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April 7, 2020

Azita G. Hamedani MD MPH MBA
Chair, State Disaster Medical Advisory Group
Sent by email: agh@medicine.wisc.edu

Dear Dr Hamedani:

Thank you for the opportunity to contribute to the development of state guidelines for allocation of ventilators during the COVID-19 pandemic.

Attached is a report with two sections: a review of guiding principles and the rationale for supporting them, and a practical guide for applying those principles, including a table for efficient decision making.

Our working group believes it would be desirable if there were consistent guidelines throughout the state, but that is probably not possible at this point. We are aware that some institutions have already approved guidelines which differ from the recommendations in our report. That said, we believe that reasonable people will disagree about some issues, and that disagreement should not imply that other guidelines are "wrong" or problematic simply because they differ from our recommendations. We are confident that the conclusions of our group are within the mainstream of thinking across the country.

The one issue we did not have sufficient time to address as thoroughly as we would like was communication with the broad community. We made a reasonable effort to do so in the time available, but encourage the state to see this as a continuing process, even after guidelines are promulgated.

Members of our working group are available to help in any way, including clarification of our recommendations, or assistance in implantation.

Sincerely,

NFost

Norman Fost MD MPH
Chair, Ventilator Allocation Advisory Workgroup

April 8, 2020

Report of the Ventilator Advisory Workgroup

On Mar 31, 2020, Dr. Azita Hamedani, Chair of the Wisconsin Department of Health Services State Disaster Medical Advisory Committee (SDMAC) asked Dr. Norman Fost to convene "a group of bioethicists and others with relevant experience" to make recommendations to the SDMAC regarding allocation of ventilators if/when they become a scarce resource in light of the COVID-19 Epidemic.

Dr. Hamedani noted that there were issues intertwined with ventilator access, including medical personnel, transfers of patients between hospitals, and sharing of ventilators, but asked that this group confine its recommendations to allocation of ventilators within each institution.

Dr. Fost convened a group of nine individuals with experience in bioethics, public health, critical care, neonatal care, emergency medicine, pediatrics, family medicine and infectious disease (Appendix A), subsequently named the Ventilator Allocation Advisory Workgroup (VAAW). The VAAW met seven times between Apr 1 and Apr 7, including one online focus group with stakeholders from various groups within the Wisconsin community. There was agreement that there was an urgent need to produce a product within days, as the epidemic was already producing a strain on medical providers within the state with a likelihood for dramatic increases in the number of patients who would need intensive care and mechanical ventilation.

PART I: Principles of Ventilator Allocation

The VAAW reviewed numerous existing guidelines on allocation of scarce resources from hospitals, state governments, academic institutions, bioethics centers, and scholars in the field. We identified recurring themes, points of general consensus as well as a short list of issues with varying perspectives in the literature. While the VAAW arrived at a consensus recommendation with respect to all these issues, we recognize that reasonable approaches may disagree with ours. We thus present our recommendations under the headings of "Recommendations about which there is general agreement" and "Recommendations about which there is not general agreement". The latter group of recommendations are ones with respect to which individual hospitals may develop guidelines that differ from ours. This document is intended as a companion to the document "PART II: Guidelines for the Implementation of Allocation Strategies".

Recommendations about which there is general agreement

There is a need for guidelines.

Ventilators can provide a potentially life-saving therapeutic intervention for patients in respiratory failure (both due to COVID-19 and due to other illnesses), although many

patients will die on ventilator support despite maximal measures. Ventilators offer a chance of benefit though do not assure survival.

There is broad agreement that in a context of scarcity the treating physician alone should not determine which patient should receive a ventilator. Any single treating physician may be subject to unconscious personal bias, might be unfamiliar with the range of thinking on the ethical issues, and at risk for unreasonable moral distress from being put in such a position, possibly many times over a prolonged period.

In addition, we are aware that numerous physicians, hospitals, and administrators throughout Wisconsin are urgently seeking help in providing such guidelines. While some hospitals have extensive resources in bioethics to help with this task, most do not.

There is also general agreement that it would be desirable to have uniform guidelines within the state. This is to prevent hospital shopping and also to prevent understandable distress in individuals who see different criteria being used in different hospitals and consequently may wonder why, for example, their relative did not receive a ventilator while a neighbor, who has a similar health profile, did.

Despite the agreement that uniform guidelines are desirable, actually implementing uniformity across the state appears impossible. Due to how far into the course of the epidemic Wisconsin already finds itself, multiple hospitals have already approved and implemented guidelines, and they are not consistent across institutions. However, since there is little support for mandatory guidelines-- no state has mandatory guidelines-- it is inevitable for there to be some variation across the state. Hospitals that are still seeking to implement guidelines may look to the guidelines promulgated under the auspices of the state, thus hopefully ensuring more uniformity than might have otherwise occurred.

Resource allocation under epidemic conditions requires a shift from the interests of each individual to the interests of the larger community.

When resources are abundant, the interests and preferences of each individual patient can be given priority by the medical team. It is rarely the case in the United States that a patient who might benefit from ventilator support, however low the chance, is denied the opportunity of such support.

Projections for the current epidemic, however, suggest that shortages may be common in the coming weeks and for an uncertain time thereafter. In the face of such shortages, using a ventilator for a patient who is highly likely to die despite treatment will result in two deaths instead of one: the death of the patient who will die with or without treatment, and the death of a waiting who has excellent prospects for survival.

Allocation of scarce resources, except for organ transplantation selection where this occurs routinely, is a new experience for health care providers and patients. It is important to inform the public of this shift, explain the reasons for it, and why such a change in approach is being implemented.

Decisions should be based on medical considerations only.

Allocation decisions must meet generally accepted notions of fairness. Thus, the following should NOT play a role in ventilator allocation decisions: ability to pay, race, ethnicity, sex, gender, gender identity, self-identification as LGBTQ+, disability status, incarceration status, and immigration and citizenship status. These guidelines are intended to be based on the best medical determination of a patient's likelihood to survive; i.e., to save the greatest number of lives.

A patient's refusal of mechanical ventilation should be respected.

As is the case in all medical practice, a patient's preference for declining medical interventions, including access to a ventilator, should be respected. These preferences may be stated by the patient, directly or through an advanced directive, or by appropriate surrogates. As a patient's condition changes during the hospitalization, surrogates may appropriately ask that ventilator support be discontinued and the goals of treatment be shifted to comfort care.

All patients are entitled to palliative care.

All efforts should be made to provide palliative care to all patients who can benefit from such services. It is important that personnel skilled in providing comfort care be available to patients who are dying, regardless of their diagnosis, and that family members be provided with supportive resources.

Guidelines should apply to non-COVID-19 and COVID-19 patients equally

While the COVID-19 epidemic is the stimulus for these guidelines and will likely comprise the majority of patients requiring ventilators in the coming months, the principles outlined in these guidelines should be applied to all patients during a time of shortage. This ensures fairness of access to treatments that could benefit patients regardless of disease.

In addition to the recommendation that guidelines apply equally to all patients, it should be understood that withholding and withdrawing life-sustaining treatment are both ethically acceptable. The decision as to whether a patient should receive ventilator support should be based on objective medical criteria, not on the circumstance of whether or not the patient has already been started on a ventilator. Neglecting to remove a patient from a ventilator who is clearly less likely to benefit from the ventilator than another patient is inappropriate and not consistent with the ethical principles of triage in the context of scarcity.

