutual consensus concerning the identified themes and categories (Lincoln & Guba, 1985).

**Quantitative analysis**

Descriptive statistics were used to describe the distribution of the study variables. The distribution of the variables was normal. T-tests for independent samples, Chi$^2$, and one way ANOVA were used to compare variables. Pearson’s correlation was used to test the associations between variables. Multivariable linear regression was used to identify the predictors of the dependent variables. All independent variables that were significant in the bivariate analyses were included in the multiple linear regression. There were no missing data manipulations. A $p < 0.05$ was considered statistically significant. The data were analyzed using SPSS v.27 (IBM, US). The study was reported according to the STROBE and COREQ reporting guidelines (https://www.equator-network.org/).

**RESULTS**

**Qualitative findings**

Qualitative data analysis revealed two main themes: (a) challenges in the COVID-19 pandemic and (b) positive aspects of the COVID-19 pandemic. Each theme was represented by a number of categories.
Challenges in the COVID-19 pandemic

Physical and emotional overload

The difficulties experienced were caused by both intrinsic and extrinsic factors. The shifts were full of non-stop activity, and the number of complex operations each nurse had to perform increased. “Working in the Corona period was challenging practically and emotionally. The nurses worked hard in protective clothing, and performed many complex procedures. Mentally, the personal burden of problems at home, distancing, lockdowns, and fears of being infected combined with the emotional strain of exposure to death and the complex clinical state of our patients. In terms of clinical outcomes, it was frustrating and difficult” - described P and M. Participant M. added: “Many of our patients passed away. We are used to saving lives and the daily death toll was unbearable”.

The impairment of work-life balance was reflected in conversations with staff nurses. I. stated: “The nurses expressed concerns for the health of family members at home, and for children without an educational framework during periods of lockdowns; they noted that friends are afraid to be in touch with them because of the stigma and the fear of being infected.” R. and I. added: “Some staff members collapsed and were unable to adapt to the new reality for a long time”.

The nurses noted that they tried to relieve emotions and conserve energies by self-training involving positive thinking and strengthening hope. I. reported: “We got into situations of great uncertainty, especially at the beginning of the pandemic. The information we were given was constantly changing. The situation was changing. All the time there was something new and unclear. We tried to overcome problems on our own. We learned and read, we tried to find out whatever we could.” Clinical practice was stressful even in ICUs that were not designated for the treatment of COVID-19 patients. G., a nurse manager of a unit that was not treating Coronavirus patients, added: “Although we were not officially associated with COVID-19 patients, there was tremendous pressure. We had many cases of patients being diagnosed with Coronavirus during the hospitalization ... and we had to deal with all the related issues. There were many staff members, who became infected or ill”.

Working environment and undesirable consequences

During the pandemic, various sites were modified to treat COVID-19 patients. At the beginning, these were sub-units in the internal medicine wards and isolation rooms in the ICUs but subsequently a large dedicated treatment site in an underground car park of the hospital was activated. P. stated: “The difficulties were related to the need to function in different facilities, to adapt yourself and get used to different settings”. M. added: “The clinical activity in a number of treatment sites required high concentration, control, and planning that occasionally went wrong and caused complications.”

Participants noted that staff nurses reported an impairment of professional functioning and quality of care, and that an increased effort was required to complete tasks due to stress, uncertainty, overload, exhaustion, and mental fatigue. A. and M. noted: “There were many disturbances. Especially when we worked in the new sites and used new devices. We had to walk about a lot, to hunt for equipment in new closets. Working in protective clothing made us sweat and also caused fatigue and drained our concentration. We had to continually check ourselves to prevent mistakes. And there were mistakes too.”

Positive aspects of the COVID-19 pandemic

The positive issues were less discussed in the focus groups but when they were raised, most participants joined in and described good things that grew out of dealing with the pandemic.

