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Preparing for the Worst-Case Scenario in a Pandemic: Intensivists Simulate Prioritization and Triage of Scarce ICU Resources

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OBJECTIVES: Simulation and evaluation of a prioritization protocol at a German university hospital using a convergent parallel mixed methods design.

DESIGN: Prospective single-center cohort study with a quantitative analysis of ICU patients and qualitative content analysis of two focus groups with intensivists.

SETTING: Five ICUs of internal medicine and anesthesiology at a German university hospital.

PATIENTS: Adult critically ill ICU patients ($n = 53$).

INTERVENTIONS: After training the attending senior ICU physicians ($n = 13$) in rationing, an impending ICU congestion was simulated. All ICU patients were rated according to their likelihood to survive their acute illness (good-moderate-unfavorable). From each ICU, the two patients with the most unfavorable prognosis ($n = 10$) were evaluated by five prioritization teams for triage.

MEASUREMENTS AND MAIN RESULTS: Patients nominated for prioritization visit ($n = 10$) had higher Sequential Organ Failure Assessment scores and already a longer stay at the hospital and on the ICU compared with the other patients. The order within this worst prognosis group was not congruent between the five teams. However, an in-hospital mortality of 80% confirmed the reasonable match with the lowest predicted probability of survival. Qualitative data highlighted the tremendous burden of triage and the need for a team-based consensus-oriented decision-making approach to ensure best possible care and to support professionals. Transparent communication within the teams, the hospital, and to the public was seen as essential for prioritization implementation.

CONCLUSIONS: To mitigate potential bias and to reduce the emotional burden of triage, a consensus-oriented, interdisciplinary, and collaborative approach should be implemented. Prognostic comparative assessment by intensivists is feasible. The combination of long-term ICU stay and consistently high Sequential Organ Failure Assessment scores resulted in a greater risk for triage in patients. It remains challenging to reliably differentiate between patients with very low chances to survive and requires further conceptual and empirical research.

KEY WORDS: clinical ethics; COVID-19 pandemic; intensive care unit resources; mixed methods study; prioritization; triage

During the COVID-19 pandemic, the demand for intensive care has temporarily exceeded supply in some countries, so that rationing of resources (triage) became necessary (1–3). To date, no consensus has been reached on the criteria that should guide prioritization and triage (4–7).

When triage is looming, focus moves from exclusively patient-centred decision-making toward the inclusion of a perspective of population health (3, 6, 8). This shift is more than a simple exchange of protocols. Triage may require withdrawing or withholding life-sustaining measures for patients who otherwise

DOI: 10.1097/CCM.0000000000005684

KEY POINTS

- **Question:** This mixed-methods, guideline-based simulation study evaluated hypothetical (re-)allocation of ICU resources during the pandemic as performed by front-line intensivists.
- **Findings:** This simulation study found that the two-step prioritization approach, 1) assessment of each patient, 2) a prioritization visit across ICUs, is feasible and acceptable; while resource-intensive, it would be effective to prevent intuitive, non-reliable decisions. Triage would put tremendous burden on intensivists, but they would be willing to assume the responsibility if the approach was transparent, legal, and included interdisciplinary cooperation.
- **Meaning:** Combining clinical assessment by physicians plus a score-based protocol could be an alternative to other triage concepts.

would have been treated until leaving the ICU or until death. Rationing whose life support to terminate, or not to initiate, is ethically challenging, medically complex, and emotionally draining. The difficulties are not just conceptual; they also pertain to putting guidelines into practice.

Triage concepts across the world differ, for example, in defining exclusion criteria for treatment and/or implementing triage officers (9). Several studies have already proved feasibility and accuracy of allocation concepts, but there are still many unresolved questions about how to predict short-term survival best, how to mitigate risks of biases or limitations of scores, and how to implement the fairest (re-)allocation (10–12).

In line with broader international consensus, a German guideline developed and refined in 2020/2021 focuses on a multiprinciple approach including: 1) likelihood of survival to hospital discharge as guidance, 2) evaluating all patients eligible for ICU treatment including reallocation, 3) ensuring transparency, and 4) applying interdisciplinary decision-making to reduce the risks of biases, inequity, and discrimination (13). To respond to the lack of consensus about triage scoring systems and to prevent biases, an interdisciplinary triage team of at least two experienced treating intensivists, specialists, and optionally ethicists should collaborate and share allocation decisions (13–15).

The aim of this study is to evaluate, in hypothetical form, the feasibility, reliability, and acceptability of an institutional prioritization protocol that was developed in our university hospital based on the German guideline. This real-time simulation study allowed to analyze the prognostic assessment of front-line physicians, the hypothetical resource (re-)allocation, and the intensivists' perspectives on this protocol. The findings are relevant not only for preparation in the current pandemic but also particularly critical for future public health crises, should clinicians need to ration scarce resources.