Despite the ethical acceptability of withholding and withdrawing life sustaining treatment, it is often psychologically more difficult for medical personnel and families to withdraw than to withhold. This psychological difficulty should not override the ethical imperative to use limited resources in a way that saves the most lives. (See below for

further discussion of this principle). The use of a triage team (see below) to evaluate all patients, including those already receiving treatment and those in need of treatment, should help to relieve the treating medical team of the moral distress associated of withdrawing life-sustaining treatment.

Questions may arise about whether a patient chronically dependent on a home ventilator should be included in these triage decisions. Home ventilators are not community property and thus should not be subject to reallocation even in the context of scarcity. However, should such a patient require critical care and have to be escalated to a hospital ventilator, they should be subject to the same criteria, as outlined in our guidelines, as all other patients.

Guidelines should be transparent.

The unprecedented extent of premature death and suffering, along with the unprecedented inability to provide for patients in the standard way, is likely to add to the distress of the general population. It is understandable that people would be frustrated and angry if a loved one does not receive treatment that may have sustained his or her life. These understandable reactions will be exacerbated if there is a perception that decisions were being made in secret, with no guidelines, or with guidelines that are secret.

Guidelines should include the input of the community.

Additionally, guidelines developed without the involvement of the community may be biased or be seen as biased. Such guidelines may result in groups of individuals being treated unfairly, or may generate the perception that such groups are being treated unfairly. It is therefore important that the guidelines used by any hospital are not only publicly accessible, but are developed in a way that includes consideration of the views of the public and traditionally marginalized communities, and that there is public education on the rationale for the guidelines. Additionally, it is important that patients and their families are informed about these guidelines in the language of their preference, and using a vocabulary that is sensitive to culture and literacy.

There are many ways of including the public in the development of guidelines, and the VAAW considered a number of options. We had to weigh the importance of such inclusion with the urgency of presenting recommendations to SDMAC. Given these constraints, we did not have the luxury, for example, of organizing multiple in person or virtual meetings throughout the state, with attention to the diversity of multiple backgrounds and viewpoints, whether based on race and ethnicity, gender identity, income, immigration and citizenship status, disability, incarceration status or age.

We discussed multiple options to engage grassroots organizations and other stakeholders that represent historically marginalized groups. However, we were limited in our capacity to develop a bidirectional process for statewide input, that would provide meaningful engagement and the opportunity to answer questions related to this topic.

To enhance the capacity of this Workgroup to develop guidelines that are equitable and fair, we contacted 26 individuals with close ties to groups that included African Americans, LatinX, LGBTQ, persons with disabilities, the elderly, Native Americans, and incarcerated persons. We invited individuals to submit written answers to open-ended questions regarding their views on fair ventilator allocation in a context of scarcity. We followed this up with an 1.5-hour online meeting with those available. During this meeting we conveyed the key issues that were under consideration, sought the views of the participants, and responded to questions.

Issues raised during this meeting, and re-iterated in the written responses from the survey, included 1) the need for transparency and inclusion of broad community perspectives at all points in the process, from guideline development, to implementation and oversight, 2) concerns about social determinants of health and their effects specifically on vulnerable populations who may present sicker to hospitals as a result, 3) distrust of the objectivity of the system and the need for oversight of triage teams to ensure no gross inequities of any kind are being perpetuated, 4) gratitude to have been given a voice in the development of these guidelines, and (5) a desire to receive updates about the process, including how to provide further feedback. There was a general consensus that the urgent nature of the current epidemic limited the community engagement process, which would ideally include multiple in-depth discussions with a broader diversity of community members. A full summary of this meeting is attached (Appendix B).

These efforts to engage the community should be continuous, and our strong recommendation is that the public should be provided with an opportunity for ongoing feedback, even after guidelines are promulgated.

Decisions should be made by a Triage Officer or (preferably) Triage Team.

As noted above, a central tenet of these guidelines is that the treating medical team alone should not determine whether their patient should receive a ventilator in a context of scarcity. Similarly, the treating team should not be the ones who interpret the guidelines or who determine whether they are applicable in a particular case. These determinations should be made by a Triage Officer, or ideally a Triage Team, consisting, ideally, of one or more attending critical care physician(s), one or more representative(s) from nursing, and a representative of hospital administration who has insight into the current and impending level of scarcity. Triage teams may also benefit from including ethics committee representatives. Although diversity of the teams is encouraged, the use of these guidelines should eliminate the possibility of decisions being biased due to ineligible characteristics as outlined above.

It is also important that there be a Triage Team Oversight Committee who oversees the triage team on a regular and timely basis, and confirms or corrects guideline application, assesses trends, and suggests guideline changes based on experience as the epidemic evolves.

Hospitals should be attuned to adverse impacts due to social determinants of health.

The COVID-19 pandemic will both expose and exacerbate pre-existing inequities in health and health care related to the social determinants of health in the United States. While these triage recommendations reflect our best efforts to distribute scarce ventilators in a fair and transparent way, it is likely that socio-economically vulnerable patients will be impacted in ways that compound pre-existing disparities because of a higher prevalence of underlying medical conditions, lack of access to health care, greater exposure to the coronavirus, and other factors. Evaluation of the impact of care provided under conditions of extreme scarcity needs to carefully consider the impact of triage decisions on such vulnerable patients. The Triage Team Oversight Committee should evaluate trends related to the allocation strategy to ensure that these decisions are not systematically biased against specific groups.

Recommendations about which there is not uniform agreement

In addition to the issues about which there is general agreement (listed above), the VAAW considered a number of issues about which reasonable people disagree. Different views on such issues have led to variation among guidelines at different institutions. In none of these issues did we conclude that the competing viewpoints consist of clearly right or wrong positions; i.e., we believe alternative views could be defended by thoughtful individuals from widely varying backgrounds. We provide a brief explanation of the reasons for reaching the conclusions stated below.

The primary aim of triage should be to save the greatest number of lives, not the greatest number of life-years.

Some have suggested[1] that the goal of saving the greatest number of lives should not be the primary goal of triage decisions in a context of scarcity. To illustrate this position, consider the following example: Two patients in an intensive care unit are in need of a ventilator. One is an 80-year-old patient with a reasonable prospect of surviving this acute hospitalization, who is, however, likely to die within a few years due to co-morbid conditions. The other is a 20-year-old patient with an equally reasonable prospect of surviving this acute hospitalization, with an expectation to survive for many decades post-discharge. The principle of saving the most lives does not provide a strategy for distinguishing between these two patients, as allocating the ventilator to either one has the same likelihood of saving one life.

Many observers point to the lack of guidance of the "save the most lives" principle in this case and suggest that the 20-year-old patient should have priority. One way to justify this decision is to invoke the goal of "saving the most life years", since by allocating the ventilator to the 20-year-old patient more years of life can be expected than by allocating the ventilator to the 80-year-old patient.

However, one problem with preferring "save the most life years" over "save the most lives" is that it may exacerbate preexisting inequalities. A person's life expectancy at a given age is influenced by social determinants of health. Patients who were born and grew up in poverty are more likely, through no fault of their own, to have life-limiting medical problems due to lack of access to basic health care, environmental hazards, crime, hazardous work or unemployment, and many other factors. Moreover, these disadvantaged patients are more likely to come from racial or ethnic groups that are victims of other forms of wrongful discrimination, or to have disabilities that have subjected them to discrimination, in the workplace, in access to health care, and so on. The life-years approach to allocating care cannot easily accommodate such considerations, but can potentially exacerbate inequity by penalizing a patient for past disadvantages.

We do not endorse the "save the most life-years" standard, primarily because it could lead to discrimination based on co-morbidities that were a consequence of previous unfair disadvantage. Instead, we recommend that the assessment of whether a patient should be allocated a ventilator should be based on the likelihood that she will survive to discharge, that she will survive for at least a year post discharge, and if necessary, on the further criterion of age. (See the accompanying "PART II: Guidelines for the Implementation of Allocation Strategies" document.)