Empowerment and strengthening of professional values

The pandemic created new opportunities for strengthening nursing values and pride. P. stated: “Dealing with the challenges of the pandemic has created an opportunity and a platform to strengthen professional values and pride”. P. and M. claimed: “We treated this situation like a war. We went into battle for the health of our patients and their families, and for our society”. R. noted: “I have always loved the nursing profession. But this year has strengthened my professional pride, and strengthened my understanding of the importance and centrality of nursing in health care.”

The nurse managers argued that the success of the first vaccination campaign in reducing morbidity and mortality produced a positive sense of “light at the end of the tunnel”, and reinforced the hope of successfully overcoming the COVID-19 pandemic. G. stated: “Our small successes in the fight against the pandemic have strengthened our faith and hope in the future”. Clinical successes in treating complex patients also strengthened morale and hope. Z. noted: “I have been working in intensive care for many years. However, there have been therapeutic successes here that I have not encountered before. In spite of all the risks and barriers.”

The pandemic highlighted ethical and professional issues that required a review of previously held professional perceptions and beliefs. P. and G.: “At the beginning we tried to plan and decide who would or would not enter Corona patients' rooms. We suggested that workers with chronic diseases such as diabetes and lung conditions, should be kept out of the isolation rooms for their own protection. Eventually, however everyone pitched in and provided direct care to Coronavirus patients.”

Leadership and team working

The managers emphasized a growth of personal leadership and role modeling in response to the challenges of COVID-19. A statement that was repeated several times during the meetings: “We were
visited all the new designated clinical coronavirus sites and facilities. It was important for us to "be part of the team" and to demonstrate personal involvement." I. added: "It was important for me to take care of COVID-19 patients by myself and to be a role model for others". "We have grown in terms of cooperation, teamwork and mutual help," M. stated and continued: "The role of nurse manager was very important, with great responsibility, and great challenges. Making decisions in difficult conditions pushed us to grow, and made us more professional and better. Each of us has benefitted from ideas and creativity that emerged in times of crisis." "It’s like an intensive course in senior management," R., who recently began running the unit, noted. I. added: "The cooperation between us, between the nurse managers in the ICU division, improved significantly."

Many examples of mutual support and willingness to help among staff nurses were presented. G. stated: "Our nurses took fewer days off, unjustified absences disappeared". M. added: "The nurses supported each other. "I have discovered unique traits and talents among my teammates, strengths that have not been identified before," R. added. K. described: "The social interactions have greatly improved. There was a point where more than half the staff members were in isolation at home due to a virus infection. Preparation of the working schedule was made possible due to the goodwill, willingness to help, and flexibility of the nurses in the ward, and with the help that came from other wards."

Despite the pressures, improvement in the ward climate was reported. Remote communication technologies contributed to keeping the teams in touch. Ir. said: "Remote staff meetings attracted more participants and attendance was higher, it was easier to communicate in conditions of isolation and lockdowns at home or while working in capsules [dedicated and regular work teams]." M. added: "We delivered updates and held remote consultations, efficiently and quickly".

Improvements in resources and administrative support

The COVID-19 dedicated ICUs were reinforced with additional personnel. P. reported: "The new staff members included new recently graduated nurses together with experienced nurses who had been transferred from other wards. Most of the nurses were absorbed and continue to work in the ICU division". Participants emphasized that the massive entry of new staff members created challenges and increased the burdens of guidance, training, and developing clinical skills but also introduced some positive effects. R. stated: "The entry of young nurses has introduced a new and fresh spirit in the units". M. added: "The corona period has allowed me to identify nurses with managerial potential."

The pandemic also created an opportunity to innovate equipment and instrumentation in the units. Ir. stated: "During the pandemic, there was extensive investment in infrastructures and advanced equipment that was budgeted by external money. For us, it was also an opportunity to replace old devices with new ones and to implement advanced technologies for the care of our patients."