MATERIALS AND METHODS

Study design, Setting, and Participants

This study is a prospective observational monocentric hypothetical cohort study during the second wave of the COVID-19 pandemic in Germany from December 2020 to March 2021 at five ICUs: two from internal medicine and three from anesthesiology and intensive care medicine at a German university hospital. We applied a convergent parallel design of quantitative and qualitative methods and linked results for interpretation. The study was conducted in agreement with the principles of the Declaration of Helsinki, and the Ethics Committee of the Technical University of Munich approved the study protocol (approval number 675/20 S). All participating physicians were approached by e-mail and informed about the study background, methods, and data protection.

Simulation Intervention and Quantitative Data Collection

All participating intensivists were trained on the background and protocol of triage in a 2-hour lecture and written materials. To prepare for the hypothetically upcoming triage, a patient survey form (**Supplementary Material**, http://links.lww.com/CCM/H211) had to be completed for inpatients in the five ICUs collecting information on the acute illness, preexisting general health, comorbidities, duration of ICU stay as well as on patients' will and patient-centered treatment plan. During a 2-day preparation, intensivists had to assess their patients' likelihood to survive the current treatment. They had to compare and categorize them into groups with "good," "moderate," and "unfavorable" prognoses on their ICU. No specifications were given for the scoring of individual items or diagnoses; intensivists were asked to decide according to their clinical judgment. Considering the underlying disease, the attending specialists (e.g., surgeons, neurologists) could have been consulted for patient-centered decision-making and prognostic assessment. The attendings of each ICU had to report two patients who were least likely to survive for the prioritization visit. The assessment of each ICU patient and the resulting choice of two patients per ICU presented a compromise between a manageable number of patients for the prioritization visit in the emergency situation and the need to assess as many patients as possible to make a fair and transparent allocation decision. For the simulation, five prioritizations teams were formed, each consisting of two attendings or senior physicians in intensive care, one from internal medicine, and one from anesthesiology. Three teams assessed in person, two teams reviewed only the survey forms and medical files. All teams were asked to rank the preselected patients according to their likelihood to survive the current treatment. Three intensivists were not available on the day of the prioritization visit due to various commitments. All patients included were followed up until hospital discharge or death.

In case of a pandemic crisis, this ordering by a prioritization team would have been the baseline for triage if no other resources were available at the hospital and beyond for additional critically ill patients.

Focus Group and Qualitative Data Collection

The participating intensivists were selected by purposive sampling with the criteria: 1) senior ICU-attendings, 2) participation in study simulation, and 3) interest in the research question. The day after the simulation, they were assigned to one of two groups matched to their duty responsibilities. Each focus group (FG), one virtually and one face-to-face, took 90 minutes. Both were moderated by the first author (K.Kn.), who has a background in intensive care and clinical ethics. Field notes were made by another researcher (K.A.). There was no hierarchical relationship between the researchers and the participants. The semistructured interview guide developed according to Helfferich was discussed, piloted, and revised in research group meetings and within the local expert network for qualitative research (16). The full methods description employed the COnsolidated criteria for REporting Qualitative research (Supplemental Material, http://links.lww.com/CCM/H211) (17).

Outcome Variables

Primary outcome with regard to the patients included was the survival of acute illness in terms of in-hospital mortality. Secondary outcomes were length of ICU stay, length of inpatient stay, and ICU mortality.

The qualitative analysis focused on how intensivists perceived the prioritization during a simulated situation of impending pandemic overload of intensive care resources and how they evaluated the applied protocol. Quantitative and qualitative data were analyzed separately and subsequently integrated for interpretation (18).

Statistical Methods

Continuous ICU patient data were described by median, 25th and 75th percentiles, and categorical data by absolute and relative frequencies. Relevant patients' characteristics were compared by Mann-Whitney *U* test (continuous variables) and chi-square test or Fisher exact test (categorical variables), respectively. Using binary logistic regression analysis, significant predictors of hospital mortality were determined, and area under the receiver operating characteristic (ROC) curve was used to quantify the predictive ability for hospital mortality. All analyses were conducted two-sided using a 5% level of significance and 95% CIs and calculated for relevant effect sizes. Statistical analyses were performed using Microsoft Excel 2013 and IBM SPSS Statistics Version 26.0 (IBM Corp, Armonk, NY).