"Fair innings" justifies giving preference to younger patients.

We have noted that we do not endorse the "save the most life-years" principle as a factor in deciding between two patients who are both in need of a ventilator. There is, however, a different reason for preferring a younger patient; namely, the "fair innings" principle. Based on a baseball metaphor (each team is entitled to the same number of chances to bat), this principle endorses the view that a 60-year-old person has already had her chance to live multiple chapters of a life, whereas a 20-year-old person has not had that opportunity. Thus, if these two patients have the same prospects for survival, the younger patient should be preferred.

Applying this principle maintains the focus on short term survival, reducing the likelihood that underlying co-morbidities, acquired due to social determinants of health, will influence allocation decisions.

There should be no preference for health care workers.

Some have suggested that health care workers should have priority over other patients for three reasons. First, because they have instrumental value, meaning that saving a health care worker's life will result in saving other lives when the health care worker returns to the workforce. Second, some believe health care workers deserve special consideration to be rewarded for exposing themselves to a substantial risk of harm, including death, for the benefit of others. Third, some believe that the willingness of an individual to work in this high-risk setting may depend on assurances that she will receive needed health care.

We believe these arguments have merit, but do not find them conclusive for the following reasons. First, it is unclear when or if a patient requiring ventilator support will return to the work force. While we may learn differently once more data regarding recovery from COVID-19 is available, it seems unlikely that such a patient will return to the workforce in the near term. Second, the claim of deserving special status, based on exposure to risk, could be expanded to a large group of individuals in all areas of hospital work, including doctors, nurses, technicians, registration clerks, cleaning staff, and morticians, as well as police and fire department employees, ambulance drivers, and other essential personal such as grocery store clerks. It would be near impossible to define in a principled way who should be included in this privileged group. Third, there does not appear to be a need to provide this incentive to health care workers. As has been the case in other epidemics, health care workers have shown remarkable bravery in exposing themselves to risks, and the small number of exceptions has not been sufficient to jeopardize the size of the workforce.

There should be no appeals process for the decisions of the triage team.

In normal times, decisions that have a profound effect on a person's life are commonly subject to appeal. In the context of the COVID-19 epidemic, these decisions must be made quickly, and appellate process would be difficult to administer in a timely way. More importantly, the ability to access the appellate process would risk unfair access, as families with connections or higher education would likely be more successful in accessing the appellate process.

We believe a post-hoc process of review of all Triage Team decisions by the Triage Team Oversight Committee will reduce the risk of improper or unfair decisions. A confirmation of the accuracy of the calculation of the triage score at the time may be appropriate. This is the role a triage oversight committee should play.

Relevance of disability

Triage practices applied in the setting of severe critical care shortages should not be influenced by judgements concerning patients' quality-of-life or functional limitations upon recovery. This includes judgments about the patient's quality of life (due to cognitive or functional disability) before the need for critical care or subsequent to the need for critical care. Thus, decisions to withhold or withdraw critical care should be based only on the medical criteria outlined in the "PART II: Guidelines for the Implementation of Allocation Strategies" document. These criteria are limited to (a) likelihood of survival to discharge from the hospital, (b) likelihood of surviving one year or more post discharge, and (c) age (under the principle of Fair Innings). Co-morbidities of a patient are only relevant in how they affect a patient's likelihood to survive to discharge from the hospital and a patient's likelihood of surviving one year beyond discharge. There should be periodic assessment of the triage decisions made by the triage team to ensure that allocation strategies are not systematically disadvantaging individuals with disabilities. As always, patients or their authorized representatives may choose to decline critical care resources based on their values related to expected or pre-existing states of cognitive or functional disabilities.

Some members of the VAAW believe that extreme cognitive impairment should be a relevant factor in deciding who has access to a ventilator. A patient in the persistent vegetative state is completely unaware of his/her environment, and the same is true for some other, less severe forms of cognitive impairment. Some such patients cannot experience the benefit of interventions and some members of the VAAW believe this is relevant in determining allocation strategy. In some other clinical situations where allocation decisions are routinely made, like organ transplants, these factors are commonly considered.

Related issues

The workgroup identified other issues that will affect access to a ventilator, but which do not fall within the scope of our mandate. We were asked to identify these issues, with the understanding they would be addressed elsewhere in the state government.

The supply of respiratory support devices should be increased.

Apart from the usual challenges of each hospital acquiring an adequate number of ventilators, there are other devices that could be used to support patients with respiratory problems, such as using one ventilator for two or more patients, anesthesia machines, CPAP equipment and so on. These decisions involve technical issues beyond the expertise of this committee.

Guidelines involving the transfer of patients or equipment

It is important that the state, as well as the nation, have a coordinated approach to the epidemic, so that equipment and personnel can be moved to the places where it is needed, and patients can be sent to hospitals that have capacity to treat them. Failure to address geographic distribution issues will further aggravate existing inequities. We were told that these issues are being addressed by other elements in the state government.

Legal issues

Lawsuits have already been filed in other states over challenges to guidelines, and it should be expected that individual patients and families will seek legal assistance in gaining access, or compensation or redress for perceived unfair treatment or negligence. These issues are beyond the expertise of this workgroup.

Disparities in acquiring COVID-19 infection and in mortality rates

It is already clear that there are major inequities, including racial differences, in who acquires and who dies from the COVID-19 virus. The reasons for this are similar to well described inequities in health status in American society, including access to health care. These problems are beyond the scope of this workgroup, but we were attentive

throughout our deliberations to the importance of recommending guidelines that would not further exacerbate these existing inequities.

Summary and Conclusions

The Working Group strongly endorses the promulgation of guidelines regarding allocation of ventilators during the Covid-19 epidemic by the Wisconsin State Department of Health. Many hospitals and physicians are asking for this assistance, and guidelines endorsed by the state should reduce the amount of variability between hospitals.

We believe the guidelines proposed in this report will increase the likelihood that resources will be used to save the greatest number of lives. These guidelines are based on medical criteria for predicting short term survival, and should avoid discrimination based on non-medical factors such as race, ethnicity, disability, socio-economic status, sex, gender, gender identity, LGBTQ+ self-identification, citizenship or immigration status, or history of incarceration. They are within the mainstream of national discussion on these issues, consistent with guidelines developed in other states that have attracted wide support.

Acceptance by the broad community requires engagement with the community, both in the development of guidelines, and in explaining their rationale to the public. This should be a continuous process, that allows for the public to access these guidelines, and provide input that can be used to revise these guidelines in light of more evidence. After the current crisis is alleviated governmental entities should promote a robust community engagement process to prepare for future public health crises.

It is unavoidable at this point that hospitals will adopt guidelines that differ from these, in ways that deserve respect and support. We have identified issues about which reasonable people may disagree.

Applying these principles requires specific guidelines. We provide such guidelines in the companion to this document entitled “PART II: Guidelines for the Implementation of Allocation Strategies”.

References

1. White DB, Katz MH, Luce JM, Lo B. Who Should Receive Life Support During a Public Health Emergency? Using Ethical Principles to Improve Allocation Decisions. *Ann Intern Med*. 2009 Jan 20; 150(2): 132–138.

Appendix A

List of Committee Members and Affiliations

Chair:
Norman Fost, MD, MPH
Professor Emeritus, Pediatrics and Medical History and Bioethics, University of Wisconsin School of Medicine and Public Health.

