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Implementation of Crisis Management Phases in Intensive Care Units in the Crisis Situation Resulting from the COVID-19 Pandemic

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Abstract

Background: *The Intensive Care Unit (ICU) during the COVID-19 pandemic was at the heart of a hospital. At that time, nurses working in the ICU were fearing for their lives, with insufficient equipment and disorganisation resulting from the lack of sound knowledge on dealing with and preventing the transmission of the virus. The ward nurses experienced crisis management, without proper knowledge of the subject.*

Aim: *The purpose of this study is to analyse the management conditions in the ICU in Poland, in a crisis situation resulting from the COVID-19 pandemic.*

Methods: *The quantitative research was carried out in Poland, on a group of nurses from the ICU, using a questionnaire distributed online.*

Results: *The results of the assessment of ICU's preparedness in the event of a crisis, including the prevention, preparation, response and recovery phases, were presented. forty respondents took part in the study. Taking into account the average number of responses in the survey, they rated the Response phase as the highest one (30/40), followed by the Prevention phase (28/40) and the Preparation phase (26/40), and the Recovery phase as the lower one (11/40).*

Conclusions: *The crisis situation resulting from the COVID-19 pandemic has weakened the unprepared Health Care System, and therefore conclusions must be drawn from that experience. An important element of maintaining the efficiency of the ICU during a pandemic is sound knowledge, risk assessment and nurse education. At such a time it is equally important to prepare a crisis management plan and to assess it while it is being implemented, as well as to ensure the safety of the patients and ICU nurses.*

Key words: *nursing, intensive care unit, crisis management, COVID-19, crisis cycle*

Introduction

Crisis management is an element of national safety. The efficiency of the public administration in this area involves the prevention of crisis situations, preparation for their supervision by way of planned operations, reactions if they occur, elimination of their consequences and the recreation of resources and critical infrastructure, all serving the primary purpose of ensuring the safety of the citizens [1].

One of the causes of a crisis situation is an epidemic, i.e. the occurrence of infections or cases of an infectious disease in a given area in a number which is significantly higher than before, or infections or infectious diseases which are unprecedented [2]. Epidemics have always posed a threat to society and have been a significant challenge for healthcare providers. The COVID-19 (Coronavirus disease 2019) pandemic has shaken the stability of healthcare systems across the globe [3]. That epidemic definitely affected the crisis management method, whose basic purpose was to ensure the medical and health safety of the citizens. The presence of professionally prepared institutions (with appropriate measures and expert support) is a necessary resource, enabling accurate and effective protective and treatment measures. They help in gathering knowledge and information.

The concept of the crisis situation

The presentation of the definition of a crisis and a crisis situation in the HCS requires more details. The authors have attempted to exemplify the issue of a crisis situation in the HCS, during a permanent state of emergency and the uncertainty resulting from the lack of the possibility to ensure the safety of the patients and medical personnel, preventing the provision of statutory/established healthcare services. A crisis is a sudden thing, caused by a risk and resulting in a limitation of or an impediment to the functioning of critical infrastructure, including health protection [1]. For the purposes of this article, basic definitions and terms have been defined in Appendix A. Nowadays, it can be assumed that the situation within the scope of the severe acute

respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic is becoming stable [4]. On 16 May 2022, based on the Ordinance of the Minister of Health of 12 May 2022, the state of the epidemic resulting from infections with SARS-CoV-2 on the territory of the Republic of Poland was cancelled [5]. Only the state of epidemic risk was announced, which was effective until 1 July 2023 [6]. It is time for evaluations, conclusions, and corrective measures.

Currently, no attempts at identifying risk areas are being made, in particular the factors that could affect the crises in management. Based on opinions, analyses, evaluations and inspections, a statement comes to the fore that the healthcare system was not able to provide services under such difficult and unstable conditions, which included the lack of knowledge on SARS-CoV-2, lack of Personal Protective Equipment (PPE) and resources – human, material and financial [7]. Many patients were admitted to the Intensive Care Unit (ICU) due to respiratory failure with the risk of death [8–10]. The scale of admissions many times exceeded the organisational capacity of the ICU [7, 10–11]. The problem was exacerbated by the lack of screening (in the initial state of the epidemic), hence many cases and absences among members of the personnel [7, 12–13]. The personnel's fear for their and their loved ones' lives paralysed and limited their physical and mental fitness [14]. It was necessary to constantly evaluate the situation, prepare new procedures and make decisions in order to avoid risks [4]. The definition of a pandemic is not present in the Polish legal system, and the term itself emerged as a result of the announcement made by the World Health Organization (WHO) on 11 March 2020, when Tedros Adhanom Ghebreyesus, WHO Director-General, announced that the pace at which the disease was spreading, its intensity and the alarming level of inaction among governments of individual countries, resulted in the global situation being declared as the coronavirus pandemic. This happened when COVID-19, within four months beginning in December 2019, managed – according to official data – spread to over 110 countries. A total of 4300 people died, with about 121 500 people being registered as infected [15]. According to the WHO definition, a pandemic is "the worldwide spreading of a new disease" [16]. In Poland the first wave of the pandemic was not emphasised due to the low number of deaths and cases, as compared to

other European countries, as well as the lack of tests at that time, according to the Supreme Audit Office's report, and the different times of the pandemic outbreak [7, 17–18]. The "zero" patient was identified on 4 March 2020. The state of epidemic emergency in Poland started on 14 March 2020 and ended on 19 March 2020. A day later, the Polish government announced the state of epidemic [7]. After two years of the epidemic (8 March 2022), according to the data presented by the Polish Association of Epidemiologists and Infectious Disease Doctors in Poland, 5 million people had a confirmed SARS-CoV-2 infection, and the percentage of deaths was 2.2% [19].

The article analyses the range of activities undertaken in various crisis management phases presented against the background of the experience of nurses who work in ICU in Poland during the emergency caused by the COVID-19 pandemic.

Legal context of the crisis situation

The task of the Public Administration is to maintain safety of the citizens of the Republic of Poland [20]. An entity which is also obliged to ensure and maintain the proper level of safety is the Polish Armed Forces [21]. Due to the different entities serving similar functions, the tasks aiming at ensuring safety are completed through many provisions of law [22]. The right to health benefits in Poland is guaranteed by universal health insurance [23]. During the COVID-19 epidemic, Poland introduced amendments to the regulations, including the ones referring to simplified rules for performing the medical profession, as well as the maintenance of professional continuity [24–25]. At the beginning of the epidemic state, as announced by the Polish government, the situation was regulated by the Act of 26 April 2007 on crisis management and the Act of 2 March 2020 on special solutions related to preventing, counteracting and combating COVID-19, other infectious diseases and the emergencies caused by them [1, 26]. Also the Act of 5 December 2008 on the prevention and combating of infections and infectious diseases in humans was also applicable [2]. The Act of 26 April 2007 on crisis management refers to a crisis situation that may occur due to different reasons,

including epidemiological ones [1]. It defines important terms: crisis management and crisis situations. Both definitions included in this legal act do not fully reflect the situation that occurred due to the pandemic announced globally on 11 March 2020 and the state of epidemic announced in Poland on 20 March 2020.