A fast and effective response by the administrative support services was reported. Participants also described a high willingness of administrative authorities to assist. Requests from the units related to maintenance and administrative tasks such as equipment supply, fault repair and installation of new devices and technologies, were answered quickly and accurately. P. described: "The administrative staff and maintenance services demonstrated a desire and motivation to complete tasks as soon as possible and to do it in the best possible way."

At the end of the first study phase, we discussed the qualitative findings. As a result, we took the decision to examine the associations between stress, uncertainty, and burnout, as negatively contributing factors, and hope, as a protective factor, in the context of nurses' professional functioning during the pandemic.

Quantitative findings

The convenience sample comprised 100 registered nurses working in the ICU division. The participants were between 26–67 years old (M = 40.05, SD = 9.30), with an average of 12.41 (SD = 9.16) years of working experience. Over half, (58.8%) were female, 54% were born in Israel, and 89% were academic nurses (graduates with a Bachelor’s or Master’s academic degree). In the last year, 20 (20%) were infected with coronavirus; 64 (66.2%) were in isolation due to exposure to a contagious patient; 68% were vaccinated against the virus. Additional personal and socio-demographic characteristics are shown in Table 1.

Descriptive statistics

The nurses reported high levels of burnout (M = 3.44, SD = 1.37, 1–7 scale), high levels of emotional stress (M = 3.19, SD = 1.07, 1–5 scale), a high degree of uncertainty (M = 3.32, SD = 0.82, 1–5 scale), moderate SHS scores (M = 5.79, SD = 1.28, 1–8 scale), and moderate levels of professional functioning (M = 3.70, SD = 0.66, 1–5 scale). An estimated 39.4% of the participants scored high to highest (4–5) levels of emotional stress.

Comparative analysis

Thirty-four (34%) of the participants did not directly treat COVID-19 patients, while 66% of the nurses reported varying levels of involvement in direct treatment ranging from single digit numbers to 32 h per week (M = 9.97, SD = 9.80; range 0–32). These two groups were compared in order to examine the impact of exposure to COVID-19 patients, but no statistical differences in any of the background or main study variables were associated with exposure to COVID-19 patients. Interestingly, further statistical analyses on the whole sample detected ethnic differences in burnout. Nurses, who had immigrated from the former USSR, demonstrated higher burnout than nurses born in Israel (M = 3.82, SD = 1.44, v M = 3.18, SD = 1.24). There were no additional differences by other background characteristics between the study variables.
| Characteristics                  | Category                              | n   | Valid % |
|---------------------------------|---------------------------------------|-----|---------|
| Gender                          | Male                                  | 40  | 41.2    |
|                                 | Female                                | 57  | 58.8    |
|                                 | Missing data                          | 3   |         |
| Religion                        | Jewish                                | 63  | 64.3    |
|                                 | Islamic                               | 25  | 25.5    |
|                                 | Christian                             | 5   | 5.1     |
|                                 | Other                                 | 5   | 5.1     |
|                                 | Missing data                          | 2   |         |
| Place of birth                  | Israel                                | 54  | 54      |
|                                 | Former Soviet Union                   | 41  | 41      |
|                                 | Other                                 | 5   | 5       |
| Professional education          | Registered nurse (RN)                 | 10  | 10.2    |
|                                 | RN with Bachelor's degree (RN BSN)    | 73  | 74.5    |
|                                 | RN with Master's degree (RN MSN)      | 15  | 15.3    |
|                                 | Missing data                          | 2   |         |
| Family status                   | Single                                | 29  | 29.0    |
|                                 | Married without children              | 7   | 7.0     |
|                                 | Married with children                 | 58  | 58.0    |
|                                 | Single with children                  | 6   | 6.0     |
| Type of ICU                     | General - respiratory                 | 26  | 27.4    |
|                                 | Coronary-thoracic (ECMO)              | 25  | 26.3    |
|                                 | Neuro-surgical                        | 16  | 16.8    |
|                                 | Cardiology                            | 15  | 15.8    |
|                                 | Surgical (Recovery room)              | 13  | 13.7    |
|                                 | Missing data                          | 5   |         |
| Type of employment (part-time)  | 26–50%                                | 2   | 2.0     |
|                                 | 51–75%                                | 15  | 15.3    |
|                                 | 76–100%                               | 81  | 82.7    |
|                                 | Missing                               | 2   |         |
| Night shifts per week           | 0 per week                            | 18  | 18.2    |
|                                 | 1 per week                            | 27  | 27.3    |
|                                 | 2 per week                            | 44  | 44.4    |
|                                 | 3 per week                            | 8   | 8.1     |
|                                 | 4 per week                            | 1   | 1.0     |
|                                 | 5 per week                            | 1   | 1.0     |
|                                 | Missing data                          | 1   |         |
| Job position                    | Clinical                              | 87  | 89.7    |
|                                 | Managerial                            | 1   | 1.0     |
|                                 | Combined                              | 9   | 9.3     |
|                                 | Missing data                          | 3   |         |
| Covid-19 morbidity             | No                                    | 79  | 79.8    |
|                                 | Infected without symptoms             | 3   | 3.0     |
|                                 | Infected with symptoms                | 17  | 17.2    |
|                                 | Missing data                          | 1   |         |
Correlational analysis

