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Research Article

Three Critical Patients and One Ventilator: An Analysis of Factors Used in Making Life-Saving or Life-Ending Decisions

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Background

Modeling studies, published in 2009, concluded that a pandemic with a severity level similar to the 1918 Pandemic, would require 400% of the current American Intensive Care Unit (ICU) beds and 200% of all mechanical ventilators [1]. This concern has not been resolved even up to 2015, whereupon New York State public health officials declared that the state's medical infrastructure still lacks the ventilator resources to meet the 1918 challenge [2].

This is a situation that all nurses must confront and challenge since they will be on the frontlines providing austere care in catastrophic circumstances. They, and all healthcare professionals, must also weigh the following published concerns:

1. A specific vaccine for the pandemic virus will not be available for six months after the first wave and most likely will be in short supply afterwards;
2. Antiviral medications will also be in short supply and will, very likely, be ineffectual;
3. The attack rate may be as high as 35% during the initial six-week outbreak;
4. A critical proportion of the affected population (30-40%) will include the healthcare professional, specifically nurses who work so closely with the sick [2].

All these factors will result in a severe deficit in resources thereby creating a unique paradigm shift in how healthcare will be delivered. This has all been acknowledged in the medical and medical ethics literature [3-5].

However, what has not been fully addressed is that healthcare must plan for a catastrophic pandemic within the context of unique 21st century challenges that are global in nature. Typically, in major disasters, private and public agencies, civilian and military have become part of the response effort. In recent times, this was the case with Hurricane Katrina (2005), the Haiti earthquake (2010), and the Aceh earthquake/tsunami (2004). A nation's military assets would likely be ordered to response to a pandemic, unless, of course, they must attend to additional threats that may be occurring at the same time.In addition, climate changecan increase the impact of multiple stressors on individuals thereby making them more susceptible to the ravages of a pandemic [6].These factors individually or collectively will exponentially worsen any response to a 1918-like pandemic.

Since the Sudden Acute Respiratory Syndrome epidemic, the concepts of altered standards of care and allocation of scarce resources abound in the medical/ethical literature, but have not filtered down to the public and the general medical infrastructure (viz. nurses). The nurses need to be singled out since they represent a critical bridge between patient and family with the rest of the medical infrastructure (physicians, nurse practitioners, physician assistants, emergency medical technicians, respiratory and laboratory technicians, to name but a few). Therefore, any pandemic planning and educational efforts need to target this vital group in order to facilitate acceptance and concordance with the rest of the community and also to provide the necessary leadership to advocate for appropriate alterations in healthcare delivery in the face of a severe pandemic.

Therefore, when there are scarce resources, decisions will have to be made. Who will make those decisions and who will carry them out [7,8]? In such a catastrophic situation, the macroethics of public health (i.e. protecting the commonwealth) will supersede the microethics of the patient-healthcare provider relationship (i.e. safeguarding the welfare of the individual patient). The nurse is appropriately positioned to navigate the perils and pitfalls

of pandemic preparedness as long as that person has received the necessary training beforehand. The nurse can serve as a catalyst, a link, and/or a bridge between:

- Pre-hospital and hospital providers;
- Physicians and patients; and
- Interdisciplinary stakeholders and the public.

There are many guiding principles that can be used to allocate scarce resources including but not limited to: maximizing the number of lives saved, broad social value, instrumental value, maximizing life-years, and the life cycle principle [1]. Within this maze of principles, there is no general consensus currently. Unless this is addressed now in the pre-pandemic period, both the public and the nurse (who will bear the brunt of the dilemma) will be forced to confront and comply with pandemic rules and regulations that are arbitrary, nebulous, unstructured, and dangerous. Without an ethical framework that is transparent, provides distributive justice, and acknowledges the duty to plan, to care, and to steward resources, there will be consternation, crisis, and chaos [2].

In the authors' opinion, the principal concepts that epitomize altered standards of care in a pandemic are "The Inclusion-Exclusion" and "Withdrawal of Care" paradigms. In a severe pandemic, when resources (specifically, ventilators) are at their nadir, criteria are required that ethically, medically, and legally would, with one set of parameters, prohibit patients with poor chance of survival from gaining access to an already-debilitated hospital and allow, with another set of parameters, any patient on a ventilator to be removed from that ventilator once it's been decided that a second patient might benefit from it.

It is obvious that a nurse will have to be intimately involved with this process, either in planning, training, implementation or all three. A recent paper dealing with the ethical implications of allocation of scarce resources presented three fictitious ICU cases in respiratory distress and challenged the reader to determine which of the three should receive the last ventilator [1]. The author also stated that past criteria are ethically suspect and proposed alternative criteria. This dilemma, unfortunately, has not reached the level of the general lay public nor the average healthcare professional.

Therefore, the purpose of this paper is to present these three case scenarios to a pilot sample of the lay public, healthcare professionals, and healthcare students to evaluate whether there is agreement or disagreement concerning which "patient" deserves the ventilator and to research what values assisted the study groups in making their decision.