Qualitative Analysis

The FG discussions were audio-recorded, transcribed verbatim with simple transcription rules, and anonymized. The transcripts were analyzed by author (K.Kn.), who is experienced in qualitative research, and by authors (K.A., E.S.), who were trained in qualitative methods. A content-structured qualitative analysis according to Kuckartz (19) was performed, using the software MAXQDA 12 (VERBI–Software GmbH, Berlin, Germany). We applied a

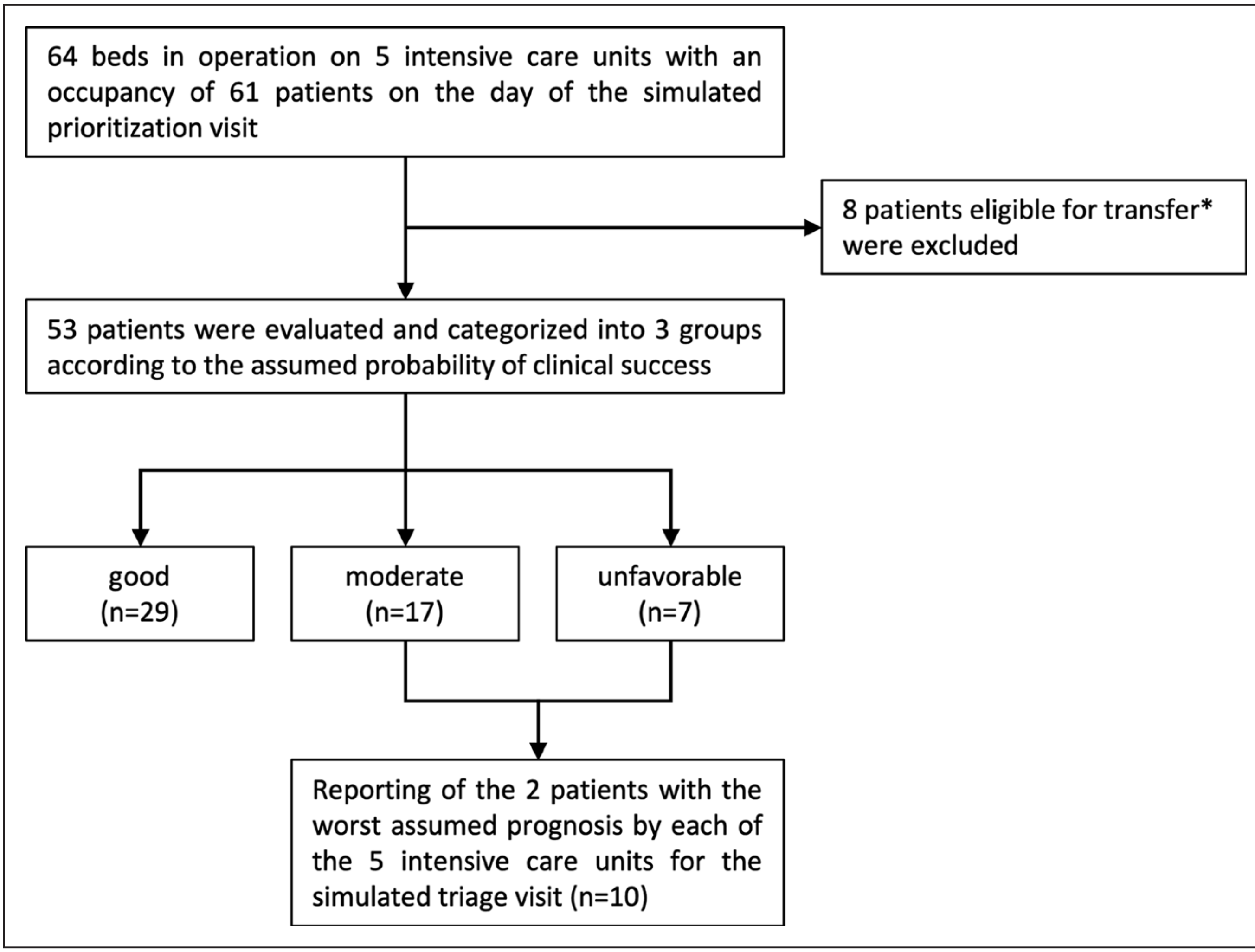

Figure 1. Flowchart of patients nominated for the simulated prioritization visit. The classification into "good," "moderate," and "unfavorable" prognoses was based on the ICU clinician's judgment (without more specific group-defining information). *Including patients with a changed treatment goal toward palliative comfort care.

data-driven strategy for a descriptive, content-based analysis using open coding. The codes were listed and systematized in a hierarchical coding frame. The category system was discussed, cross-validated, and revised by the research team. The coding frame was revised in a second application to the material. The resulting coding guide was applied to the whole material and is available on request. Illustrative quotes are listed with FG and participant number (P). Preliminary results were discussed with participants in a plenary session.