Members of the Committee:

Arthur R. Derse, MD, JD
Director, Center for Bioethics and Medical Humanities, Professor of Bioethics and Emergency Medicine, Medical College of Wisconsin

William J. Ehlenbach, MD, MSc
Assistant Professor of Pulmonary/Critical Care, UW Health

John Fangman, MD
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Karola Kreitmair, PhD, MSc
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Steven Leuthner, MD
Professor of Pediatrics and Bioethics, Medical College of Wisconsin and Neonatology, Children's Hospital of Wisconsin

Michael Lohmeier, MD
Medical Director, UW Health Emergency Education Center

Kristi Maso, MD
Assistant Professor of Emergency Medicine, Medical Director, Froedtert Emergency Department and Assistant Professor, Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Internal Medicine, Medical College of Wisconsin

Maria Mora Pinzon, MD, MS
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Jasmine Zapata, MD, MPH
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Acknowledgements
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Appendix B

Summary of Community Stakeholder Focus Group Meeting

A total of 26 individuals were invited to attend the online focus group, and complete a supplemental open-ended survey. Of these 16 attended the focus group and completed the survey and 3 completed the survey only (total N=19). They represented multiple communities that live in Madison, Milwaukee and Green Bay, with a majority of them working in advocacy, community organizing, public health, government, healthcare, education, non-profit work, among others. The attendees self-identified as belonging to the following communities: African American, people living with disability, LGBTQ, Hispanic/Latino, aging population, Faith leadership, and caregivers. We also invited people from rural and native communities, who were unable to attend due to the short notice. .

Much of the meeting was devoted to discussing the need to allocate ventilators and other life-saving treatments. Many questions arose outside the scope of this working group, including: how are ventilators currently distributed around the state, is there already a disparity? Is the size of the ICU standard across institutions or are these based on other factors? What is being done to prevent scarcity? What can be done to assure that we don't reach that point (e.g. can vents being brought up from other locations, are state officials advocating for resources)? What can medical professionals do to provide care to more people (e.g. using one vent for two people)? What is the state doing about incarcerated populations?

The following themes specifically related to ventilator allocation were expressed in the focus group:

Inclusion & Transparency (Who is included in the conversation?)

Attendees questioned the inclusivity of the group in light of the absence of native, Hmong, rural communities, and healthcare providers working in FQHC settings. They expressed the view that the general public should be aware of the process of preparing and implementing guidelines, have access to the guidelines/documents, and be given the opportunity to provide input in multiple ways (e.g. online, phone call, town halls).

Individuals stated that the communities are unaware of the magnitude of the current situation, and that there needs to be wide engagement of communities not only in the development of guidelines, but in their implementation and evaluation. Communities are afraid that the lack of diversity at any point (e.g. attending physician, triage committee,

hospital administration, policy-makers) would result in exclusion of disadvantaged individuals if/when allocation decisions become necessary.

When asked *"who should be part of these conversations?"* attendees mentioned over 50 unique individuals and organizations that should not only be aware of this discussion but be engaged as these guidelines are approved and disseminated (See full list below). The purpose of the engagement is to assure that individuals are not being excluded in the basis of race, ethnicity, age, gender, disability status, comorbidities, gender identity, geographical location, citizenship, undocumented status, occupation, primary language, faith, among other topics, and that the guidelines are clear in their language regarding the above conditions. It was mentioned that "color blind" does not mean that the outcome won't be racially biased; some believe it would be better to be explicit about race/ethnicity and other factors, so triage teams can deal with their own biases at the time of assessment. Diverse teams are one of the safeguards in situations like this that could help to navigate bias.

Attendees also expressed a need for engagement with community organizations as a way to transmit the information and initiate conversations about preventive strategies and end-of-life care.

Minoritized communities are penalized for consequences of structural racism

There were concerns from attendees that minoritized communities would fare worse in any scenario, because they tend to delay care resulting in advanced disease at the time of arrival at the hospital, have more comorbidities, and are regularly undertreated or mistreated within the healthcare system. These are seen as a result of structural racist policies that have disenfranchised populations resulting in high rates of poverty, lack of insurance, underinsurance, malnutrition, lower education achievement, high rates of incarceration, and many other factors included in the social determinants of health.

Attendees expressed the view that any use of comorbidities or other factors such as wealth, ability to pay, or insurance should never be part of any triage process. Even more, the attendees felt that any triage process should have some oversight or audit process that evaluates that certain groups of people are not being disproportionally triaged out without medical basis.

It was important for attendees that during the development and implementation of these guidelines, it is important to understand that health disparities are a result of a multitude of factors that result in adverse social determinants of health. Factors such as the inability to work from home, high population density in urban areas, the inability to isolate if someone has symptoms, and the need to take public transportation, make it very difficult to comply with social distancing recommendations, and are putting disadvantage communities at higher risk of infection, and worse outcomes.

Distrust of the system (healthcare and government)
The attendees shared many experiences where a healthcare encounter resulted in worse health outcomes because of neglect and racism by medical providers. The attendees expressed concern that if decisions were to be in the hands of one person then they would not be ranked high enough to be allocated a ventilator based on their own comorbidities and personal experiences.

Many individuals have experienced concerns about disenfranchisement within the healthcare system and expressed the need to make sure that the allocation of ventilators relates to the need of the community. There was also a concern that the allocation of ventilators is just the last step in a series of triage decisions that start from the moment someone enters the emergency department: are symptoms in patients of color being taken seriously? Are they being triaged as safe to go home when they should have stayed in the hospital?, If they get a ventilator, would they receive a fair chance, or would the ventilator be withdrawn before the patient has had a chance to recover? In summary, there were doubts that an equitable policy to allocate ventilators would safeguard individuals from mistreatment at earlier stages of the disease.

The attendees also expressed mistrust in the development of these guidelines. As mentioned in the transparency theme, the attendees almost unanimously expressed that these guidelines should be public, easily accessible, and that the government continue the effort to engage communities and organizations during this crisis.

Gratitude
Some participants expressed concern at the lack of representation in the group and the rushed timing of the convocation. However, many of them expressed gratitude to be able to express their opinions, and to have been called to the table. They also expressed their desire to stay engaged and provide more input and feedback as these guidelines move along.

The following is a summary of survey responses (n=19) to concrete questions:

Q1. In your opinion, what is the most fair and equitable way to decide how ventilators will be assigned if there are not enough for everyone in need? (For example, how should age, pregnancy, overall life expectancy, preexisting conditions, etc be factored in, if at all?)

Many of the responses agreed that the possibility to survive and recover should be a factor along with life expectancy.

People agree that capacity to pay, insurance, occupation, fame, or socioeconomic status should NOT be a factor.

Some responses included that considerations might be necessary for age, pregnancy, caregiving responsibilities, first responder, comorbidities, and others. At the same time, others disagreed that any of these factors should have weight in the decision.

Q2. When considering health equity, what things do you feel are important for any resource allocation guidelines to consider?

Most of the responses re-iterated topics discussed in the focus group. Anyone involved in the development of the guidelines must be aware of the influence that social determinant of health (e.g. poverty, income, location, education) and racism have over health outcomes and health disparities.

Some key points brought up in this question include:

- Everyone should have equal chance—lottery system
- Guidelines must be inclusive
- There must be diversity of voices at the table making and implementing guidelines.
- There must be oversight of the teams making decisions on ventilator allocation, to ensure that decisions that are made are not racially biased or discriminatory.

Q4. In your opinion, after hospitals have done everything they can to increase resources, what is the best way hospitals should communicate ventilator assignment guidelines to patients and to the community?