Methods

A survey was developed based on the published pandemic scenario, received Institutional Review Board (IRB) approval, and then administered to health care students, professionals, and the general public. The case scenarios were re-written in laymen's terms to improve comprehension. Potential respondents were identified at a local hospital and were provided the study description and asked if they were willing to participate. Those who agreed were provided the survey and allowed to complete it by themselves in a quiet room. Once they completed the survey, they provided it to the research team member.

The respondents had to choose among the following three patients which one would receive the lone available ventilator.

Patient 1: A 32-year-old female with chronic severe blood vessel damage to her lungs. She was recently admitted to ICU due to accidental overdose of narcotics and tranquilizers. Her Sequential Organ Failure Assessment (SOFA) score is 4, which equates to a 90% chance of being discharged from hospital alive given maximum ICU care.

Patient 2: A 83-year-old male, homebound. He has severe peripheral vascular disease and severe coronary artery disease. His heart condition is inoperable. Long-term survival prospect is not good. His SOFA score is 10, which equates to a 50% chance of being discharged from hospital alive given maximum ICU care.

Patient 3: A 44-year-old male who has been completely healthy. He now is admitted with sepsis. Many of his organs are failing as a result of the infection. His SOFA score is 12, which equates to a 30% chance of being discharged from hospital alive given maximum ICU care.

Besides the general demographics that were included in the author's examples, there was emphasis on SOFA score. This score is one among many to predict mortality and has been chosen virtually unanimously as the best tool to use in the Pandemic allocation of scarce resources model because it's predictive of short-term survival, it's easy to implement and it requires minimal laboratory analyses [1]. Short-term survival estimates based on these SOFA scores were provided assuming each patient received optimal Intensive Care Unit (ICU) management. Respondents, who were provided chief complaint, the relevant SOFA scores, a few demographic data, and their own analysis of each patient's general situation, chose which of the three patient vignettes would receive the last ventilator.

In addition, respondents were asked to rank the following fifteen factors from most to least important in determining who should receive a ventilator: age, gender, ethnicity, religion, ideology, race, occupation, social importance, marital status, comorbidities, Glasgow Coma Scale (GCS), SOFA score, criminal status, whether he/she had dependents, and pregnancy status. Many of these confounders were not part of the scenarios, but served

as distractors or confounders to focus their selections upon more traditional selections. The Mann-Whitney U test was used to determine if there were statistically significant differences in ranking of factors between the lay public and health care providers, as well as between males and females.

Results

All but five of the 135 respondents (97.8%) gave the ventilator to either the 32-year-old (60%) or 44-year-old patient (37.8%). The 83-year-old patient, who had the second-best probability of short-term survival based on SOFA scores, was denied the last ventilator by 98.8% of the subjects (Table 1).

Lay Public	N	%	Education Level Completed	N	%
Yes	40	29.6	**High School**	11	8.1
No	95	70.4	**College**	84	62.2
			Graduate/Post	40	29.7
Age Group					
18-29	101	74.8	**Gender**		
30-49	22	16.3	**Male**	89	65.9
50-69	11	8.1	**Female**	46	34.1
70+	1	0.8			
			Patient Choice		
Race			**Patient One**	81	60
Caucasian	73	54.1	**Patient Two**	3	2.2
Black	47	34.8	**Patient Three**	51	37.8
Asian	5	3.7			
Hispanic	3	2.2			
Other	7	5.2			

Table 1: Demographic Information and Patient Choice of Study Sample.

The five most important factors for determining which patient received the ventilator, from first to fifth, were the SOFA score, Glasgow Coma Scale (GCS), pregnancy status, co-morbidities, and age. However, differences existed between the lay public and health care students and professionals, as well as between males and females (Table 2). Males prioritized co-morbidities and age ahead of pregnancy status while females put pregnancy status before these two factors. The two most important to the lay public were the SOFA score and age, whereas SOFA score and GCS were the two most important factors to the health care providers and students. All other factors had an average rank greater than eight with five of the factors (gender, ideology, religion, ethnicity, and race) having an average rank greater than eleven.

Rank	Health Care Factor	Lay Public Factor
1	SOFA Score	SOFA Score
2	Glasgow Coma Scale (GCS)	Age*
3	Co-morbidities	Glasgow Coma Scale (GCS)*
4	Pregnancy Status	Pregnancy Status
5	Age	Dependents*
6	Dependents	Co-morbidities*
Rank	**Females**	**Males**
1	SOFA Score	SOFA Score
2	Glasgow Coma Scale (GCS)	Glasgow Coma Scale (GCS)
3	Pregnancy Status	Co-morbidities
4	Co-morbidities	Age
5	Age	Pregnancy Status
6	Dependents	Dependents
*** indicates p < .05**		

Table 2: Rankings of Factors to Determine Allocation of the One Ventilator.

The lay public responders who chose the first patient felt that age and having dependents were more important in ventilator allocation compared to the healthcare providers and students, who favored GCS and co-morbidities (Table 3).