RESULTS

On the simulation day, 64 beds were in operation, 61 occupied in the five ICUs, and 53 patients could be included in the study (**Fig. 1**). Patients who were redirected to palliative comfort care or transferred for recovery were excluded. The median age was 69 years (Q_{25}–Q_{75}: 57–76 yr); 70% were male. Participating intensivists (*n* = 13) assessed the prognosis as "good" in 29, "moderate" in 17, and "unfavorable" in seven patients. When the forecasts were later compared with actual mortality rates at the hospital, there was good concordance: good equals to 13.8% mortality, moderate equals to 64.7%, and unfavorable equals to 71.4% (**Table 1**).

The patients nominated for a prioritization visit (*n* = 10)—the two with the worst forecasts per each ICU—had higher Sequential Organ Failure Assessment (SOFA) scores and a prolonged intensive care and hospital stay until that moment. The predicted poor outcome was confirmed by an in-hospital mortality rate of 80%; details are shown in Table 1. None of the prioritization

TABLE 1.
Characteristics and Outcome Variables of the Study Cohort

Characteristics, Median (25–75th Percentiles) Unless Otherwise Indicated	Total Cohort ($N = 53$)	Predicted Outcome: Good ($N = 29$)	Predicted Outcome: Intermediate ($N = 17$)	Predicted Outcome: Unfavorable ($N = 7$)	Not Nominated for Prioritization Simulation ($N = 43$)	Nominated for Prioritization Simulation ($N = 10$)	p[a]
Age (yr)	69 (57–76)	67 (57–75)	74 (55–76)	73 (58–75)	68 (56–77)	73 (64–76)	0.707
Male sex, *n* (%)	37 (69.8)	19 (65.5)	13 (76.5)	5 (71.4)	30 (69.8)	7 (70)	1.0
Eastern cooperative oncology group performance status	1 (0–2)	0 (0–2)	1 (0–2)	1 (0–1.5)	1 (0–1.5)	2 (0.25–2.75)	0.19
Karnofsky index	80 (70–90)	80 (70–90)	80 (67.5–90)	74 (62.5–95)	80 (70–90)	75 (60–85)	0.509
Clinical Frailty Scale	3 (2–4.5)	3 (1.5–5)	3 (2–4)	3 (2–5)	3 (2–4)	3 (2.5–5.5)	0.402
Charlson Comorbidity Index	4 (2–6)	4 (2–5)	4 (3–7)	5 (3–7)	4 (2–5.5)	6 (3.5–6.75)	0.075
Duration of ICU stay (on day of prioritization)	11 (6–21)	9 (3–17)	13 (7–21)	35 (25–44)	9 (4–19)	28 (20–37)	**0.001**
Duration of hospital stay (on day of prioritization)	18 (8–29)	14 (6–21)	21 (11–19)	46 (34–52)	13 (7–21)	42 (27–55)	**< 0.001**
Sequential Organ Failure Assessment score (on day of prioritization)	6 (3–10)	4 (2–6)	10 (7–12)	8 (6–11)	6 (3–9.5)	9 (7.25–11.5)	**0.038**
COVID-19 patients, *n* (%)	16 (30.2)	5 (17.3)	8 (47.1)	3 (42.8)	13 (30.2)	3 (30)	1.0
Duration of ICU stay (d)	32 (19–48)	26 (12–41)	34 (22–53)	55 (42–68)	27 (15–43.5)	50 (41–71)	0.008
Duration of hospital stay[b] (d)	62 (35–138)	85 (35–142)	43 (31–108)	88 (65.5–153)	55 (32–137)	79 (59–136)	0.251
Mortality (ICU), *n* (%)	16 (30.2)	4 (13.8)	9 (52.9)	3 (42.9)	10 (23.3)	6 (60)	0.05
Mortality (hospital), *n* (%)	20 (37.7)	4 (13.8)	11 (64.7)	5 (71.4)	12 (27.9)	8 (80)	0.004

[a]Mann-Whitney *U* test (continuous variables) and chi-square or Fisher exact test (categorical variables) comparing patients selected/respectively not selected for prioritization simulation.

[b]Including further treatment and/or rehabilitation hospitals until discharge (to home, nursing home, or death).

