Public Attitudes Toward Allocating Scarce Resources During the COVID-19 Pandemic*

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All materials and data are available on Open Science Framework: <https://osf.io/cdtm6/>.

Abstract

The general public is subject to triage policies that allocate scarce lifesaving resources during the COVID-19 pandemic, one of the worst public health emergencies in the past 100 years. However, public attitudes toward ethical principles underlying triage policies used during this pandemic are not well understood. Three experiments (preregistered; online samples; N = 1,868; U.S. residents) assessed attitudes toward ethical principles underlying triage policies. The experiments evaluated assessments of utilitarian, egalitarian, prioritarian, and social usefulness principles in conditions arising during the COVID-19 pandemic, involving resource scarcity, resource reallocation, and bias in resource allocation toward at-risk groups, such as the elderly or people of color. We found that participants agreed with utilitarian and prioritarian principles for allocating scarce resources during initial allocation and disagreed with egalitarian and social usefulness principles. However, support for these principles did not extend to resource reallocation between existing patients. Lastly, participants did not agree with utilitarian principles when they disadvantaged at-risk groups, such as people of color and people with disabilities. Abandoning utilitarian principles that disadvantaged people of color in favor of equitable allocation resulted in significantly more agreement with triage policy. Understanding these attitudes can contribute to developing triage policies, increase trust in health systems, and assist them in achieving their goals of patient care during the COVID-19 pandemic.

Keywords: bioethics; health policy; judgment; decision-making; utilitarianism; triage; COVID-19

1. Introduction

Public health emergencies can place a significant burden on health systems [1-4]. Patients needing lifesaving treatment may quickly outpace a hospital's resource capacity. When this happens, decisions about how to allocate scarce resources must be made. Triage policies provide guidance in these circumstances [5]. They outline specific rules for distributing scarce resources, such as ventilators, ICU beds, and other lifesaving treatments among patients in need.

Triage policies are supported by different, and sometimes competing, ethical principles. Most appeal to the utilitarian principle to maximize benefits [6-8], which directs health systems to save the most lives by allocating scarce resources to patients with the greatest chances of surviving treatment with a reasonable life expectancy. Other approaches are founded on different ethical principles, such as egalitarianism, prioritarianism, or social usefulness [9]. Egalitarianism gives all patients an equal chance at receiving scarce resources through a random lottery or a first-come-first-served approach. Prioritarianism allocates resources to the most medically vulnerable patients first, or those that are worst-off. Allocating resources according to social usefulness considers which patients have the greatest instrumental value to society (see [9] for extensive review).

These ethical principles remain matters of practical and philosophical debate [9-13]. Although most triage policies are based on the utilitarian principle to maximize benefits, this approach can also reveal latent attitudes regarding which lives are worth saving [14]. If certain patient groups have a lower chance of surviving treatment, due to pre-existing comorbidities, biological age, or disability, they may receive less priority than

others for lifesaving resources [10, 11, 15-17]. This raises concerns about the fairness of allocation and public trust in health care institutions.

Concerns about fairness and trust highlight the need for public involvement in developing and evaluating triage policy. Triage policies can be enhanced by consulting the communities impacted by them [18]. Failure to address public concern through “closed door” policy development could sow distrust and negatively affect patient care. This worry is pronounced in the COVID-19 pandemic, as black Americans are dying at three times the rate of white people [17] and mortality in long-term care facilities is also disproportionately high [19, 20].

Prior to COVID-19, some research groups have studied public reaction to triage policies through survey studies and community engagement [21-25]. While these efforts provide valuable insight into public opinion, further study in the current pandemic could provide vital information for health systems. First, there is a palpable worry that, as physical distancing eases, COVID-19 caseloads might increase and lifesaving resources may again become scarce. Second, there has been international discussion on the ethics of withdrawing ventilators or other scarce resources from patients with poor prognoses to reallocate them to others with better chances of survival [26], but this practice remains controversial. Lastly, there has been public outcry over racial disparities in mortality in the United States and abroad, highlighting the need for substantive changes to health care policy [14]. Attitudes toward ethical principles underlying triage policies in these circumstances are not well understood.

The present studies seek to understand how laypeople evaluate allocation principles, with focus on emerging triage dilemmas posed by the COVID-19 pandemic.

Our specific research questions are as follows. First, what effect does scarcity during the pandemic have on lay evaluations of utilitarian, prioritarian, egalitarian, or social usefulness principles (Experiment 1)? Second, does the same pattern of judgments made about allocation principles involving new patients extend to reallocating resources between existing patients (Experiment 2)? And third, does the public support a utilitarian allocation principle even if it disadvantages members of at-risk groups, such as people with disabilities or people of color (Experiment 3)?