Patients:

- Face-to-face; patients with family present
- Through the patient's primary provider

Community:

- Media— hospitals should have a press release and talk about their guidelines; this can also be covered in news article and other media.
- Community town hall meeting with different communities and have the information also available in different format (e.g., video, radio, social media).
- Through the designated Hotline, the Health Department, the Area on Aging and through Public Service announcements
- Use community organizations that have the trust of the community to help the hospitals relay culturally and linguistically appropriate information. Help the community understand what the process is and why.
- Churches and other faith groups.

Q3. Are there any other voices/stakeholders you believe should be included in this ongoing conversation? (Please list specific names/organizations if applicable)

1. Aaron Perry, Rebalanced Life Wellness Association
2. Adam Jackson, Strategic Consultant, Humana Hospital
3. Adams Garden Park
4. Alex Gee (Pastor, Dr)
5. Antonio Butts - Walnut Way
6. Betsy Abramson, Wisconsin Institute for Health Aging
7. Beverly Scow, Wise Women Gathering Place (Green Bay Area & Oneida Nation)
8. Center for patient partnerships
9. Centro Hispano (Karen Menedez)
10. Cheryl Wittke, Safe Communities of Dane County
11. Collaborative center for health equity (CCHE)
12. Corey Smith, IT essential worker, AA business resource group president
13. Debbie Jones, Hospitalist, SSM Dean Health
14. Denise Pommer, LCO Tribal Nation
15. Disability Pride Madison
16. Equity by Design
17. Federally Qualified Health Care Centers
18. Gale Johnson, WO Well Woman Program,
19. Gina Green Harris, UW School of Medicine and Public Health
20. Greg Jones - Chicago native, diversity practitioner, Chief Diversity Officer
21. Greg Jones, NAACP
22. Harambee Birthing Doulas
23. Ho-Chunk Nation, WI Tribal Nations
24. Ingrid Parker Hill, Green Bay Area Public Schools
25. James Graham, essential worker, HVAC
26. John Gramling
27. Kabzuag Vaj, Hmong community organizer in Madison, Executive Director Freedom Inc
28. Lance Kelly, NWTC & Oneida Nation
29. Latino Health Council in Dane county
30. Lea Kitz, disability rights
31. Lisa Peyton-Care, Foundation Black Women's Wellness
32. Lisa Poupart, First Nations Studies, UWGB (Lac du Flambeau Tribal Member)
33. Lt Governor Mandela Barnes
34. Lt. Lucretia Thomas, Milwaukee Police Department
35. Lucretia Wadem All of Us
36. Luis Franco-Toscano, Bilingual Family Engagement Coordinator Green Bay Area Public Schools
37. Mai Lo Lee, Diversity Director, Multi-Ethnic Student Affairs UWGB
38. Marcus Allen, Mt. Zion church,
39. Markasa tucker
40. Melanie Maczka, Executive Director, Casa ALBA Melanie
41. Michael Ford

42. Michael Johnson, Boys & Girls Club
43. Michele Bria, Journey House
44. Native American Center for Health Professions (NACHP)
45. Oscar Mireles, omega alternative school
46. Pastor Christopher Boston- Lamb of God
47. Peng Her, Hmong Health Council
48. Pooja Argawal, UWGB
49. Public Health Madison & Dane County
50. Renee Moe, United way
51. Rev. Everett Mitchell
52. Robin Lankton, UW Health
53. Robin Tinnon, We All Rise African American Resource Center
54. Ruben Anthony, Urban League of Greater Madison
55. Rural Communities of color
56. Sabrina Madison, Black Women's Empowerment Center
57. Sami Schalk
58. Sara Finger, WI Alliance for Women's Health
59. Sharon Adams, Walnut Way Founder
60. Sheri Johnson, WI Population Health Institute
61. The Black Bloc
62. Urban league
63. Urban Triage
64. Voces de la frontera in Milwaukee.
65. Walt Lanier - MATC
66. Yussif Kassim, Bilingual Family Engagement Coordinator, Green Bay Area Public Schools

PART II: Guidelines for the Implementation of Allocation Strategies (Companion to "PARTI I: Principles for Ventilator Allocation")

We are facing an outbreak of a new disease called COVID-19, which is caused by a coronavirus. This disease was first seen in Wuhan, China in December 2019, and has since spread all around the world. This disease has come to Wisconsin, and social distancing measures have been imposed to slow its spread in our communities. We know that most people infected with this virus will have a mild illness, but that about 1 out of 5 people infected may get very sick. Some of those people will need to be treated in intensive care units. Even with the best medical care, some people with this infection will die from it.

Because no one is immune from this new infection, there is a risk that many people will become very sick in a short amount of time. Due to this potential rapid increase in critically ill patients, there is a possibility that there will not be enough intensive care unit beds, ventilators, or health care professionals to take care of all patients who need critical care. While we hope this does not happen, we are taking steps to prepare in case it does. The recommendations issued herein only pertain to the ethical allocation of ventilators, although such an allocation will inevitably be intertwined with the allocations of other scarce resources, such as beds and personnel.

These guidelines are based on the accompanying document, entitled "Principles for Allocating Ventilators" and are intended as practical guidance on how to implement those principles.

If health care resources become critically short, decisions about starting patients on ventilators, or continuing ventilator support for patients already receiving such treatment, must be made in accordance with principles of medical ethics. We advocate ***the primary goal of saving as many lives as possible****, the secondary goal of saving the lives of the most patients who are expected to live at least one year post discharge, and the tertiary goal of prioritizing younger of older patients (based on the principle of "Fair Innings").* The criteria to guide these decisions have been created by a diverse group of health care professionals, medical ethicists and community members using the best available scientific information to help determine which patients are the most likely to benefit from life supporting treatments, i.e., critical care. If members of this group become ill during a period of scarcity, this group is not exempt from the rationing rulesdescribed herein.

In a context of severe resource scarcity, institutional pediatric and adult critical care resources should be pooled to the extent to which this is possible. This is to ensure that a concerted effort is made to pursue the stated aim of saving as many lives as possible.

The central clinical indicators required to implement this strategy are the estimated benefits of ventilator access for patients who are critically ill due to COVID-19 and for those who are critically ill for other reasons. Patients who have critical illness due to COVID-19 do not have special priority over those who are critically ill for other reasons.

For critically ill patients generally, a number of validated mortality prediction tools exist, such APACHE II, SAPS II, SOFA, and PELOD (https://clincalc.com/IcuMortality/Default.aspx). None of these tools is perfect for making decisions for individual patients. However, when triage decisions must be made,

imperfect but objective data are ethically preferable to improvised or arbitrary decisions at the bedside.

Herein, we have used SOFA for adults and PELOD for children as predictors of mortality, as this is a strategy used by other institutions and other states in their allocation of critical care resources and for triage guidelines created by the Society of Critical Care Medicine.

Tiered allocation strategy:

Under increasing levels of scarcity, the proposed allocation strategy for ventilators consists of moving between *triage stages*, which reflect rules for how to allocate medical resources among patients in different *mortality categories*. Intentionally, we have not defined a "level of scarcity", because it is difficult to predict what the numbers might be, or how many patients may fall into any triage category at any given time. The mortality categories are as follows (see also "Clinical Overview of Mortality Categories" Table):

- Patients in the "GRAY" group are ***extremely unlikely*** to survive to discharge despite critical care.
- Patients in the "RED" group are ***highly unlikely*** to survive to discharge despite critical care.
- Patients in the "ORANGE" group are ***unlikely*** to survive to discharge despite critical care.

The primary goal of our strategy is to save the most lives by allocating ventilators to patients who are most likely to survive to discharge. Thus, all patients in the GRAY group should be excluded from ventilator access before any in the RED group, and all patients in the RED group should be excluded from ventilator access before any in the ORANGE group. Objective metrics for mortality should be used (eg. SOFA or PELOD).