Crisis management in the state of epidemic was not limited to the activity of the public administration bodies. Public benefit organisations and non-profit organisations were also supported [18, 27].

The crisis that arose, especially at the beginning of the pandemic, did not cause such entities as hospitals, within the meaning of the Act of 15 April 2011 on medical activity, to cease their activity [28]. It resulted in the development of alternative forms of healthcare services, such as telemedicine, including in Poland [29–30].

However, the epidemic affected the state of balance, related to instability and disorganisation. It caused significant restrictions in the activity of appropriate public administration bodies, due to the inadequacy of the resources and capabilities. Due to COVID-19, many legislative changes were introduced in healthcare. They aimed at improving the process of providing healthcare benefits and stabilising the epidemiological situation in the country (preventing and counteracting the consequences and combating the epidemic in Poland). For the purposes of this paper, selected legal acts were included in Appendix B.

During the pandemic, changes were introduced to the ordinance on the organisational standard of healthcare in the field of anaesthesiology and intensive care [25, 31–32]. The amendment concerned the extension of the period of professional adaptation of the nurses who did not have the required qualifications while providing healthcare services to patients in anaesthesiology and intensive care units. The legislator also extended the time which applies to the special requirements on equipment and infrastructure in the units until the end of 2022. Due to the lack of personnel and employees in certain job positions, patients who were mechanically ventilated due to SARS-Cov-2 stayed on different wards. As a result, the Polish Association of Anaesthesia and Intensive Care Nurses took the initiative and translated

materials concerning quick professional adaptation for nurses who did not work in ICU [33]. The problem of the healthcare staffing shortage was also formally regulated, while students and employees from other organisational units of the healthcare system filled the gap [34].

The healthcare system in the first days following the announcement of the epidemic was not prepared to provide healthcare services. Under such difficult and unstable conditions, which resulted from a number of elements, one of the most important being the lack of knowledge of SARS-CoV-2 and the methods for handling the risk, while both the statutory and the executive provisions did not have a significant impact on hospitals' operations and their work organisation, health care services were provided. The Agency for Health Technology Assessment and the Tariff System offered help, and together with specialists prepared recommendations for dealing with COVID-19, which were available on its website [35]. WHO played an important role in delivering sound knowledge about SARS-Cov-2 [36]. The opinion-forming body was the Chief Sanitary Inspectorate in Poland and the Ministry of Health [37–39]. The National Research Institute prepared the main rules for HCWs [40].

The analysis of the literature of the subject shows that in crisis situations caused by an epidemiological risk, as a society we deal with two scopes of activities: short- and long-term ones [22, 41]. The short-term activities include the current activities aimed at providing care and treatment to patients, preventing the infection from spreading as well as protecting the medical and non-medical personnel working in a hospital. Based on experiences, a prevention plan is developed. The long-term activities are prepared when a risk decreases in intensity, but still exists. The activities undertaken during such a time should aim at developing the rules and procedures, and dealing with such or similar situations, according to the crisis management cycle.

Crisis management phases

Four repetitive phases are distinguished during the crisis management process: prevention, preparation, response and recovery [22, 41–42]. Such a crisis management cycle is shown in Fig. 1. WHO notices that these phases, to

which the organisation refers to as the "shocks cycle", contribute to the maintenance of the resilience health system. They were described as "preparedness, shock onset and alert, shock impact and management and then recovery and learning" [43]. Veenema et al. compare the phases of the crisis management cycle to the life cycle. The authors emphasise that, regardless of the life cycle stage of an institution, the phases of the crisis management cycle may interpenetrate [22, 44]. They also underline the prevention and preparation phases as the most important ones in crisis management [41–42]. The crisis management process from the management point of view requires a process approach and concerns planning, organisation and decision making. Motivating employees and supervising are also management functions which are applicable during crisis situation management particularly during the preparation phase [22].

There is no precise direction in which the phases function. The analysis of the phases aims at evaluating the possibility of preparing and gathering specific knowledge, necessary for maintaining the continuity of the ICU in a crisis situation.

Figure 1. The phases of the crisis management cycle. Wojciechowska-Filipek, S., Mazurek-Kucharska, B. Zarządzanie w kryzysie. Aspekty organizacyjne i psychologiczne (Management in crisis. Organisational and psychological aspects), 2nd edition. CeDeWu: Warsaw, Poland; 2021).

The crisis management cycle is presented using sequences of the phases, without a distinguished method of direction labelling. This means that the phases may have a different order [41–42]. Preparation and prevention are crucial [41, 44]. As studies show, these phases should take most of the time devoted to the activities.

Aim of the paper: The purpose of this study is to analyse the management conditions in the ICU in Poland, in a crisis situation resulting from the COVID-19 pandemic.

Materials and methods

The study attempts to evaluate the conditions for management in the ICU organisation during a crisis situation, such as the COVID-19 pandemic. The following questions were asked:

Q1. What solutions were implemented at each phase of the crisis management cycle to rise to the challenge of the pandemic?
Q2. How was management in a crisis situation assessed by ICU nurses?
Q3. What elements of the crisis management cycle were important for ICU nurses?
Q4. What was the level of knowledge on crisis management among ICU nurses?

The purpose of asking these questions was to check whether management in a crisis situation enabled efficient operations aimed at maintaining the flow of activities in the ICU, and at the same time maintaining the healthcare benefits which are guaranteed in Poland. In order to prepare the research questionnaire, the following understanding of the individual phases of the crisis management process was adopted:

The **prevention phase** is distinguished by a number of activities which, in relation to management functions, may be related to planning. For an organisation this means an activity directed at the future [45]. While managing a crisis situation resulting from an epidemic, the main goal is to ensure medical safety for patients and professional safety for employees, against

a disease and the risks related to complications. The activities should focus on the technical area, informational area and mental support for the personnel. In the ICU the technical area is a complicated system which is directly responsible for maintaining and restoring a patient's vital functions. This is an area requiring the cooperation of many technical services, medical equipment, etc. During the prevention phase, the sources of knowledge, recommendations, opinions are important. Work organisation includes the classification and analysis of risks, the evaluation of legal standards, systemic, formal regulations and recommendations is also significant [42]. Feedback on crisis management from consultants and health services is important. During such a time it is important to plan the financial, human and material resources necessary for preparing a comprehensive crisis management plan.

The **preparation phase**, within the scope of management functions, is related to organisation. It is distinguished by the assessment of the risk of a potential emergency [44]. This is a process of forming a system of people and information that are able to help achieve the goal, which relates to safety. While making decisions, a manager should aim to delegate tasks, providing a clear explanation of the rules applicable during the performance of responsibilities, while ensuring good communication and establishing a hierarchy [44, 46]. According to the author, one of the most important stages is training at each level of management [41]. Sometimes learning optimal management includes the activities of preparing simulations of the procedures and updating the existing ones, monitoring potential risks and preparing strategies. At this stage, effective communication must be established it is important to prepare and re-organise resources as well as assign personal responsibility and improve/adjust the infrastructure [44–45, 47–48].