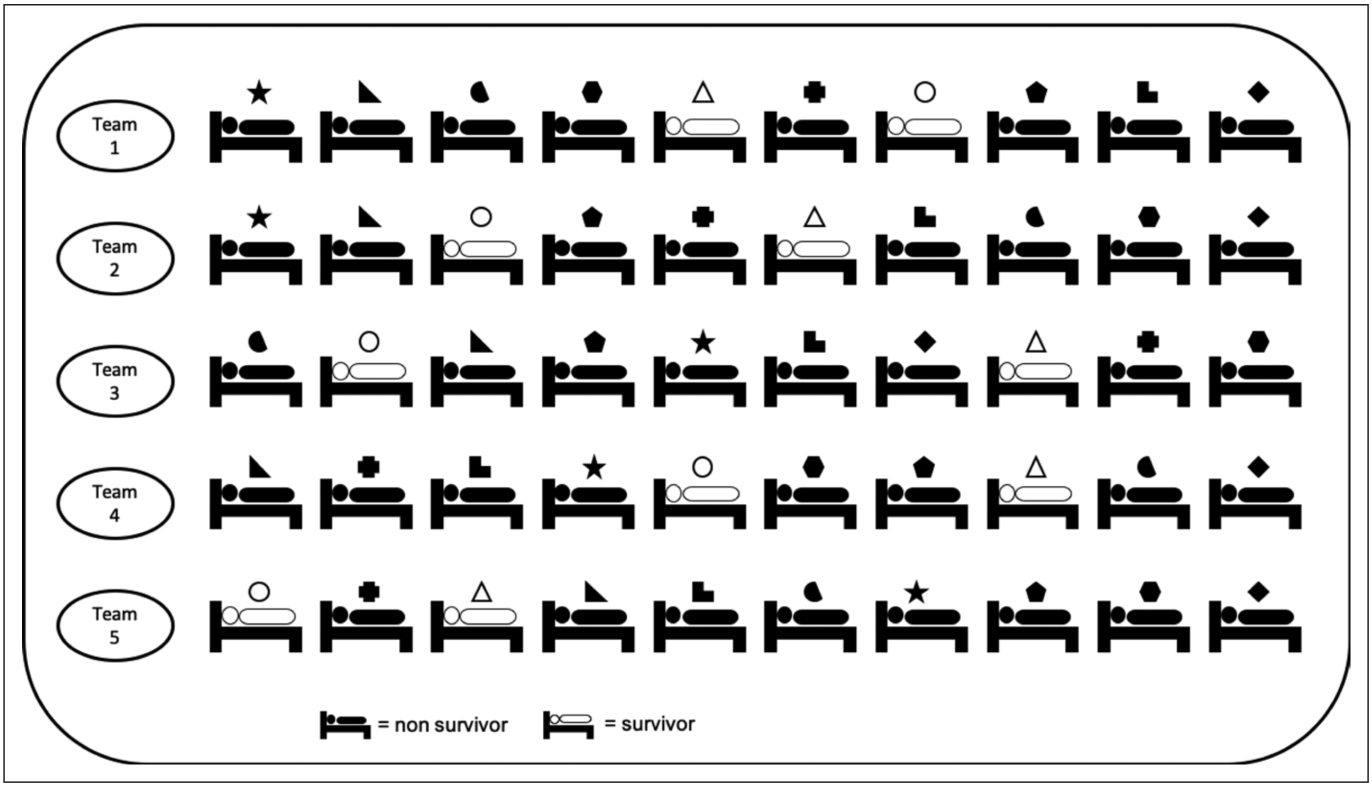

Figure 2. Grouping of patients nominated for the simulated prioritization visit. Illustrated are the 10 patients nominated for the prioritization visit, sorted by estimated prognosis by each prioritization team (1–5) from less unfavorable (left side of figure) to most unfavorable (right side of figure). Each symbol (*star*, *pentagon*, etc.) refers to a specific patient. The prioritization teams had access to patient data, records, and survey forms. Teams 1, 2, and 3 visited the patients, whereas teams 4 and 5 performed the assessment and grouping only after reviewing the available records.

teams considered the two survivors to have the worst or second-worst prognosis. Four of the five teams identified the same patient as having the most unfavorable prognosis, but in general the comparison within this group of patients with a very low probability of survival to hospital discharge was not concurrent (**Fig. 2**).

In binary logistic regression analysis, age ($p = 0.029$) and SOFA score at the point of prioritization visit ($p = 0.007$) were significant predictors of in-hospital mortality leading to an area under the ROC curve of 0.87. The statistical model predicted the in-hospital mortality for all included patients. The 10 with calculated worst prognosis (ranging from 77.7% to 90.6%) had an observed in-hospital mortality of 60%. However, participating physicians were comparatively more accurate. Compared with the statistical model, the group of 10 patients nominated by the intensivists had a mortality of 80% (Table 1 and Fig. 2).