2. General Methods

We conducted three preregistered experiments, involving a total of 1,868 U.S. residents, between April and May 2020, when the COVID-19 death toll in the United States exceeded 100,000. All participants were adult residents of the United States. Participants were recruited and tested using online platforms, Mechanical Turk (<https://www.mturk.com>) and Qualtrics (<https://www.qualtrics.com>). All experiments were approved by the University of Manchester University Research Ethics Committee (UREC #9628).

All data and materials for each experiment are available through the Open Science Foundation (<https://osf.io/cdtm6/>). No previous literature provided guidance on target recruitment for power analysis. Consistent with past survey studies, target recruitment was set at approximately 75 participants per condition within the experiments (or 600 per experiment), with sufficient additional participants as a precaution against attrition.

Each experiment was designed to address one of the three research questions above. To answer these questions, experiments contained scenarios and manipulations derived from literature review, expert knowledge, and emerging triage dilemmas posed by the

COVID-19 pandemic. These dilemmas involved allocation in conditions of scarcity, the forcible withdrawal of resources from patients with poor prognoses to give to others with better prognoses, and the treatment of at-risk populations with pre-existing comorbidities. Attitudes were evaluated using a combined measure of agreement with hospital triage policies as well as the behavioral intentions of participants regarding which hospital they would choose in these circumstances to receive lifesaving treatment.

3. Experiment 1

Experiment 1 tested the effect of resource scarcity on layperson attitudes toward principles of resource allocation.

3.1. Methods

Six hundred and twenty-two people participated in the study. Their mean age was 37 years (range = 18-77, SD = 12), 36% were female, and 95% reported native competence in English (see supplemental materials for complete demographic details). Participants were randomly assigned to one of 8 conditions in a 2 (Resources: plentiful, scarce) $\times$ 4 (Principle: order, serious, lives, importance) experimental design. Participants first read a single brief scenario, then responded to two comprehension check questions and two test statements. In each scenario, a hospital adopts a new triage policy for distributing lifesaving resources during a pandemic. The pandemic is described as fast moving and the disease potentially life threatening without adequate medical care. Each triage policy reflects one of the four ethical principles outlined above: prioritarianism (serious), utilitarian (lives), egalitarianism (order), social usefulness (important). Participants were randomly assigned a condition featuring one of four principles (see table 1). After reading about a principle,

participants were further assigned to conditions in which lifesaving resources were either plentiful or scarce. Specifically, they were told that either “there are many more [lifesaving resources available than there are patients/patients than there are lifesaving resources available]” and that because of this “[no/many] patients will go without lifesaving treatment who need them.”

Table 1. Experiment 1. Manipulation of Principle. Participants were told that a hospital triage team has decided on a new policy for allocating resources, according to one of the four principles.

Condition	Principle
Serious	According to this policy, patients will receive lifesaving resources in the order of the seriousness of illness, with those who are the worst off being prioritized.
Lives	According to this policy, patients will receive lifesaving resources in the order that saves the most lives, with those having the best chances of recovery being prioritized.
Order	According to this policy, patients will receive lifesaving resources in the order in which they arrive, with those arriving to the hospital first being prioritized.
Important	According to this policy, patients will receive lifesaving resources in the order of their importance, with those standing to contribute the most to society being prioritized.

Beneath the scenario, on the same page, participants responded to four statements (order fixed):

1. There are enough lifesaving resources for every patient who needs them.
(comprehension 1)
2. Lifesaving resources are allocated to patients based on _____.
(comprehension 2)
3. The allocation policy the triage team decided on is a good one. (policy; test 1)
4. I would choose this hospital over others if I or someone I loved needed lifesaving treatment. (hospital; test 2)

Comprehension 1 assessed whether the resource manipulation was effective (i.e. that participants recognize whether resources were plentiful or scarce). Responses were collected by dichotomous yes/no answer randomly rotated. Comprehension 2 assessed whether the principle manipulation was effective (i.e. that participants recognize a specific principle was implemented). Responses were collected by a sentence completion task with the four randomly rotated options, “the order in which they arrive”, “the seriousness of illness”, “what saves the most lives”, or “how important the patient is to society”. Participants then responded to two test questions, policy and the hospital, using a standard 7-point Likert scale, 1 (“strongly disagree”) - 7 (“strongly agree”), arranged left-to-right on the participant’s screen. These items evaluated allocation principles on two dimensions: judgments concerning the policy itself and resulting behavioral intentions, such as choosing which hospital to visit in a public health emergency.