The **response phase** is about making decisions which are related to the basic management activity. The main response character is an activity resulting from a specific situation, as well as the implementation of corrective measures aiming at restoring the balance from before the event. It is a time of continuous mental support for employees and the injured parties,

all of which plays an important role [10, 49]. At this stage, the plans and procedures that have been prepared in advance are implemented in the crisis situation that occurred. It is important to limit the damage and to manage the situation. At this stage, feedback on the prepared procedures is important as well as any possible modifications.

The **recovery phase** involves supervision and evaluation. It also focuses on drawing conclusions and introducing improvements. This phase aims to adjust to the existing changed conditions resulting from a crisis situation. The recovery phase is also distinguished by the evaluation of the damage in the infrastructure area, material resources or the organisational area, followed by the implementation of the required short- or long-term changes. The last phase of activities concentrates on the restoration of the initial state of resources from before the event [42, 44].

The study was based on quantitative methods. In order to conduct the study, the authors developed a questionnaire whose questions concerned the assessment of the preparation, prevention, response, and recovery effects of a crisis situation (the pandemic) based on the literature.

In order to conduct the survey, the authors contacted the Polish Association of Ana-esthesia and Intensive Care Nurses (PTPAiIO), which gathers a professional group of nurses working in ICU – the target study group. The survey was conducted among ICU nurses in Poland for the first time. After obtaining permission to post the questionnaire on the PTPAiIO website (www.ptpaio.pl), the authors received access to a group of approximately 600 website users. To verify the correctness of the study group selection, two criteria were adopted: work in a nursing position and possession of qualifications resulting from the completion of training or a specialization in anesthesiology and intensive care. The correctness of the sample selection was verified by three metric questions included in the questionnaire (Appendix C). This way a total of 40 answers was obtained from this. The survey questionnaire consist of 28 questions, including 1 open-ended and 27 closed-ended or semi-open-ended questions, single or multiple choice, and an option of writing an own answer, assessing the preparation of units which provide ICU services, drawn up based on subject matter literature [42, 44].

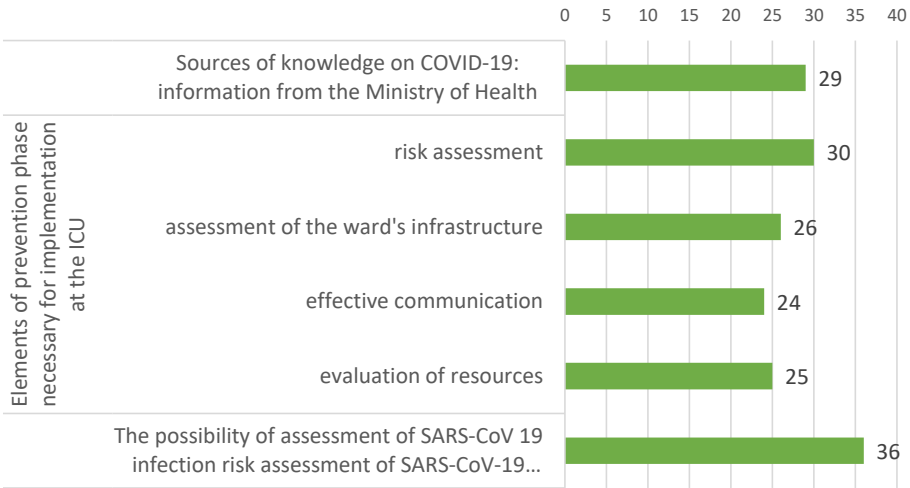
Appendix D. The data was collected in an electronic format using Google Forms. Participation in the survey was anonymous. The study was conducted in the period from 13 July 2020 to 4 April 2022. The data analysis was conducted using the Microsoft Excel software. The results were presented using descriptive statistical data relating to the frequency of responses by respondents were used.

Results

The following part discusses the evaluation results of the effectiveness of activities undertaken by ICU personnel as part of the individual crisis management phases. Only those results that crossed the threshold of 20 out of 40 of the answers to a given question will be described. As the study shows, it was the first attempt at presenting the conditions related to crisis management in an ICU in Poland. To ensure analyses' clarity, detailed answers to the survey questionnaire are provided in Tables 1–4.

Prevention phase. For the purposes of the study, the prevention phase includes the following issues: Over half of the surveyed have obtained information about SARS-CoV-19 by participating in webinars and internal training. 29 out of 40 respondents have used information from the Ministry of Health (Q4). The surveyed persons have also pointed out the "evaluation of resources (human, material, information, financial resources)" in the prevention phase (25/40), assessment of the ward's infrastructure (26/40), effective communication (24/40), and risk assessment 30 out of 40 (Q6). Almost all respondents have indicated the assessment of SARS-CoV-19 infection risk for "the entire personnel working in the ICU" as necessary (Q28).

Table 1. Distribution of answers – prevention phase. Issues indicated by respondents