The thirteen participating intensivists, ranging in age from 37 to 56 years (median, 42 yr), had 3–21 years of ICU experience (median, 7 yr). All but one, who was prevented by duty, participated in the FGs. All emphasized that everything must be done to prevent rationing and triage. Qualitatively, we identified the following three themes that describe challenges of implementing an institutional pandemic rationing protocol. An overview is summarized in **Table 2**.

The Characteristics of the Prioritization and Triage Decisions

Participants highlighted that focusing exclusively on the likelihood of survival to hospital discharge differs from general goals in intensive care, which also consider the long-term prognosis. The intensivists characterized the comparative analysis of their patients as completely different from nonpandemic decision-making. They worried that the time pressure may prevent the common step-by-step shared decision-making and would mean less time for surrogates for farewell.

> "[in non-pandemic times] we communicate about limitation of treatment, and then it usually takes at least two days until the relatives have discussed it until they have gathered

TABLE 2.
Core Statements and Illustrative Quotes From Intensivists About Challenges of Triage and Benefits of an Institutional Protocol After a Simulation of Rationing Decision-Making During a Pandemic

Subthemes	Challenges of Triage Decision-Making	Benefits of Institutional Triage Protocol
Likelihood to survive the current acute illness as the single criterion	Implication to disregard the long-term outcome and the general aim at reasonable outcomes, not only at survival is challenging. "...there is always the question 'what is the goal?'. That is certainly not to be disregarded if you have the appropriate experience, but it was just not the question. I found that difficult." FG2 PF Prognostic uncertainty could be a potential risks for prejudice and discrimination "If someone has a tumor and is already maybe at a certain age, at a decreased health status, they're going to be treated with lower priority than a most severe brain hemorrhage, trauma,... because it is so hard to anticipate how that will develop." FG1 PG	It is more certain, less complex and less influenced by individual values and attitudes about a 'good' life. "The overall prognosis may be worse, but acute survival may be ensured. [long-term prognosis] is more complex to predict than just the acute survival." FG1 PH "That's why I am actually already behind this concept: It's about assessing who probably won't survive the acute phase and not so much about what they'll be like afterwards. Because often you can say that, but not always." FG2 PD
Team-based distributive decision-making process	The evaluation of "unknown" patients and the comparison of prognoses are unusual and difficult. "I would find it extremely difficult to adequately assess a neurosurgical patient, because I actually lack the experience." FG2 PR "You're never absolutely sure. But I found it extremely difficult to compare with the patients in the other wards." FG2 PB An autonomous decision by a single clinician would be more prone to error and bias. "In this situation, the consensus is absolutely important and that ultimately more than two decide." FG2 PD	The consensus-oriented team-based approach, interdisciplinarity, time for preparation, reevaluation and exchange improve decisional certainty. "But the scores are only one aspect of the assessment. The medical experience, yes, a hundred things are included." FG2 PD "So, for me, the best way was to talk to my colleagues on the ward. We exchanged ideas and that gave us a bit more certainty. That is really the strongest factor." FG2 PD "I found it very positive, that the procedure was spread over several days. Because you had more time to think about it." FG2 PB
Responsibility, communication and transparency	The professional assessment is one aspect, but the distribution of responsibility is still unclear. "We would find consensus on a professional level, but who ultimately backs up the decision and assumes the responsibility, therefore honestly, I never got an answer." FG2 PR The desire for transparency within the team, at the hospital, for the public and the communication with patients or their next of kinare major concerns: "Making it as transparent as possible, also to the public, 'What is the rationale behind, is required if it would become necessary.'" FG1 PP	Time for deliberation and resources for support such as an ethics team is needed. "[the interdisciplinary exchange]is a very good approach….That you talk to e.g. the neurosurgeon in the daily round: Ok, your patient is one of our worst…and should things get tight, he will be a 'candidate'. I think that needs to be discussed." FG1 PA "I know I would have definitely brought the ad hoc ethics team in because I wouldn't have known how to discuss it [with the family]." FG1 PG

FG = focus group.

together, until they have said goodbye. So far, no one is prepared for an abrupt termination of treatment." (FG1, PA)

The Human Factors Influencing Decision-Making

Participants underlined the influence of qualifications, work experience, and the role of personal attitudes on decision-making. More professional years bring more experiential knowledge, but professional action was also seen to entail a risk of bias. Participants emphasized their physicians' duties to care and to respect patients' preferences even when being different from their own values. Knowing a patient's disease trajectory was characterized not only as prerequisite for prognostic assessment but also considered a risk of bias. Still, all stressed, that if the worst-case scenario required triage, they would like to assess the patients selected for triage themselves, instead of relying only on assessments by others, so they would be more certain of their decisions. Reflecting critically on limits of their professional competencies, they suggested the involvement of colleagues and further specialists for the best qualified and most objective assessment of patients' individual prognoses.