If a secondary criterion is required in order to distinguish between patients for exclusion in a given mortality category, specifically if excluding all patients in a particular mortality category would liberate more ventilators than are needed for patients in a category with lower mortality, only those patients with an expected survival post discharge of less than one year should be excluded. (See Section on "Use of tiered allocation strategy" for an explanation of how this should be implemented.)

If a tertiary criterion is required in order to distinguish between patients for exclusion in a given mortality category once all patients with an expected survival of less than one year have been excluded, patients should be excluded on the basis of age, with priority given to younger patients. This prioritization is based on the notion of *fair innings*, which gives preference to patients who have not yet had a chance to live through as many stages of life as older patients. (See "Use of tiered allocation strategy" Section.)

Note: We do not recommend giving consideration to remaining life-years of a patient, assuming survival to discharge, as this may disproportionately disadvantage already disadvantaged populations who, due to social determinants of health, live with more comorbidities than more advantaged populations.

A hospital's incident command system team should determine when to move from one stage to the next of this tiered allocation strategy

Clinical Overview of Mortality Categories:

	ADULTS		PEDIATRIC

GRAY Category Patients
EXTREMELY UNLIKELY TO SURVIVE THIS ADMISSION DESPITE INTERVENTION
	• Moribund Trauma (confirmed by 2 trauma attendings)
	• Severe burns in patients with any two (2) of the following
	  ○ Age >60
	  ○ >40% TBSA
	  ○ Inhalation Injury
	• Cardiac Arrest
	  ○ Unwitnessed OR Witnessed and recurrent / refractory
	• Metastatic malignant disease
	• New severe and irreversible neurological event or condition with high expected mortality*
			• Moribund Trauma (confirmed by 2 trauma attendings)
			• Severe burns with expected mortality >90%
			• Cardiac Arrest
			  ○ Unwitnessed OR Witnessed and recurrent / refractory
			  ○ Metastatic malignant disease
			  ○ New severe and irreversible neurological event or condition with high expected mortality**

	ADULTS with COVID-19	**ADULTS with Other Conditions**	**PEDIATRIC**

RED Category Patients
HIGHLY UNLIKELY TO SURVIVE THIS ADMISSION DESPITE INTERVENTION
	• Patients age >80
	  ○ (Due to disease specific mortality of COVID-19)
	All Ages
	• Severe ARDS + Severe AKI
	  ○ (Cr >2, need for renal replacement therapy)
	• SOFA >11
		• SOFA >11
		• After 120 hours of ICU care:
		  ○ SOFA 8-11 without improvement
		• Transplant ineligible end-stage organ failure (needing critical care)
		  ○ Class III/IV CHF
		  ○ Severe chronic lung disease: FEV <25%, pHTN with HF III/IV, Mean PA pressure >50
		  ○ MELD >20
			• PELOD >33
			• After 168 hours of ICU care:
			  ○ PELOD 25-33 without improvement OR
			  ○ Worsening PELOD score since admission

ORANGE Category Patients
UNLIKELY TO SURVIVE THIS ADMISSION DESPITE INTERVENTION
	• Patients age >70
	  ○ (Due to disease specific mortality of COVID-19)
	All Ages
	• After 48 hours of ICU care:
	  ○ SOFA sscore increased by 2
	• After 120 hours of ICU care:
	  ○ SOFA 8-11 without improvement
		• After 48 hours of ICU care:
		  ○ SOFA 8-11, without improvement
		• Transplant eligible end-stage organ fialure (needing critical care)
		  ○ Class III/IV CHF
		  ○ Severe chronic lung disease
		  ○ MELD >20
			• After 120 hours of ICU care:
			  ○ PELOD 25-33, without improvement
			• Transplant ineligible end-stage organ failure (needing critical care)

*Severe and irreversible neurological event or condition with high-expected mortality in adults:

1) Global cerebral injury due to metabolic/ infectious / anoxic insult on CT/CTA/MRI
2) High grade aneurysmal subarachnoid hemorrhage with poor GCS
3) Intraparenchymal hemorrhage with high ICH score
4) Penetrating brain injury with significant parenchymal damage
5) Moderate to Severe traumatic brain injury with high IMPACT score

**Severe and irreversible neurological event or condition with high-expected mortality in pediatric patients:

1) Global cerebral injury due to metabolic/ infectious / anoxic insult on CT/CTA/MRI
2) Intraparenchymal hemorrhage
3) Moderate to Severe traumatic brain injury

Table of Abbreviations	
TBSA	Total Body Surface Area
ARDS	Acute Respiratory Distress Syndrome
AKI	Acute Kidney Injury
Cr	Creatinine
SOFA	Sequential Organ Failure Assessment
CHF	Congestive Heart Failure
FEV	Forced Expiratory Volume
pHTN	Pulmonary Hypertension
HF	Heart Failure
MELD	Model for End-stage Liver Disease
PELOD	Pediatric Logistic Organ Dysfunction

Use of tiered allocation strategy:

Each allocation stage represents the clinical characteristics of patients who are to be excluded from receiving ventilators based on mortality estimates. As scarcity increases and ability to increase ventilator capacity is exhausted, the Clinical Triage Team should move sequentially through each stage based on resource demands. (See Tiered Allocation Flow Chart). Every patient who is excluded from ventilator access should have a No CPR order and receive appropriate end-of-life care including symptom management.

The GRAY Triage Stage should be applied to *all* patients on ventilators who meet GRAY criteria. (This is because these are patients who are extremely unlikely to benefit from ventilator and critical care treatment, and for which it is thus warranted to exclude them from treatment, especially in a context of scarcity.)

When the RED Triage Stage is invoked, the Clinical Triage Team should determine how many ventilators are needed to care for patients with predicted mortality *lower* than patients in the RED category. If the number of patients with predicted mortality *lower* than patients in the RED category (i.e. patients in the ORANGE category and beyond) is equal to or exceeds the number of patients in the RED category, all patients meeting criteria for the RED category should be excluded from access to a ventilator.

If there are sufficient ventilators to allocate them to *all* patients with predicted mortality lower than patients in the RED category and *some* of the patients in the RED category, *some but not all* of the patients in the RED category should be excluded. In this event, those patients in the RED category with predicted survival of < 1 year even if they were to survive this critical illness should be excluded from access to a ventilator.

If after the patients in the RED category with predicted survival of < 1 year are excluded there still remains a shortage of ventilators to care for those patients who have a mortality lower than patients in the RED category, patients in the RED category should be excluded from oldest to youngest, motivated by the principle of Fair Innings. (See Appendix C for an example.)