There were no significant correlations between the continuous socio-demographic or work characteristics and the main study variables. Correlational analysis between the study variables revealed interesting findings. As shown in Table 2, the higher the emotional stress at work, the more burned out the nurses felt and the lower their professional functioning. Higher burnout was associated with lower hope and poor professional functioning. The higher the nurses’ uncertainty, the lower the hope and professional functioning. Hope was strongly and positively associated with professional functioning.

Regression analysis was used to identify the predictors of professional functioning of ICU nurses during the COVID-19 pandemic. Age, gender, place of birth, religion, type of employment, and all the main study variables, were entered as independent variables. As shown in Table 3, state hope, uncertainty, and burnout variables contributed significantly and explained 46% of the variance of the professional functioning among nurses caring for Coronavirus patients.

Qualitative analysis of participants’ responses to the open-ended questions reinforced the findings that emerged from the focus groups and quantitative analyses. A total of 121 responses to questions were received. The most frequently repeated responses were as follows: 53% recommended maintaining a routine of rest, nutrition and adequate sleep, sports activities, and hobbies; 38% recommended strengthening hope and positive thinking and believed they would be able to overcome the pandemic; 23% noted the importance of mutual support of colleagues at work; and 17% emphasized the importance of family support.

DISCUSSION

The aim of this study was to explore the experiences of intensive care nurses during the COVID-19 pandemic. The COVID-19 challenging reality in five ICUs in a large tertiary hospital in Israel was examined comprehensively from two points of view: that of nurse managers in a qualitative fashion; and that of staff nurses, in a quantitative approach. The qualitative findings were derived from the deliberations of two focus groups, and the quantitative findings were obtained by examining the relationships between nurses’ professional functioning and stress, uncertainty, and burnout (negative factors), or hope (positive factor). The mixed-methods design revealed a number of interesting and even innovative findings in the quantitative and qualitative results.

The lack of effect of direct care for COVID-19 patients was unexpected in that the levels of stress, uncertainty, and burnout, as negative factors, and hope and professional function, as positive indications, were similar in the nurses who did or did not have direct contact with COVID-19 patients. This was in contrast to previous reports that associated direct contact with COVID-19 patients with higher levels of psychological distress (Fernandez et al., 2020; Ng et al., 2020). However, our findings can be discussed in light of a recently published study conducted in the third wave of the pandemic in Israel (Benbenishty et al., 2021), which found only marginal differences between nurses who treated coronavirus patients and those who did not. In addition, the differences found in univariate analyses were not supported by multivariate analysis. Similarly, the researchers found no differences in personal resilience, which could
TABLE 3 Multifactorial linear regression: Professional functioning