The Challenges of Triage and Benefits of the Institutional Protocol

During the simulation, the participants perceived high complexity of decision-making that goes beyond the individual patient's interest. Key benefits of the practice model were the preparation period, the consensus-oriented team-based decision-making approach, and the focus on the prognosis of short-term survival that they estimated as being less influenced by personal values and therefore less prone to bias. Preexisting severe illness or advanced age were described as a potentially higher risk in influencing prognostic assessment than acute severe illness, for example, trauma with high prognostic uncertainty but also a high risk to die. Participants stressed what they found helpful in decreasing these risks of misjudgment: 1) making allocation decision not based on one particular moment in time but on serial information about the patient's course of treatment, 2) engaging other treating specialists, and 3) considering time for interdisciplinary exchange. The stepwise approach was perceived as resource-extensive but effective to prevent spontaneous or/and intuitive decisions. The default of assessing solely the short-term survival without considering long-term outcome and quality of life was perceived as challenging by participants. They had to deliberately disregard reflection on individual attitudes toward a good life in light of severe neurologic impairment.

All participants were in favor of adding the face-to-face prioritization visit to the survey form. Scores about general health status and comorbidities were seen as only one part but as not decisive for their prognostic assessment. More information about the acute illness and sufficient time for interdisciplinary exchange was suggested. Further, participants requested absolute transparency for surrogates, family members, team members, clinic staff, and the general public about applying such a protocol. They stressed the need for societal consensus and legal permission.

All participants agreed that prioritization and triage would be a tremendous burden and enormously challenging for physicians. "It felt like handing someone over to death" (FG2 PL). The requested consensus-oriented team-based assessment with ICU colleagues and specialists was perceived as crucial. They were however not in favor of fully delegating the decision-making to other professions, to specialties, or to triage officers. For moderation and communication of allocation decisions, participants suggested that the prioritization team should involve clinical ethicists. Overall, the protocol was perceived as extremely helpful, reassuring, and a supporting tool to meet the emotional burden.

DISCUSSION

The present study sought to hypothetically test the implementation of a prioritization protocol during a simulation of an impending ICU resource overload. Exploring intensivists' experiences reveals challenges of the triage dilemma and the benefits of an institutional protocol.

For decades, experts have engaged in an ethical debate about fair allocation of scarce medical resources (9, 20–22). During triage, the focus shifts from exclusively patient-centered decisions to an increasing consideration of obligations toward a collective of patients. The need arises to decide about the best use of scarce health resources (23, 24). The values that guide prioritization differ between jurisdictions. Although some states—like the

United Kingdom or South Africa—lean toward utilitarian principles, other countries place more emphasis on egalitarian values—for example, Austria or Spain (25-28). The criteria that are supposed to be applied in clinical practice require a balancing between these different accounts of distributive justice. Options are to decide according to the rule to save as many lives as possible, the rule "first come first served," or a lottery. A subset of the debate asks whether certain groups of people, such as healthcare workers or children, should be given special status (29, 30). Each criterion comes with different ethical and social benefits and problems, and a full ethical deliberation is beyond the scope of this article (4, 5, 7, 31).

In Germany, key professional associations collaborated considering the ethical, social, and medical dimensions of ICU resource prioritization in a pandemic overload (13, 32). The resulting guideline attempted to align individual and public health interests aiming at minimizing preventable deaths, ensuring adequate healthcare, and preventing discrimination. In contrast to other countries, such as Switzerland, that categorically set limits regarding age and frailty, the German guideline focuses on a comparative analysis and on allocation across all patients with ICU needs (13, 33). Main criteria for triage decisions are acute chance of survival and collaborative decision-making.