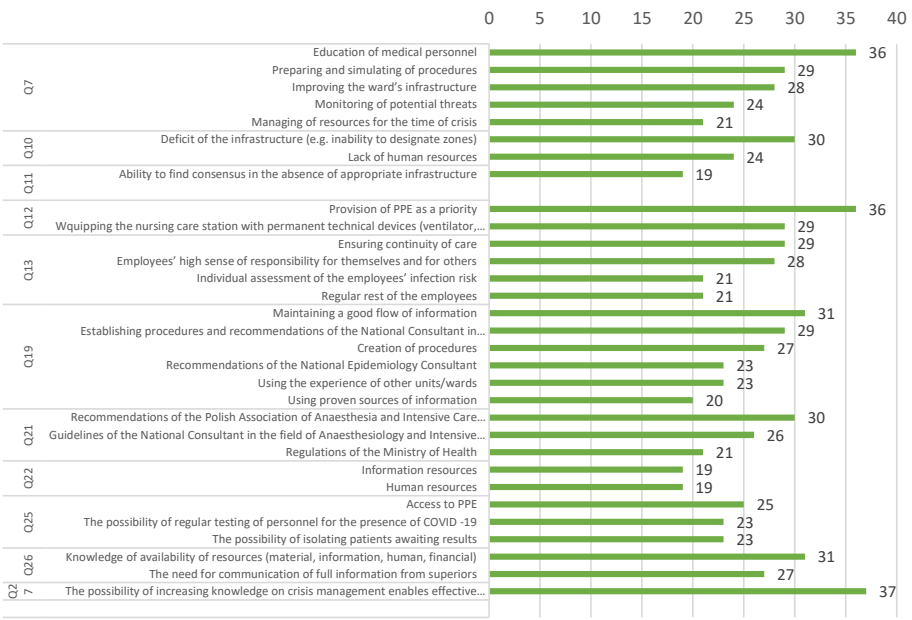


Preparation phase. For the purposes of the study the preparation phase includes the following issues: The surveyed people pointed out in the "managing of resources for the time of the crisis" (21/40) (Q7) the ability to prepare and simulate procedures and improving the ward's infrastructure by 28 out of 40 of the surveyed conducted "as significant elements'' of the prevention phase. Whereas in the preparation phase, most of the respondents have indicated the "education of medical personnel" as necessary (36/40) while 24 out of 40 of the employees emphasised the need for "monitoring of potential threats". Almost half of the surveyed persons opted for the "updating of procedures" (18/40) (Q7) Among the highest-rated obstacles included in the study that hinder an ICU's adaptation to a crisis situation resulting from the pandemic, the respondents indicated the: "deficit of infrastructure (e.g. inability to designate zones)" (31/40), while only 24 out of 40 indicated the "lack of human resources" as an obstacle to the adaptation of the unit (Q10). According to the respondents, the element which is the most important in determining the mobility zones is the ability to find a consensus in the case of a lack of appropriate infrastructure (19/40) (Q11). Almost everybody (36/40) indicated the provision of PPE as a priority. In the infrastructure

assessment, 30 out of 40 indicated "equipping the nursing care station with permanent technical equipment (cardiac monitors, ventilators, infusion pumps, etc.)" (Q12). For the priorities related to organizing human resources during crisis management in the COVID-19 pandemic, over 29 out of 40 consider that during the organisation of resources for crisis management, the priority should be to ensure the continuity of care and the employees' high sense of responsibility for themselves and for others. More than half (21/40) indicated as important in resource planning: regular rest of the employees (21/40) and individual assessment of the employees' infection risk (21/40) (Q13). For the priorities related to organizing information resources during crisis management in the COVID-19 pandemic, the researchers indicate maintaining a good flow of information (31/40) and establishing the procedures and recommendations from the National Consultant in Anaesthesiology and Intensive Therapy (29/40), establishing procedures (27/40), and recommendations from the National Epidemiology Consultant (23/40). Half of the respondents also indicated the use of reliable sources of information as a reliable aspect in the organisation of IT resources during the preparation phase (Q19). The respondents decided that the sources of information useful in developing a plan to prepare procedures in the COVID-19 pandemic were recommendations of the Polish Association of Anaesthesia and Intensive Care Nurses (30/40) (Q21). The most important in the preparation of procedures in the case of contact with a patient diagnosed with a COVID-19 infection were information and human resources, indicated by almost 20 out of 40 of the researchers (Q22). Aspects of crisis management in times of the SARS-CoV19 pandemic which should be considered when organizing patient care in the ICU were the polled indicated access to PPE (25/40), the possibility of regular testing of personnel for the presence of COVID-19 (23/40), and the possibility of isolating patients awaiting results (23/40) (Q25). Among the elements which form the basis of crisis management, the respondents listed the knowledge of the availability of resources (material, information, human, financial) (31/40) and the need for communication of full information from superiors (27/40) (Q26). The possibility of increasing knowledge on crisis

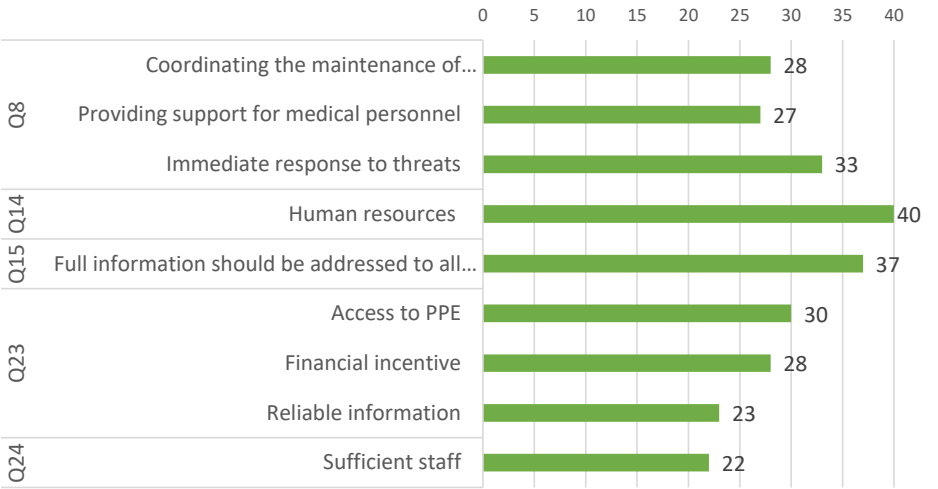
management enables effective decision-making in urgent situations, which is important for almost all the surveyed (Q27). Answers presented in Table 2.

Table 2. Distribution of answers – preparation phase. Issues indicated by respondents



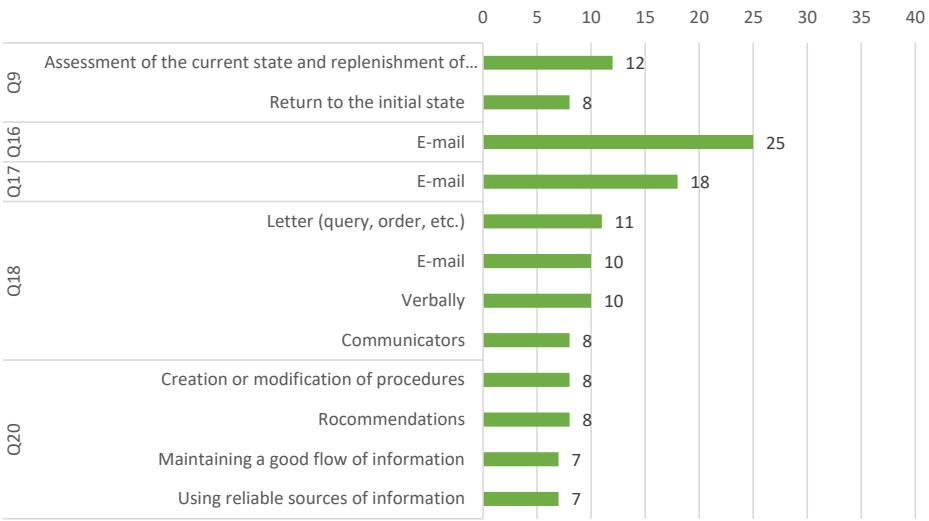
Response phase. For the purposes of the study, the response phase includes the following issues: The necessary elements of the response phase area at the ICU surveyed indicated coordinating the maintenance of operational continuity of the ICU (28/40) and the immediate response to threats (33/40). What is important is that providing support for medical personnel was indicated by 27 out of 40 of the surveyed (Q8). All respondents indicated "human resources" as significant in crisis management (Q14). Almost all questioned people responded that "full information should be addressed to all employees" (Q15) but only a 22 out of 40 response showed the most difficult resources to implement/secure was the correct number of staff (Q24). This phase of resources which mobilized staff to action was indicated as access to PPE (30/40), financial incentives (28/40) and reliable information (23/40) (Q23).