3.2. Results

Our research question was to determine which allocation principles are viewed favorably or unfavorably when affected by resource scarcity. To answer this question, we first excluded those participants who did not pass both comprehension checks (see preregistration). One hundred and eighty-two participants were removed for not answering the comprehension checks correctly, leaving a total sample of four hundred and forty participants. We examined the relationship between responses to our two dependent variables, policy and hospital, using a Spearman-Brown prediction formula. The Spearman-Brown test coefficient was .886. We averaged these variables into a single combined measure for analysis. Multiple linear regression was conducted with the combined measure as response and with resources, principle, an interaction of resources and principle, self-reported biological sex, and participant age as predictors.

There were statistically significant effects for resources, principle, and their interaction (see table 2 and fig 1). Resources was a significant predictor of responses, with lower scores in scarce as compared to plentiful conditions ($\beta = -0.62$). Principle also predicted responses with lower scores associated with order ($\beta = -0.67$) and important ($\beta = -2.38$) as compared to serious conditions. The differential impact of resources on the order condition was associated with lower scores as compared to the serious condition ($\beta = -0.96$). Sex and age were not significant predictors.

Table 2. Experiment 1: Multiple linear regression predicting the combined measure.

Predictors	Beta	CI	p
(Intercept)	5.71	5.14 6.29	<. 001
Resources	-0.62	-1.14 -0.11	.017
Principle			
Lives	-0.39	-0.92 0.13	.139

Order	-0.67	-1.19 -0.16	.011
Important	-2.38	-2.91 -1.85	< .001
Sex	0.21	-0.05 0.47	.117
Age	< 0.00	-0.01 0.01	.630
Resources*Lives	-0.16	-0.89 0.57	.666
Resources*Order	-0.96	-1.67 -0.25	.008
Resources*Important	-0.51	-1.23 0.21	.162

N = 440, $R^2 = 0.4265$, Adjusted $R^2 = 0.4145$. Reference class for Resources is Plentiful; reference class for Principle is Serious; reference class for Sex is Female.

Figure 1. Experiment 1. Mean response for each allocation principle grouped by level of resources. Scales ran 1 (SD) – 7 (SA). Dots overlay distributions and show means with 2 SEM.

Follow-up pairwise comparisons show significant differences in responses between plentiful and scarce conditions across all allocation principles (see table 3).

Table 3. Experiment 1. Independent sample t-tests.

	Plentiful		Scarce							
	M	SD	M	SD	t	df	p	MD	95% CI	d
Serious	5.73	1.05	5.10	0.99	3.21	105	.002	0.63	0.24 1.02	0.62
Lives	5.36	1.10	4.59	1.03	3.65	103	< .001	0.76	0.35 1.18	0.72
Order	5.08	1.61	3.50	1.63	5.29	116	< .001	1.58	0.99 2.17	0.97
Important	3.38	1.73	2.23	1.31	3.97	108	< .001	1.15	0.58 1.73	0.76

Follow-up one sample t-tests showed that when resources were plentiful, responses were significantly above the neutral midpoint of 4 in the order, serious, and lives conditions, and significantly below the midpoint in the important condition (see table 4).

Table 4. Experiment 1. One sample t-tests.

	t	df	p	MD	95% CI	d
Plentiful						
Serious	11.64	49	< .001	1.73	1.43 2.03	1.65
Lives	8.86	51	< .001	1.36	1.05 1.66	1.1
Order	4.98	54	< .001	1.08	0.65 1.52	0.67
Important	-2.55	50	.014	-0.62	-1.1 -0.13	-0.36
Scarce						
Serious	8.38	56	< .001	1.10	0.83 1.36	1.11
Lives	4.19	52	< .001	0.59	0.31 0.88	0.58
Order	-2.44	62	.018	-0.50	-0.91 -0.09	-0.31
Important	-10.38	58	< .001	-1.77	-2.11 -1.43	-1.35

When resources were scarce, responses are significantly above the midpoint in the serious and lives conditions, and significantly below the midpoint in the order and important conditions. Lastly, when resources were scarce, agreement was strongest in the serious condition. These preferences were significantly greater than those for the lives ($t(108) = 2.61$, $p = .01$, $d = 0.50$), order ($t(118) = 6.41$, $p < .001$, $d = 1.17$), and important ($t(114) = 13.27$, $p < .001$, $d = 2.42$) conditions.