When testing the German recommendations, we found that forecasting short-term survival is suitable, feasible, and to some extent reliable. Our study shows that SOFA score and length of ICU stay were the variables that—in hindsight—correlated most strongly with the worst prognosis. The SOFA score is a common criterion in triage protocols (8). However, it should be noted that there is a risk of disadvantaging marginalized patients through protocols that rely on it (34). In our study, SOFA score was one among several criteria and as such our findings support its usefulness. Our data did not answer the questions about limitations of SOFA score nor whether comorbidity or frailty scores applied according to the guideline are indicative at all of the individual outcome prediction. It is known that frail patients, for example, have a reduced functional status and a higher risk of developing persistent critical illness as well as of subsequently dying from their condition (35). But as previously shown, the functional trajectory during hospital stay is not necessarily worse than that of nonfrail patients, suggesting a relevant rehabilitation potential (36). Our qualitative findings confirm the shortcomings of score-based prediction and the benefit of assessing more than one point in time. Including serial information, the course of the current illness and the response to treatment could lead to more certainty in predicting the survival for an individual patient. Thus, it could potentially decrease risks of discrimination due to pre-existing illness, age, or prognostic uncertainty. Similar to Butler et al (10, 37), who in contrast applied a triage officer approach, our data underline the role of procedural criteria such as interdisciplinary assessment and collaborative decision-making as most decisive for estimating short-term survival, decreasing the risk of biases and for alleviating the burden of triage decisions. That said, the remaining prediction discordance within the patient group with the highest risk to die in the ICU raises the question whether better predictions tools could yield better judgments or whether there will always remain limits to differentiate precisely between these very severely ill intensive care patients.

In a simulated situation of extreme scarcity, intensivists were able to add to their professional duties toward the individual patient the duty to fulfill their obligation to distribute scarce resources fairly between all critically ill patients at the hospital. With regard to the principle of nonmaleficence and their professional duty to care, intensivists stressed their burden caused by the dilemma to withdraw or to withhold a therapy that could otherwise have been beneficial. Physicians require societal consensus as to how rules of distributive justice and procedural criteria should be translated into clinical settings for frontline decision-making. Other prerequisites for implementing protocols are regular education and training to prevent misapplication, to counteract risks of misinterpretation, and to prepare clinicians for their role in allocating scare resources (37–39).

In summary, our study confirms that the operationalization of a national triage guideline into an institutional protocol is feasible, acceptable, and supportive.

Our study has limitations. The single-center design in one European country cannot account for the contribution to the contingencies in other regional, legal, and social contexts. Furthermore, the results cannot be transferred to other hospitals. We increased the validity of our findings through triangulation by using a mixed methods approach that allowed to obtain deeper insights into challenges of implementing a prioritization protocol. Using a simulation allowed gaining knowledge that increases the pandemic preparedness of a crucial healthcare institution. Future research should focus on verifying a combination of criteria and allocation procedures to become as certain as possible and to prevent misuse.

CONCLUSIONS

Before an impending pandemic overload materializes, hospitals should implement and train a consensus-oriented, structured, and transparent approach to ensure ethically legitimate distribution of scarce ICU resources. To mitigate potential bias and minimize emotional burden of intensivists, allocation decisions should be supported by interdisciplinary physicians and clinical ethicists. Ongoing information including on current response to treatment is useful. However, differentiating between patients with very low chances to survive remains challenging and requires further conceptual and empirical research. A prioritization and triage protocol, its assignment or categorical criteria and procedural measures, need to be publicly debated and analyzed by further research.

ACKNOWLEDGMENTS

We would like to thank the participating physicians of the departments of Internal Medicine and the department of Anesthesiology and Intensive Care at the University Hospital rechts der Isar, School of Medicine, Technical University of Munich for their interest and support during the challenging times of the COVID-19 pandemic. We also thank the Munich network of qualitative research in medicine and public health for the opportunity of discussing the study design and data analysis with qualitative researcher outside of the study group and Marie-Christine Fritzsche for her valuable contributions and feedback on the draft article.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's website (http://journals.lww.com/ccmjournal).

Drs. Knochel and Heim are the principal investigators, developed the protocol, and wrote the article. Dr. Ulm is the study statistician. Drs. Knochel, Adaktylos-Surber, and Heim were involved in data acquisition and quality assurance. Drs. Knochel, Adaktylos-Surber, Schmolke, Meier, Buyx, Schneider, and Heim were involved in the ethical approval, in the analysis, and in the interpretation of the data. Dr. Kuehlmeyer gave advice on the qualitative study. All authors critically revised the article and approved its final version.

Dr. Knochel disclosed that she is a member of the German Interdisciplinary Association of Intensive Care and Emergency medicine and a coauthor of the German guideline for allocation of intensive care resources in the context of the COVID-19 pandemic. Dr. Buyx disclosed that she is chair of the German Ethics Council. The remaining authors have disclosed that they do not have any potential conflicts of interest.

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The Ethics Committee of the Technical University of Munich approved the protocol of this study and waived the need to obtain consent for the collection, analysis, and publication of the data of the ICU patients (approval number 675/20 S). All physicians involved in the analysis gave their written consent to participate. The study was conducted in agreement with the principles of the Declaration of Helsinki except a trial registry was considered dispensable.

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