When the ORANGE Triage Stage is in invoked, The Clinical Triage Team should determine how many ventilators are needed to care for patients with predicted mortality *lower* than

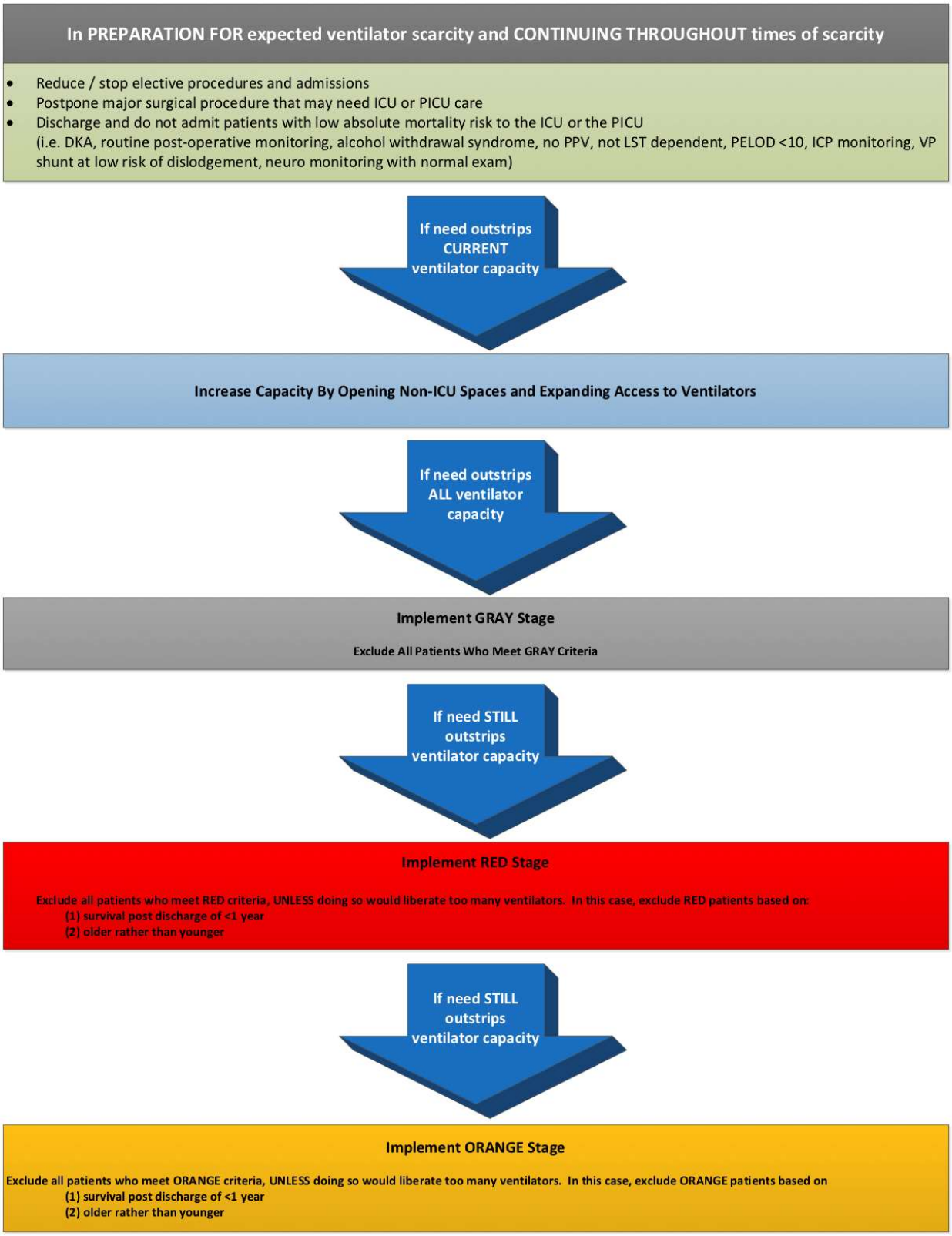
patients in the ORANGE category. If the number of patients with predicted mortality *lower* than patients in the ORANGE category is equal to or exceeds the number of patients in the ORANGE category, all patients meeting criteria for the ORANGE category should be excluded from access to a ventilator.

If there are sufficient ventilators to allocate them to *all* patients with predicted mortality lower than patients in the ORANGE category and *some* of the patients in the ORANGE category, *some but not all* of the patients in the ORANGE category should be excluded. In this event, those patients in the ORANGE category with predicted survival of < 1 year even if they were to survive this critical illness should be excluded from access to a ventilator.

If after the patients in the ORANGE category with predicted survival of < 1 year are excluded there still remains a shortage of ventilators to care for those patients who have a mortality lower than patients in the ORANGE category, patients in the ORANGE category should be excluded from oldest to youngest, motivated by the principle of Fair Innings.

A flow chart describing the progressive implementation of each stage is on the following page.

Tiered Allocation Strategy Flowchart:



Additional considerations:

Organ Donation: Patients who meet brain death criteria or who have severe neurological injury and are potential organ donors should NOT be included in the GRAY group unless the demand for ventilators greatly exceeds supply. This is because the organ-sustaining treatments that these potential donors require may provide life-saving benefit for more than one patient who is awaiting organ transplantation (assuming transplantation of vital organs continues despite the pandemic).

Appendix C: Scenarios for Ventilator Allocation in Red and Orange Stages

Scenario 1

An ICU has a total of 10 ventilators. Currently, 8 are being used to support patients who meet RED criteria and 2 are being used to support patients who meet ORANGE criteria. There are now 8 new patients who meet ORANGE criteria and who are newly in need of mechanical ventilation. In this case, all patients who meet RED criteria will have their ventilator support withdrawn and the 8 new patients who meet ORANGE criteria, together with the previous 2 patients who meet ORANGE criteria will receive ventilator support.