| Variables   | B     | SE   | Beta | t     | p    |
|-------------|-------|------|------|-------|------|
| Constant    | 3.793 | 0.633| 5.996| 5.996 | 0.000|
| Age         | -0.005| 0.006| -0.074| -0.856| 0.395|
| Place of birth | 0.095 | 0.102| 0.083| 0.929 | 0.356|
| Religion    | -0.055| 0.063| -0.079| -0.872| 0.386|
| Employment  | 0.015 | 0.158| 0.008| 0.992 | 0.356|
| State Hope  | 0.218 | 0.050| 0.410| 4.373 | 0.000|
| Uncertainty | -0.155| 0.073| -0.192| -2.125| 0.037|
| Burnout     | -0.123| 0.049| -0.251| -2.490| 0.015|
| Stress      | -0.098| 0.058| -0.153| -1.692| 0.095|

Note: $R^2 = 0.46$, Adj. $R^2 = 0.41$.

resemble the hope we followed as a protective characteristic in our study.

The lack of effect can be explained in a number of ways. First, it is possible that the experiences gained during a year of dealing with COVID-19 pandemic, may have refined the coping mechanisms among ICU nurses, who were routinely exposed to stressful situations even in pre-pandemic times. Secondly, it is possible that the high intensities of the psychosocial effect of the pandemic have a significant effect on all nurses, whether or not they care for COVID-19 patients directly. Finally, it is also possible that exposure to newly diagnosed and confirmed COVID-19 cases in non-dedicated units might be particularly stressful because the encounter with the disease there is more unexpected and may be associated with a lack of control, uncertainty, and anxiety. In contrast, continuous treatment of COVID-19 patients in dedicated units may reduce the stress, uncertainty, and burnout because of the development of a sense of control over the situation and an appropriate appraisal of the risks. This option is supported by the qualitative findings of this study, where the nurse managers described the high levels of stress associated with unexpected encounters with random confirmed COVID-19 patients in the neurosurgical ICU.

The quantitative findings of high emotional stress and burnout together with the qualitative findings of mental distress among nurses following exposure to severe illness, poor control over patient flow, complications, and death of COVID-19 patients, are consistent with the literature from the COVID-19 pandemic period. Emotional burden along with extreme multitasking and therapeutic overload, can promote both physical and psychological exhaustion and burnout that, in turn, may lead to lower performance and impair the quality of care (Fernandez et al., 2020; Magner et al., 2021; Ng, et al., 2021; Rutter et al., 2020). Given the high rate of burnout among nurses even in pre-pandemic times, as found in a recent national survey by the Ministry of Health (MOH) (2018), and in emergencies (Bruyneel et al., 2021; Hu et al., 2021; Stocchetti et al., 2021), continuous and consistent activity is recommended to reduce burnout in this risk group of nurses.

The negative associations between uncertainty, burnout, and professional functioning and the positive relationship between hope and functioning, add a unique contribution to the fast-growing body of knowledge about how intensive care nurses cope during the Covid-19 pandemic. For effective cognitive coping with uncertainty, the literature recommends interventions involving providing and structuring of information and sharing of accumulated knowledge in accessible ways according to the changing needs of nurses in an ambiguous reality (Fernandez et al., 2020; Magner et al., 2021).

In contrast, hope is cited in the literature as a protective factor against the negative effects of stressful situations (Kotera et al., 2021; Lijuan & Rong, 2021; Simmons & Nelson, 2001). Therefore, the positive relationships of the SHS score with the study variables, especially with professional functioning, are consistent with findings of other studies. These quantitative findings were also supported by the positive comments that emerged in the focus groups and highlight the professional growth of nurses during the pandemic. Similarly, other studies have described the benefits and positive effects that extreme situations may have on functioning. In this context, a frontline dynamic environment has been shown to generate a heroic atmosphere and the accompanying professional challenges, promote effective teamwork and encourage mutual support, and fulfillment of personal skills and talents (Fernandez et al., 2020; Magner et al., 2021). Hope as an expression of positive thinking and setting achievable goals, plays an important role in maintaining motivation and reducing the effects of negative factors such as pressure and burnout, while functioning in prolonged stressful conditions. For this reason, it could be useful to offer interventions that improve mindfulness and encourage positive thinking skills. Implementation of effective interventions to reduce uncertainty and burnout together with preserving and strengthening hope, may lead to an improvement in the professional functioning of ICU nurses in emergency.