Table 3. Distribution of answers – response phase. Issues indicated by respondents



Recovery phase. For the purposes of the study, the recovery phase includes the following issues: For the studies in the recovery phase, in (Q9) concerning the most important aspect of this phase, the threshold was not reached. A similar situation applies to (Q18), where the respondents were asked to point out the most effective method of information management. The structure of answers in (Q20)is similar to the previous questions. However, (Q16) concerned which channel was used to provide full information on the resulting procedures. The survived indicated by e-mail (25/40). Q17 also concerned the information on the partial communication of the procedures, where 18 out of 40 of the respondents indicated e-mails.

Table 4. Distribution of answers – recovery phase. Issues indicated by the respondents



For the sake of clarity, the authors describe in the tables above only those results that crossed the threshold of 20 out of 40 of answers to a given question. A complete list of answers is available in Tables 5–8.

Discussion

The knowledge of the phases of crisis management is an important element of management in a crisis situation. Although the respondents considered all management phases as important, as we know from the literature the prevention phase plays a crucial role and plays the key role in manager duties [41–42]. Only one-fourth of respondents indicated the importance of this phase. When assessing risk, half of all respondents mentioned the need to organize resources in a crisis situation. The phases of crisis management can interpenetrate and most frequently this happens in the healthcare area [44]. The prevention phase is distinguished by a necessary careful risk assessment, whose importance was emphasised in documents released by WHO and The Lancet Commission [45, 48].

The available literature highlights the importance of reliable and credible sources of information during a crisis arising from a pandemic [52]. According to the respondents, the source of knowledge on SARS-CoV-2 in Poland was the Ministry of Health and WHO [53–55]. According to the authors, the prevention phase in the ICU should include regular evaluation of available resources, infrastructure capabilities and training on possible risks [42, 44]. Also WHO, CDC and The Lancet COVID-19 Commission indicated the necessity of carrying out risk assessment, which in the case of ICU nurses significantly affected the sense of safety of their profession [45, 48, 56]. In the questionnaire, almost all respondents also indicated the necessity of SARS-CoV-2 risk assessment as an essential solution for ICU nurses.

The effect the COVID-19 pandemic had on healthcare workers, the number of deaths, cases and the resulting sickness absence clearly shows that risk assessment in the current situation is an important element of the preparation phase [51, 57–59]. Also in our research, three quarters of respondents confirmed risk assessment as important. The Lancet Commission and other authors highlight the need to prepare a strategy in the case of a risk, and to organise and carry out individual and group simulations [12, 44–45, 47]. The importance of this element was indicated by the respondents as an important part of preparation. The author stresses the fact that human resource management is important, and it has also been mentioned in studies by different authors [43–44, 60]. It is also important to emphasize the necessity to maintain the level of safety among ICU patients and nurses who provide healthcare services, regardless of external situations, which was also important during the COVID-19 pandemic. Just before the pandemic, occupational burnout among ICU personnel was confirmed [61]. The lack of safety caused the fear of risk and the resulting mental strain among the nurses. Work overload and the lack of appropriate equipment in the workplace significantly affected the nurses' psychological resistance during the pandemic, which emerged in our study, as nearly three-fourths of all respondents expected support and repair measures in the response phase [62]. Almost all respondents indicated PPE as necessary to provide and ensure care to patients during the COVID-19 pandemic. Their lack caused the fear of risk and the resulting mental strain

among the nurses [12, 63–65]. Fear of their loved ones' health was also important [63]. It was probably one of the elements that affected the increase in sick leave absence. Access to PEE of appropriate quality in difficult and changing conditions contributed to a stronger feeling of safety and work satisfaction among HCPs [64]. More than half of all respondents mentioned the need to reorganise resources and assign personal responsibility as important in the response phase [44, 48]. Study results show that what is important in the preparation phase is effective communication [45, 48]. It is equally important to engage the personnel by engaging employees in the process from the very beginning, including feedback from the people implementing the plan, which was mentioned as important only by a third of respondents [66]. The initial stage of the pandemic was related to the lack of reliable, credible knowledge about SARS-CoV-2. It was a situation concerning information chaos. In this way, at the beginning, the recommendations from scientific societies, procedures and amended regulations played an important role and served as the basis for the coordination of healthcare entities, which was mentioned as important by half of respondents. At that time, institutions, organisations and individual representatives of medical professions, who shared their knowledge with others, played a valuable role [67]. This important aspect of crisis management should be included in crisis management, as there is no point in reinventing the wheel. Management in a crisis situation requires particularly effective decision-making, that is why it is so important to have up-to-date and reliable knowledge of the possible risks. Relatively, the less time we spend preparing and preventing, the more time we have for reacting and recreating, which means less time is necessary for a ward to return to its normal operations.

The ICU's response to the crisis situation refers to the maintenance of effective operations for the unit and limitation of the existing risks. During this time the prepared plan is tested. Information about restrictions is important. The key aspect is the provision of resources, which was also pointed out in the studies [68]. Maintaining good communication with all employees is still important [44, 66]. It is important to remember that the source of motivation for the nurses was access to PEE and the financial incentive, which was

indicated by three-fourths of all respondents, as well as engagement and positive relations in the ICU [12, 66, 69].

The last element of the crisis management cycle phase refers to recovery. Although the respondents did not explicitly mention the most important aspect of that phase, continuous assessment of the current condition of the unit and replenishment of resources remain essential elements. Returning to the initial state, according to the author, involves drawing conclusions [22, 44].

It is important to emphasise the significance of up-to-date knowledge on the risks once again. An equally important element of the manager's tasks is clear communication with the team and support for people in need [44, 71–72]. At such a time, it is important that a manager creates a good work environment, which may also significantly affect the nurses' professional resistance [61, 70].

Limitations

One of the limitations of the presented studies is the low number of received responses, which may affect the general conclusions. The reduced number of questionnaires received could be caused by the current COVID-19 pandemic. This resulted in an increased number of illnesses among nurses as well as a general work overload of staff working in intensive care units. Moreover, the authors observed a general aversion to sharing knowledge of crisis management and undertaking activities.

Conclusions

The analysis of the conditions for management during the COVID-19 pandemic in an ICU refers to the individual phases of crisis management. The prevention phase focuses on the assessment of risks and the collection of reliable information, as well as the evaluation of available resources, including nurses. The preparation phase mainly refers to the collection of data on the risks and preparation of procedures. At this stage, the infrastructure is adapted to the existing needs while the resources necessary for maintaining patients' vital functions are gathered. During the response phase, the prepared plans

were verified and included in the current risk assessment. Maintaining ICU operations and the flow of information is essential. The recovery phase is distinguished by a continuous regular assessment and the replenishment of resources. During such a time, an attempt at drawing conclusions should be made and effective actions must be determined. Efficient management in a crisis situation would not be possible without conscious management by a resilient ward nurse.