An exploratory analysis was conducted to determine the influence of demographic and personal factors on responses. We conducted a multiple regression analysis with the combined measure as the dependent variable that included resources, principle, an interaction of resources and principle, race, sex, age, highest level of education completed, religiosity, politics (two measures, social and economic), and hospital experience (two measures, being admitted to hospital any time in the last five years, and either working or studying as a health care professional) as predictors. Of these factors, there was weak evidence that politics predicted participant responses. On a 1 (extremely conservative) – 7 (extremely liberal) scale, indicating economic liberalism (e.g. “How economically conservative or liberal are you?”) was associated with higher scores on the combined measure ($\beta = .11$, $t(421) = 1.90$, $p = .058$). However, indicating social liberalism (e.g. “How socially conservative or liberal are you?”) was significantly associated with lower scores ($\beta = -.15$, $t(421) = -2.34$, $p = .02$). General level of education predicted responses, with higher levels of education significantly associated with higher scores ($\beta = .12$, $t(421) = 2.22$, $p = .03$). Lastly, there was weak evidence for an association with participant sex, with higher scores by men ($\beta = .25$, $t(421) = 1.87$, $p = .062$). No significant effects were observed with other demographic or personal factors included. These effects are exploratory, have not been adjusted for multiple comparisons, and are only included here to guide future research.

3.3. Discussion

This experiment examined the effect of resource scarcity on evaluations of allocation principles. We found that when resources were scarce, participants gave lower scores to all

principles. However, the degree to which resource scarcity impacted responses depended on the allocation principle. Scarcity had the largest negative effect on responses in the order condition ($d = 0.97$) and smallest in serious condition ($d = 0.62$). Participants generally agreed with utilitarian and prioritarian allocation principles and disagreed with egalitarian and social usefulness principles. When resources were scarce, however, participants preferred allocating based on the seriousness of patients' conditions as compared to all other principles ($d = 0.5$ to 2.4).

4. Experiment 2

Experiment 2 tested the effect of reallocating lifesaving resources between existing patients on layperson attitudes toward principles of resource allocation.

4.1. Methods

Six hundred and seven people participated in the study. Their mean age was 38 years (range = 18-77, $SD = 13$), 45% were female, and 93% reported native competence in English (see supplemental materials for complete demographic details). Participants were randomly assigned to one of 8 conditions in a 2 (Stage: allocation, reallocation) $\times$ 4 (Principle: serious, lives, order, important) experimental design. Participants read a single scenario and answered questions similar to those used in Experiment 1. In each scenario, a hospital adopts a new triage policy when resources are scarce. Participants were randomly assigned to conditions in which the policy involved allocating scarce resources to new patients or reallocating scarce resources between existing patients (i.e. taking from one to give to another). Participants were then asked to consider one of four allocation principles. The

new patient cases were identical to the scarcity conditions used in Experiment 1. Reallocation condition manipulations are shown in Table 5.

Table 5. Experiment 2. Manipulation of Principles in Relocation Conditions.

Condition	Principle
Serious	According to this policy, lifesaving resources will be taken from one patient and given to another patient depending on the seriousness of illness, with those who are the worst off receiving priority.
Lives	According to this policy, lifesaving resources will be taken from one patient and given to another patient depending on what saves the most lives, with those having the best chances of recovery receiving priority.
Order	According to this policy, lifesaving resources will never be taken from one patient and given to another patient for any reason aside from the patient recovering or expiring.
Important	According to this policy, lifesaving resources will be taken from one patient and given to another patient depending on their importance, with those standing to contribute the most to society receiving priority.

Participants were told that a hospital has decided on a new policy for reallocating resources between existing patients, according to one of four allocation principles. Beneath the scenario, on the same page, participants responded to similar comprehension and test items used in Experiment 1:

1. There are enough lifesaving resources for every patient who needs them.
(comprehension 1)
2. Lifesaving resources are allocated to new patients based on _____.
(comprehension 2, allocation conditions only)
3. Lifesaving resources are reallocated between existing patients based on _____. (comprehension 2, reallocation conditions only)
4. The policy the triage team decided on is a good one. (policy; test 1)
5. I would choose this hospital over others if I or someone I loved needed lifesaving treatment. (hospital; test 2)

Response options were the same as those used in Experiment 1, with the exception of the second comprehension check in reallocation conditions, which were “the patient recovering or expiring”, “the seriousness of illness”, “what saves the most lives”, and “how important the patient is to society”.

4.2. Results

Our research question was to determine which allocation principles are viewed favorably or unfavorably when reallocating resources between existing patients. To answer this question, we first excluded participants who did not pass both comprehension checks (see preregistration). One hundred and twenty-one participants were removed, leaving a total sample of four hundred and eighty-six participants. We examined the relationship between responses to our two dependent variables, policy and hospital, using a Spearman-Brown prediction formula. The Spearman-Brown test coefficient was .856. We averaged these variables into a single combined measure for analysis. Multiple linear regression was

conducted with the combined measure as the dependent variable and with allocation stage, principle, an interaction of stage and principle, self-reported biological sex, and age as predictors.