Our qualitative findings emphasized the importance of leadership, role modeling, and managerial engagement in current happenings "in the field". Providing appropriate explanation and sharing communication of information to frontline workers along with strong leadership have been proven in the past to be essential resources and crucial in better dealing with pandemics (Fernandez et al., 2020).
Nursing managers reported an improvement in the ward climate that was reflected in a willingness to help and support each other. Previous pandemics and the current reality of the Covid-19 crisis teach that, in emergencies, nurses demonstrate professional collegiality and increased caring for their co-workers, and that the situation promotes team working, and encourages team spirit and mutual support. Previous studies have reported a high commitment and a strong motivation of nurses to perform their role during emergencies and pandemics, despite physical difficulties and emotional overload (Fernandez et al., 2020).

LIMITATIONS
A number of limitations can be attributed to this study. First, the sample is relatively small. It is important to note that ICU nurses represent a limited population of unique and quality personnel. Although much effort has been invested to ensure the sample size, validity, and reliability of the data, in further studies, it is recommended to initiate a multi-center survey in order to increase the target population. Secondly, the study design does not allow suggestions regarding the causality of the relationships between variables due to the cross-sectional design of the study.

CONCLUSIONS
This study addressed the experiences of nurses at all organizational levels in intensive care units and the results identify significant associations between stress, uncertainty, burnout, hope and professional functioning. According to the study findings, the intensity of the experiences and psychosocial phenomena is not affected by exposure to treatment of COVID-19 patients. The relationships between the study variables emphasize the importance of implementing interventions to reduce uncertainty, address burnout, and strengthen hope. Improvement in these indices may be reflected in better nurses’ professional functioning and work life well-being. We have identified a need to formulate policies and implement interventions to treat these phenomena in a routine manner of working plans, and specifically a policy that promotes the systematic provision and sharing of up-to-date information with employees in prolonged emergencies. The findings of the study highlight the claim that during a stressful situation such as a global pandemic, emotional support should be offered both to nurses, who directly care for COVID-19 patients, and those who are not directly exposed or dedicated to the care of these patients.

Clinical Resources
- Hope in Nursing Practice: https://nursinganswers.net/essays/the-concept-of-hope-in-different-people-nursing-essay.php
- The Oxford Handbook of Hope: https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199399314.001.0001/oxfordhb-9780199399314
- COVID-19: Confronting uncertainty through & beyond the crisis: https://www2.deloitte.com/global/en/pages/about-deloitte/articles/covid-19/covid-19--confronting-uncertainty-through---beyond-the-crisis-.html

AUTHORSHIP
We confirm that all authors meet the criteria of substantial contribution to all of the following: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted.

AUTHORS’ CONTRIBUTIONS
IK - Conceptualization, Methodology, Data Curation, Formal analysis, Writing Original Draft, Review & Editing; NL - Conceptualization, Resources, Data collection, Resources, Writing Original Draft; IW - Conceptualization, Resources, Data collection, Resources, Writing Original Draft; Reporting guidelines; STROBE reporting guidelines were used.

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CONFLICT OF INTEREST
The Authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available from the corresponding author [IK], upon reasonable request.

ETHICS STATEMENT
Approval for this study was obtained from the Helsinki Ethics Board of the Rabin Medical Center, Approval number: 0946–20 (November 5, 2020).

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