Appendix A

Epidemic – infections or cases of an infectious disease in a given area in a number which is significantly higher than before, or infections or infectious diseases which are unprecedented [2].

State of epidemic risk – a legal situation introduced in a given area as a result of the risk of an epidemic, for the purposes of taking preventive measures, specified in an act [2].

Epidemic risk – conditions or circumstances presenting the risk of an epidemic in a given area [2].

State of an epidemic – a legal situation introduced in the whole area, due to an epidemic, for the purposes of taking anti-epidemic and preventive measures specified in an act, in order to minimise the effects of an epidemic [2].

Crisis – this word comes from "krino" in Greek and means: a turning, breakthrough point, a decisive moment, a qualitative change of a system or in a system [73]. Crisis (in English) expands the meaning to suddenness, injuries and the subjective consequences of an injury in the form of negative experiences. In general, we can say that a crisis is a sudden or an escalating event, posing a threat to one's life, health, property, and the human environment, and that in order to defy it one needs to engage strength and resources which often go beyond local capabilities [74].

Crisis management – activities undertaken by public administration bodies which are a part of national safety management and involve prevention of crisis situations, preparation for their supervision through planned operations, reaction to crisis situations, elimination of their consequences and replenishment of resources and critical infrastructure [1].

Crisis situation – a situation which negatively affects the level of safety of people, property, to a large extent, or the environment, causing serious limitations to the operations of appropriate public administration bodies due to the inadequacy of manpower and resources [1]. It also determined the moment of discontinuation at a given time, starting from the state of balance, going through instability and finally reaching stability in a new situation [75].

Appendix B

Selected regulations applying to the provision of healthcare services during a pandemic. The notion of an "act" refers to a normative act which is widely applicable and enacted by a parliament. In Poland it is a legal act which includes general norms [76].

- Act of 26 April 2007 on crisis management (Journal of Laws no. 89 item 590 as amended)[1].
- Act of 2 March 2020 on special solutions related to preventing, counteracting and combating COVID-19, other infectious diseases and emergencies caused by them (Journal of Laws of 2020, item 374)[26].
- Act of 5 December 2008 on the prevention and combating of infections and infectious diseases in humans (Journal of Laws of 2021 item 2069 and 2120 and of 2022 item 64)[2].
- Ordinance of the Minister of Health of 20 March 2020 on the announcement of the state of epidemic in the Republic of Poland 77].
- Ordinance of the Minister of Health of 7 March 2020 on the list of diseases resulting in the obligation to quarantine or have epidemiological supervision, and the period of obligatory quarantine or epidemiological supervision [78].

- Ordinance of the Minister of Health of 16 December 2016 on the organisational standard of healthcare in anaesthesiology and intensive care (Journal of Laws of 2020 item 940)[31].
- Ordinance of the Minister of Health of 12 May 2022 on the cancellation of the state of epidemic in the Republic of Poland (Journal of Laws of 2022 item 1027)[5].

The legal act on the methods for preventing, counteracting and combating COVID-19, as well as the procedures, combating other infections and other infectious diseases, specified preventive, anti-epidemic measures, and the principles governing public administration bodies. The act also regulated the scope and responsibilities of patients and entities providing health services to people in the territory of Poland. An important element of the act was a regulation on financing the health services in patients with a suspected or confirmed COVID-19 disease. The introduction of the legislation enabled the initiation of government programmes which helped launch the Anti-COVID-19 Fund [77]. Another document regulating the activities of the public administration bodies during COVID-19 was the Act on crisis management [1]. The act specified the activities aiming to provide national safety, prevent crisis situations and plan operations, as well as react to a crisis situation and replenish resources. The act also specified the scope of critical infrastructure which included the healthcare system.

The legislator also determined the rules and the procedures for preventing and combating infectious diseases in humans. The regulations specified the methods for preventing infectious diseases, limiting transmission and neutralising the sources of infection. An important aspect of the act are the provisions regulating the rights and obligations of healthcare providers related to preventing and combating infections and infectious diseases among people in Poland [2]. The regulations also included the method for monitoring an epidemiological situation. Another legal act regulated the announcement of the state of epidemic in the Republic of Poland [78]. The ordinance applied to restrictions on movement, organisation of mass events and prohibition of sale or export of Personal Protective Equipment (PPE). The legislator also imposed temporary restrictions on the functioning of institutions

and companies [78]. The above regulations applied to social issues, and to a small extent they applied to medical activities. Hospital personnel and healthcare managers eagerly waited for laws, regulations and procedures. One of the few legal acts at that time, one that had a practical application, was the Act of 5 December 2008 on the prevention and combating of infections and infectious diseases in humans [2].

Appendix C. Demographic and social characteristics of the studied cohort (n = 40)

Analysed characteristic	Statistical parameter*	
	n	*%*
Sex:		
female	38	95.0
male	2	5.0
Qualifications:		
qualification course	1	2.5
specialisation	32	80.0
both degrees	7	17.5
Current position:		
unit nurse	3	7.5
coordinating nurse	13	32.5
charge nurse	24	60.0

(For category characteristics: n – number of answers; % percentage of the answers in relation to the number of respondents).*

Table 5. Distribution of answer prevention phase: full version

Cycle Phase	Question	Areas Aspect	Issues indicated by respondents	n
Prevention	Q4	Sources of knowledge on COVID-19	Information from the Ministry of Health	29
Prevention	Q6	Elements of prevention phase necessary for implementation at the ICU	Risk assessment	30
			Assessment of the ward's infrastructure	26
			Effective communication	24
			Evaluation of resources	25
Prevention	Q28	The possibility of assessment of SARS--CoV 19 infection risk	assessment of SARS-CoV-19 infection risk for the entire personnel working in the ICU as necessary	36

Note: In the distribution of answers table, the first column shows the phases of the crisis management cycle. The second column shows the question number (Q). The third column contains the areas of questions. The fourth column contains the distribution of indicated answers to a given question. n – number of indications by respondents. The last column presents a percentage distribution of the answers. In the results table we only presented the issues for which the answer was indicated by over half of the respondents.