Lay Public Rank	Patient #1	Patient #2	Patient #3
1	SOFA Score	SOFA Score	SOFA Score
2	Age	Pregnancy Status	Glasgow Coma Scale (GCS)
3	Dependents	Age	Pregnancy Status
4	Pregnancy Status	Glasgow Coma Score (GCS)	Age
5	Glasgow Coma Scale (GCS)	Co-morbidities	Co-morbidities
Healthcare Providers Rank			
1	SOFA Score	Pregnancy Status	SOFA Score
2	Glasgow Coma Scale (GCS)	SOFA Score	Glasgow Coma Scale (GCS)
3	Co-morbidities	Age	Pregnancy Status

4	Pregnancy Status	Glasgow Coma Scale (GCS)	Co-morbidities
5	Age	Dependents	Age

Table 3: Ranking of Factors to Determine Allocation of the One Ventilator-Comparing the Lay Public to Healthcare Providers.

Discussion

The results of this pilot study revealed the following:

1. Utilizing the SOFA score was an important part of the life-death decision-making regardless of the status of the individual subject.
2. Other aspects of the "patients" were also considered in making that decision (e.g. age, co-morbidities, pregnancy)
3. The choices and "weight" of those choices resulting from the patients' medical situation were subtly skewed based upon each subject's personal demographics (e.g. occupation, gender, etc.).
4. Decision factors which most, if not all, people in American society would consider anathema (i.e. religion, ideology, ethnicity, etc.) were ranked at the bottom for all three study cohorts (healthcare professionals, healthcare students, and the lay public). However, these were purposely included because some of these factors are relevant in other societies [9-11].

Generalizing these results, the investigators conclude that the study cohorts not only considered the short-term survival prospects of each "patient" (i.e. SOFA score results), but also counted the potential of long-term survival (i.e. co-morbidities and age). This is exemplified by the 83-year old who had the second-best SOFA score, but who was virtually excluded from any ventilator salvation.

These results also should raise some concerns among pandemic pundits and professionals. How much weight should the SOFA scale have in making these critical decisions? How much consternation would there be if it is revealed during a 24-hour news cycle and via "Wild West" social media that the SOFA scale has never been validated in a pandemic? In fact, in one study, it had been employed in eight real ICU patients with H1N1. Had there been an actual pandemic, five of the patients would have had their critical care measures withdrawn and yet, in real life, they all survived [12].

Age is another issue. Is the use of age sufficient to deem a person should be removed from a ventilator in order to possibly salvage someone younger? Age and whether or not a patient had dependents were considered very important factors to the lay public responders, whereas the healthcare providers and students favored more clinical factors, in addition to SOFA (GCS and co-morbidities). If the SOFA scale, with all its medical objectivity, comes into question then decision-making can become a cacophonous free-for-all where the ethical framework of clarity, transparency, and equity is nowhere to be found. While age remains an important factor in determining the allocation of scarce healthcare resources, other clinical factors also appear to be important.

New York State has published its 2015 guidelines in determining care allocation during a time of pandemic crisis [2]. Though they are guidelines and not law, they underscore the importance of healthcare and public health professionals, as well as ethicists and the general public to convene and discuss what factors are most important in their communities [13-14]. Perhaps, as a community's one cohesive force, it can arrive at a solution that incorporates multiple factors in an objective and ethical format giving appropriate consideration to patient demographics, short-term survival prospects, and long-term viability [1].

This is a process that does not begin during the pandemic, but before; in fact, now. The issues are complex and require significant deliberations between healthcare and the public. Nurses are critical in this endeavor. Procrastination can be unnecessarily deadly to the patient, physically and mentally debilitating to the nurse caring for that patient, and destructive to the community in which both reside. As this was a pilot study, we cannot be certain that all healthcare providers and students, as well as the lay public, prioritize these factors in the same manner.

Further, some of our respondents were not comfortable with factors such as race, religion, ethnicity, and ideology. These factors may not and should not be relevant to allocation of scarce resources. However, depending on where a disaster occurs, it is possible that they may play a role, as well as other factors that our research did not address. This was a pilot study that will provide the impetus for additional research. More comprehensive studies will be done centering on healthcare specialties and others strictly on lay public citizens. An additional limitation was that our study population was primarily under the age of 30. Thus, it would be premature to generalize these findings across all ages. Future research should continue to expand the age of people surveyed so that decision-making can be better-compared across ages.

Summary: The purpose of this research is to study the ethical issues associated with catastrophic, pandemic decision-making with attention to opinions from both the general public and health care professionals. We believe the process for developing allocation criteria must be as transparent as possible in order to build trust within the community. There is no one "correct" answer but doing this work beforehand will make these very difficult decisions a little bit easier when they have to be made. Hopefully, this work will provide some guidance for other communities as they begin the process of developing and analyzing their own disaster proto-

cols. Communities must be prepared and the only way to do so is to begin preparing before a disaster occurs.

However, a structure has to be developed in order to determine a community's criteria, provide oversight, and develop procedures for appealing and revising criteria and policies. Above and beyond implementing systems to deliver services to traditionally vulnerable and underserved populations, it would be difficult to ration resources in absolute shortage, including ventilators [8,15].

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