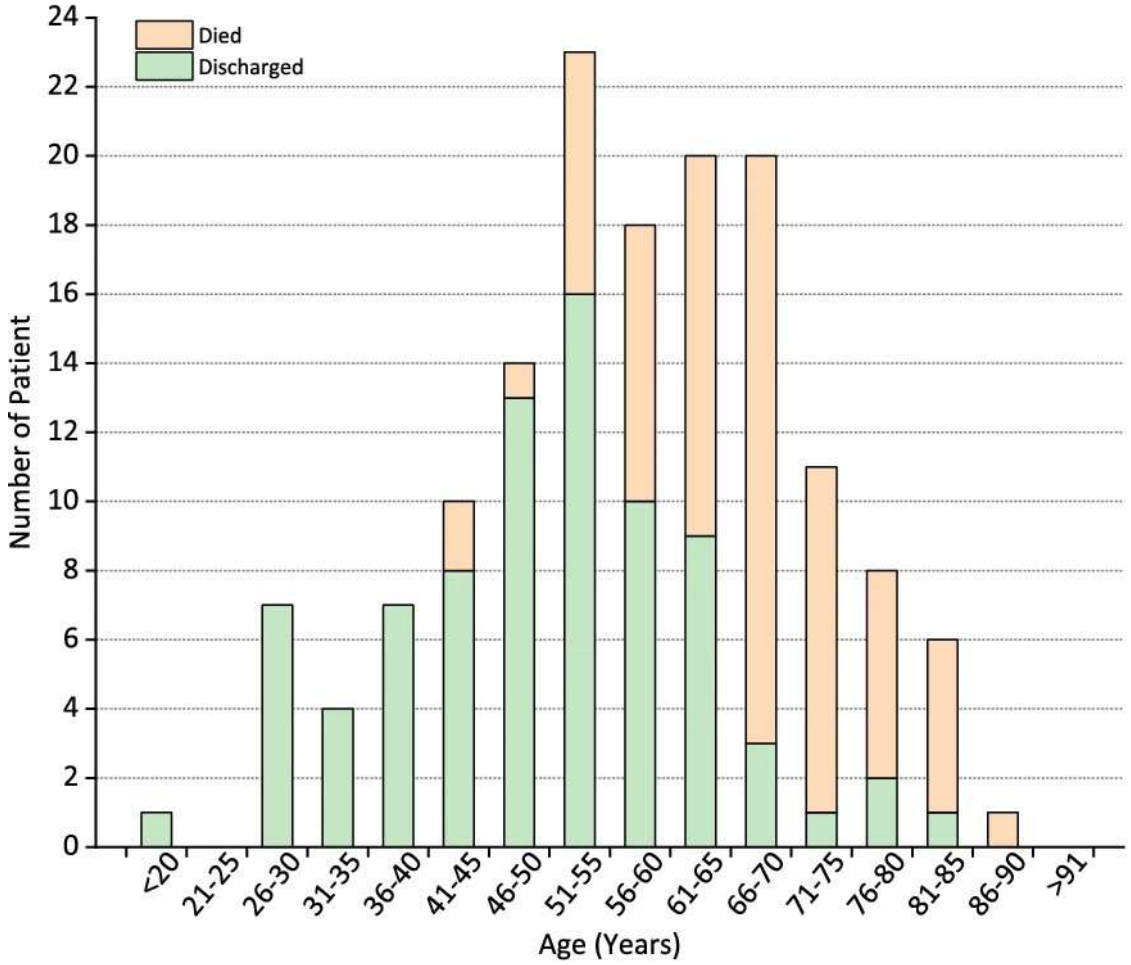
Scenario 2

An ICU has a total of 10 ventilators. Currently, 8 are being used to support patients who meet RED criteria and 2 are being used to support patients who meet ORANGE criteria. There are now 3 new patients who meet ORANGE criteria and who are newly in need of mechanical ventilation. In this case, not all 8 patients who meet RED criteria should have their ventilator support withdrawn. Only 3 of the patients who meet RED criteria should have their ventilator support withdrawn (to allow access to ventilators to the 3 new ORANGE patients). The first step is to exclude patients on the basis of expected survival post-discharge of less than one year. One of the patients who meets RED criteria has an expected survival post-discharge of less than 1 year while the other 7 have an expected survival post-discharge of more than 1 year. The patient with the expected survival of less than 1 year should have her ventilator withdrawn. This still leaves a shortage of 2 ventilators. The next step is to exclude older patients rather than younger patients. At this point, the two oldest remaining patients who meet RED criteria should be excluded from ventilator access. In this step-wise process, 3 patients who meet RED criteria are excluded and those 3 ventilators can be provided to patients who meet ORANGE criteria.

Appendix D: COVID-19 data sources

Mortality data: The overall case fatality rate (CFR) of COVID-19 cases in China who required the ICU was 49% in Wu and McGoogan (JAMA 2020); in Guan et al 27% of those admitted to the ICU and 60% of those who required invasive mechanical ventilation died. In another Chinese case series, 31 of 32 invasively mechanically ventilated patients died (Zhou Lancet 2020). In another report from Wuhan, mortality was 62% among critically ill patients and 81% among those requiring mechanical ventilation (Yang et al Lancet Resp Med 2020). These data provide estimates of the mortality rate *with* ICU. The CFR increases with age with an inflection point somewhere above 60 years of age; in Yang et al 9 out of 13 died in the 50-59 age group (69%), 11/17 (65%) 60-69, 7/8 (88%) 70-79, 2/2 >/= 80. Overall, in this study 30 (81%) of 37 patients requiring mechanical ventilation had died by 28 days.

Figure 1: Age distribution of patients with confirmed COVID-19 and outcome, Wuhan China(a)



(a)from Ruan, Q., Yang, K., Wang, W. et al. Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. Intensive Care Med (2020). https://doi.org/10.1007/s00134-020-05991-x

Figure 2: Case Fatality Rate by Age, Italy([b])

Table. Case-Fatality Rate by Age Group in Italy and China[a]

	Italy as of March 17, 2020		China as of February 11, 2020	
	No. of deaths (% of total)	Case-fatality rate, %[b]	No. of deaths (% of total)	Case-fatality rate, %[b]
All	1625 (100)	7.2	1023 (100)	2.3
Age groups, y				
0-9	0	0	0	0
10-19	0	0	1 (0.1)	0.2
20-29	0	0	7 (0.7)	0.2
30-39	4 (0.3)	0.3	18 (1.8)	0.2
40-49	10 (0.6)	0.4	38 (3.7)	0.4
50-59	43 (2.7)	1.0	130 (12.7)	1.3
60-69	139 (8.6)	3.5	309 (30.2)	3.6
70-79	578 (35.6)	12.8	312 (30.5)	8.0
≥80	850 (52.3)	20.2	208 (20.3)	14.8

[b] Onder G et al. JAMA. Published online March 23, 2020. doi:10.1001/jama.2020.4683; note, this is the overall case fatality rates for all known cases, not just for those requiring critical care or mechanical ventilation

Appendix E: SOFA score guide

The SOFA Score*

Organ System, Measurement	SOFA Score				
	0	1	2	3	4
Respiration PaO_2/FiO_2, mmHg	Normal	<400	<300	<200 (with respiratory support)	<100 (with respiratory support)
Coagulation Platelets $x10^3/mm^3$	Normal	<150	<100	<50	<20
Liver Bilirubin, mg/dL (µmol/l)	Normal	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (<204)
Cardiovascular Hypotension	Normal	MAP<70 mmHg	Dopamine ≤5 or dobutamine (any dose)**	Dopamine >5 or epinephrine ≤0.1 or norepinephrine ≤0.1	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1
Central Nervous System Glasgow Coma Score	Normal	13-14	10-12	6-9	<6
Renal Creatinine, mg/dL (µmol/l) or Urine output	Normal	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440) or <500 mL/day	>5.0 (>440) or <200 mL/day

* Source: Vincent et al., 1996.

**Adrenergic agents administered for at least 1 hour (doses given are in mcg/kg/min).

When arterial blood gas sampling has not been performed and PaO2:FiO2 ratio cannot be calculated, SaO2:FiO2 can be calculated, and the following SOFA respiratory scorecan be determined:

The SOFA respiratory score using SaO_2:FiO_2

SOFA Respiratory score	PaO_2/FiO_2	SpO_2/FiO_2
1	<400	<512
2	<300	<357
3	<200	<214
4	<100	<89

(a)From Pandharipande P et al. Crit Care Med. 2009 Apr; 37(4): 1317–1321.

Appendix F: PELOD score guide

Pediatric Logistic Organ Dysfunction Score: PELOD 33 = 90% mortality
PELOD 25 = 50% mortality
PELOD 10 = 5% mortality

	Scoring system			
	0	1	10	20
Organ dysfunction and variable				
Neurological*				
Glasgow coma score	12–15	7–11	4–6	3
	and		**or**	
Pupillary reactions	Both reactive	NA	Both fixed	NA
Cardiovascular†				
Heart rate (beats/min)				
<12 years	≤195	NA	>195	NA
≥12 years	≤150	NA	>150	NA
	and		**or**	
Systolic blood pressure (mm Hg)				
<1 month	>65	NA	35–65	<35
1 month–1 year‡	>75	NA	35–75	<35
1–12 years‡	>85	NA	45–85	<45
≥12 years	>95	NA	55–95	<55
Renal				
Creatinine (μmol/L)				
<7 days	<140	NA	≥140	NA
7 days–1 year‡	<55	NA	≥55	NA
1–12 years‡	<100	NA	≥100	NA
≥12 years	<140	NA	≥140	NA
Respiratory§				
PaO_2 (kPa)/FIO_2 ratio	>9·3	NA	≤9·3	NA
	and		**or**	
$PaCO_2$ (kPa)	≤11·7	NA	>11·7	NA
	and			
Mechanical ventilation§	No ventilation	Ventilation	NA	NA
Haematological				
White blood cell count ($\times 10^9$/L)	≥4·5	1·5–4·4	<1·5	NA
	and	**or**		
Platelets ($\times 10^9$/L)	≥35	<35	NA	NA
Hepatic				
Aspartate transaminase (IU/L)	<950	≥950	NA	NA
	and	**or**		
Prothrombin time¶ (or INR)	>60 (<1·40)	≤60 (≥1·40)	NA	NA