Table 6. Distribution of answers preparation phase: full version

Cycle Phase	Question	Areas Aspect	Issues indicated by respondents	n
Preparation	Q7	Necessary elements of crisis management at the preparation phase	Education of medical personnel	36
			Preparing and simulating of procedures	29
			Improving the ward's infrastructure	28
			Monitoring of potential threats	24
			Managing of resources for the time of crisis	21
Preparation	Q10	Obstacles which make it difficult to adapt the department to the existing crisis caused by the COVID-19 pandemic	Deficit of the infrastructure (e.g. inability to designate zones)	30
			Lack of human resources	24
Preparation	Q11	Which element, in your opinion, is the most important in determining the mobility zones?	The ability to find a consensus without appropriate infrastructure	19
Preparation	Q12	Priorities for organizing physical resources during crisis management in the COVID-19 pandemic	Provision of PPE as a priority	36
			Equipping the nursing care station with permanent technical devices (ventilator, cardiac monitor, bed, infusion pumps, resuscitator, laryngoscope, etc.)	29
Preparation	Q13	Priorities for organizing human resources during crisis management in the COVID-19 pandemic	Ensuring continuity of care	29
			Employees' high sense of responsibility for themselves and for others	28
			Individual assessment of the employees' infection risk	21
			Regular rest of the employees	21
Preparation	Q19	Priorities for organizing information resources during crisis management in the COVID-19 pandemic	Maintaining a good flow of information	31
			Establishing procedures and recommendations of the National Consultant in Anaesthesiology and Intensive Therapy	29
			Creation of procedures	27
			Recommendations from the National Epidemiology Consultant	23
			Using the experience of other units/ wards	23
			Using proven sources of information	20

Cycle Phase	Question	Areas Aspect	Issues indicated by respondents	n
Preparation	Q21	Sources of information useful in developing a plan to prepare procedures in the COVID-19 pandemic	Recommendations of the Polish Association of Anaesthesia and Intensive Care Nurses	30
			Guidelines of the National Consultant in the field of Anaesthesiology and Intensive Therapy	26
			Regulations of the Ministry of Health	21
Preparation	Q22	Which resources, in your opinion, were the most important in the preparation of procedures in the case of contact with a patient diagnosed with a COVID-19 infection?	Information resources	19
			Human resources	19
Preparation	Q25	Aspects of crisis management in times of the SARS-CoV19 pandemic which should be considered when organizing patient care in the ICU	Access to PPE	25
			Possibility of regular testing of personnel for the presence of COVID-19	23
			Possibility of isolating patients awaiting results	23
Preparation	Q26	Elements which form the basis of crisis management	Knowledge of availability of resources (material, information, human, financial)	31
			Need for communication of full information from superiors	27
Preparation	Q27	Do you agree with the statement: the possibility of increasing knowledge on crisis management enables effective decision making in urgent situations?	Completely agree	37

Table 7. Distribution of answers response phase: full version

Cycle Phase	Question	Areas Aspect	Issues indicated by respondents	n
Response	Q8	Necessary elements of the response phase at the ICU	Coordinating the maintenance of operational continuity of the ICU	28
			Providing support for medical personnel	27
			Immediate response to threats	33
Response	Q14	Key areas of crisis management for maintaining the continuity of ICU work during the COVID-19 pandemic	Human resources	40
Response	Q15	Manner of communicating information on conducted crisis management actions	Full information should be addressed to all employees	37
Response	Q23	Resources which mobilized staff to action	Access to PPE	30
			Financial incentive	28
			Reliable information	23
Response	Q24	Which of the resources listed above was the most difficult for you to implement/secure?	Appropriate number of employees	22

Table 8. Distribution of answers recovery phase: full version

Cycle Phase	Question	Areas Aspects	Issues indicated by respondents	n
Recovery	Q 9	Necessary elements of the recovery	Assessment of the current state and replenishment of resources	12
			Return to the initial state	8
Recovery	Q16	Which channel was used to provide full information on the resulting procedures?	Via e-mail	25
Recovery	Q17	By which channels was partial information communicated, for example, concerning the established procedures?	Via e-mail	18
Recovery	Q18	Which method of information management was the most effective, in your opinion?	Written (query, order etc.)	11
			E-mail	10
			Oral	10
			Messengers	8
Recovery	Q20	Which activities from the above resources were the most effective in your opinion?	Establishment or modification of procedures	8
			Recommendations	8
			Maintaining a good flow of information	7
			Using reliable sources of information	7

Appendix D. Survey: Intensive Care Unit Crisis Management Areas

1) Gender*

- ☐ Woman
- ☐ Man

2) Professional qualifications related to work in the Intensive Care Unit*

- ☐ Qualification course
- ☐ Speciality training

3) Position*

- ☐ Coordinating nurse
- ☐ Ward nurse
- ☐ Ward manager
- ☐ Other:

4) Where did you learn about SARS-CoV-19?*

- ☐ In-house training
- ☐ Webinars
- ☐ Studies
- ☐ Social media
- ☐ Ministry of Health
- ☐ World Health Organization
- ☐ Agency for Health Technology Assessment and Tariff System
- ☐ Other:

5) The crisis management cycle comprises 4 phases. Which of the phases is, in your opinion, the most important?

- ☐ Prevention phase
- ☐ Preparation phase
- ☐ Response phase
- ☐ Recovery phase
- ☐ All phases
- ☐ No opinion

6) Which of the elements of the prevention phase should be implemented in the Intensive Care Unit?*

- ☐ Risk assessment (distance in time, personnel exposure)
- ☐ Scale of the threat (small, medium, large loss — refers to the loss of human resources)
- ☐ Assessment of the microenvironment (competition, suppliers, recipients of services)

- ☐ Assessment of the macroenvironment (economic, political, social and demographic conditions)
- ☐ Assessment of the ward's infrastructure (power supply, ventilation, supply of gases, possibility of isolation)
- ☐ Evaluation of resources (human, material, information, financial resources)
- ☐ Collection of current legal regulations
- ☐ Knowledge of the necessary time of preparedness (in this case, donning Personal Protective Equipment)
- ☐ Effective communication
- ☐ Control of the sanitary and epidemiological status of the ward
- ☐ Other:

7) Which elements of the preparedness phase of crisis management in ICU do you consider necessary?

- ☐ Preparing and simulating of procedures
- ☐ Monitoring of potential threats
- ☐ Defining of effective communication
- ☐ Preparing for reorganisation of human resources
- ☐ Updating of procedures
- ☐ Managing of resources for the time of crisis
- ☐ Education of medical personnel
- ☐ Assigning of personnel responsibilities
- ☐ Improving the ward's infrastructure (e.g., communication routes, delimitation of zones)
- ☐ Other:

8) Which elements of the response phase in the ICU do you consider necessary?*

- ☐ Launching the procedure(s)
- ☐ Feedback on the effect of preparing the procedures
- ☐ Continuous improvement of procedures
- ☐ Providing support for medical personnel

- ☐ Epidemiological control
- ☐ Continuous modification of human resources
- ☐ Maintaining a constant level of material resources
- ☐ Incident management
- ☐ Immediate corrective action
- ☐ Immediate response to threats
- ☐ Disseminating reliable information
- ☐ Collecting information relevant to the target audience (other wards)
- ☐ Coordinating the maintenance of operational continuity of the ICU
- ☐ Other:

9) **Which of the elements of the recovery phase, in your opinion, is necessary in crisis management in the ICU?***

- ☐ Initial assessment of the effectiveness of the actions taken
- ☐ Assessment of the current status and replenishment of resources
- ☐ Reorganization of the ward's infrastructure
- ☐ Reorganisation of human resources
- ☐ Evaluation of the notification system
- ☐ Threat monitoring
- ☐ Return to the initial state
- ☐ Other:

10) **Which obstacles made it difficult to adapt the department to the existing crisis caused by SARS-CoV19?***

- ☐ Lack of material resources (e.g., Personal Protective Equipment)
- ☐ Deficit of the infrastructure (e.g., inability to designate zones)
- ☐ Lack of a clear procedure regarding the movement of personnel
- ☐ Failure to provide information on the location of zones in the ward
- ☐ Lack of strict routes for the movement of medical personnel
- ☐ Lack of training in moving around the zones
- ☐ Lack of human resources
- ☐ Lack of good information flow
- ☐ Other:

11) Which element, in your opinion, is the most important in determining the mobility zones?*

- ☐ Appropriate infrastructure
- ☐ Material resources
- ☐ Ready procedure
- ☐ Training of medical personnel
- ☐ Ability to find a consensus in the absence of adequate infrastructure
- ☐ Continuous improvement of the created procedure
- ☐ Feedback from the employees
- ☐ Other:

12) When organizing physical resources during crisis management in the COVID-19 pandemic, which of the following will be your priorities?*

- ☐ Equipping the nursing care station with permanent technical devices (ventilator, cardiac monitor, bed, infusion pumps, resuscitator, laryngoscope, etc.)
- ☐ Disposable equipment
- ☐ Personal Protective Equipment
- ☐ Medications
- ☐ Antiseptic agents
- ☐ Professional chemical agents and equipment necessary to keep the department clean
- ☐ Isolation room
- ☐ Means of communication (telephone, computer)
- ☐ Instruments enabling quick laboratory diagnostics
- ☐ Social rooms
- ☐ Clean rooms
- ☐ Prepared infrastructure (adapted)
- ☐ Other:

13) When organizing human resources during crisis management related to a pandemic, your priority will be:*

- ☐ Planning of human resources
- ☐ Recruiting of human resources
- ☐ Ensuring continuity of care
- ☐ Purpose of human resources planning
- ☐ Individual assessment of the employees' infection risk
- ☐ Regular rest of the employees
- ☐ Possibility to choose a motivational tool
- ☐ Employees' high sense of responsibility for themselves and for others
- ☐ Employee availability
- ☐ Other:

14) Which areas/resources of crisis management do you consider important in maintaining the continuity of ICU work?*

- ☐ Information area
- ☐ Human resources
- ☐ Material resources
- ☐ Financial resources

15) How should information on conducted crisis management actions be communicated?*

- ☐ Full information (addressed to all employees)
- ☐ Partial information (addressed to management staff)
- ☐ Lack of information
- ☐ Other:

16) Which channel was used to provide full information on the resulting procedures?

- ☐ Electronic means
- ☐ Telephone
- ☐ Written information
- ☐ Direct meeting of the superior with employees

17) By which channels was partial information communicated, for example, concerning the established procedures?

- ☐ Electronic means
- ☐ Telephone
- ☐ Written information
- ☐ Face-to-face meeting with employees
- ☐ Hospital radio hub
- ☐ Messenger (SMS, WhatsApp, Messenger etc.)
- ☐ Other:

18) Which method of information management was the most effective, in your opinion?

- ☐ Written information
- ☐ Oral information
- ☐ Information by electronic means
- ☐ Information via a communicator
- ☐ Other:

19) When organizing information resources during crisis management related to a pandemic, your priority will be:*

- ☐ Establishing procedures
- ☐ Intra-departmental training
- ☐ Maintaining a good flow of information among the team
- ☐ Analysing the provided information
- ☐ Using proven sources of information
- ☐ Using the experiences of other units/departments
- ☐ Possibility to modify procedures/algorithms
- ☐ Recommendations of the National Consultant in Epidemiology
- ☐ Recommendations of the National Consultant in Anaesthesiology and Intensive Therapy
- ☐ Other:

20) Which activities from the above resources were the most effective in your opinion? Please enter a maximum of 3 actions.*

21) Which knowledge about the COVID-19 pandemic was useful in developing a plan to prepare procedures?*

- ☐ Risk assessment of medical personnel's exposure to the SARS-CoV-19 coronavirus
- ☐ Guidelines of the National Consultant in the field of Anaesthesiology and Intensive Therapy
- ☐ Recommendations of the Polish Society of Anesthesiological and Intensive Care Nurses
- ☐ Regulations of the Ministry of Health
- ☐ Guidelines of the National Consultant in Epidemiology
- ☐ Recommendations of the Agency for Health Technology Assessment and Tariff System
- ☐ Recommendations of the World Health Organization
- ☐ Knowledge of resources (material, information, human, financial)
- ☐ Other:

22) Which resources, in your opinion, were the most important in the preparation of procedures in the case of contact with a patient diagnosed with a COVID-19 infection?

- ☐ Information resources
- ☐ Material resources
- ☐ Financial resources
- ☐ Human resources

23) Which of the selected resources, according to your observations, mobilized the staff to action?

- ☐ Access to Personal Protective Equipment
- ☐ Reliable information
- ☐ Financial incentive
- ☐ Possibility of rest
- ☐ Possibility of introducing changes to new procedures
- ☐ Other:

24) Which of the resources listed above was the most difficult for you to implement/secure?

- ☐ Access to Personal Protective Equipment
- ☐ Reliable information
- ☐ Sufficient staff
- ☐ Providing rest
- ☐ Maintaining the continuity of nursing care
- ☐ Other:

25) Which aspects of crisis management in times of the SARS-CoV-2 pandemic should be considered when organizing patient care in the Intensive Care Unit?

- ☐ Possibility of regular testing of personnel for the presence of SARS--CoV-2 genetic material
- ☐ Possibility of isolating patients awaiting results
- ☐ Professional Personal Protection Equipment
- ☐ Possibility of changing the work organization of nursing staff
- ☐ Other:

26) What elements of knowledge do you think constitute the basis of crisis management?

- ☐ Knowledge of social reactions to the occurring threat
- ☐ Knowledge of the phases of crisis management
- ☐ Full information from superiors
- ☐ Knowledge of the law on crisis management
- ☐ Knowledge of the crisis management plan at the work place
- ☐ Knowledge of the threat
- ☐ Knowledge of availability of resources (material, human, financial, information)
- ☐ Risk analysis
- ☐ Other:

27) Do you agree with the statement: the possibility of increasing knowledge on crisis management enables effective decision making in urgent situations?

- ☐ I fully agree
- ☐ I do not agree
- ☐ No opinion

28) Do you think the assessment of SARS-CoV19 infection risk should apply to:

- ☐ Entire personnel working in the ICU
- ☐ Personnel present in close contact with SARS-CoV-2 patients
- ☐ Systematic assessment of the personnel working in close contact with SARS-CoV-2 patients
- ☐ Personnel working in indirect contact with SARS-CoV-2 patient
- ☐ Other:

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