There were significant effects for allocation stage, principle, and their interaction (see fig 2 and table 6). Stage was a significant predictor of responses, with lower scores for reallocation as compared to allocation ($\beta = -0.61$). Principle also predicted responses with lower scores associated with order ($\beta = -1.14$) and important conditions ($\beta = -2.01$) as compared to the serious condition. The differential impact of stage on the order condition was associated with higher scores as compared to the serious condition ($\beta = 1.60$). There was weak evidence for an effect of sex, whereby mean response was higher for males ($M = 3.83$, $SD = 1.63$) than for females ($M = 3.70$, $SD = 1.65$), though this did not reach the traditional threshold for statistical significance ($p = .056$).

Table 6. Experiment 2: Multiple linear regression predicting the combined measure.

Predictors	Beta	CI	p
(Intercept)	4.63	4.06 5.20	< .001
Stage	-0.61	-1.11 -0.11	.017
Principle			
Lives	-0.10	-0.61 0.41	.703
Order	-1.14	-1.64 -0.65	< .001
Important	-2.01	-2.52 -1.50	< .001
Sex	0.25	-0.01 0.51	.056
Age	< 0.00	-0.01 0.01	.666
Stage*Lives	-0.10	-0.83 0.64	.793
Stage*Order	1.60	0.89 2.30	< .001
Stage*Important	0.23	-0.48 0.94	.530

N= 484, $R^2 = 0.269$, Adjusted $R^2 = 0.256$. Reference class for Stage is Allocation; reference class for Principle is Serious; reference class for Sex is Female. Two participants were not included in the model because they chose not to disclose their gender or age.

Figure 2. Experiment 2. Mean response for each allocation principle grouped by stage of allocation. Scales ran 1 (SD) – 7 (SA). Dots overlay distributions and show means with 2 SEM.

Follow-up independent samples t-tests further revealed that the stage/principle interaction occurred because mean agreement was significantly lower in reallocation than initial allocation for the serious and lives conditions but was significantly higher for the order condition (see table 7).

Table 7. Experiment 2. Independent sample t-tests.

	Allocate		Reallocate		t	df	p	MD	95% CI	d
	M	SD	M	SD						
Serious	4.70	1.36	4.05	1.34	2.68	124	.008	0.65	0.17 1.12	0.48
Lives	4.58	1.19	3.86	1.37	2.92	107	.004	0.72	0.23 1.20	0.56

Order	3.53	1.56	4.54	1.64	-3.56	125	< .001	-1.01	-1.57	-0.45	-0.63
Important	2.69	1.51	2.32	1.27	1.45	122	.149	0.36	-0.13	0.86	0.27

Follow-up one sample t-test showed that, at the initial allocation stage, responses were significantly above the neutral midpoint of 4 in the serious and lives conditions, and significantly below the midpoint for the order and important conditions (see table 8). At the reallocation stage however, responses were only significantly above the midpoint in the order condition.

Table 8. Experiment 2. One sample t-tests.

	t	df	p	MD	95% CI	d
Allocate						
Serious	4.08	63	< .001	0.70	0.35 1.04	-0.51
Lives	3.73	58	< .001	0.58	0.27 0.89	-0.49
Order	-2.43	64	.018	-0.47	-0.86 -0.08	0.3
Important	-6.66	58	< .001	-1.31	-1.71 -0.92	0.87
Reallocate						
Serious	0.28	61	.777	0.05	-0.29 0.39	-0.04
Lives	-0.72	49	.473	-0.14	-0.53 0.25	0.10
Order	2.59	61	.012	0.54	0.12 0.96	-0.33
Important	-10.65	64	<.001	-1.68	-1.99 -1.36	1.32

At the reallocation stage, agreement was strongest in the order condition, and this was significantly greater than the lives ($t(110) = 2.35$, $p = .021$, $d = 0.45$) and important ($t(125) = 8.54$, $p < .001$, $d = 1.51$) conditions. This effect did not pass the conventional threshold for statistical significance in the serious condition ($t(122) = 1.83$, $p = .07$, $d = 0.33$).

An exploratory analysis was conducted to determine the influence of demographic and personal factors on responses. A multiple regression analysis was conducted with the combined measure as the dependent variable that included stage, principle, an interaction

of stage and principle, race, sex, age, highest level of education completed, religiosity, social liberalism, economic liberalism, hospital experience, and hospital training as predictors. Political attitudes predicted responses, where social liberalism (e.g. “How socially conservative or liberal are you?”) was associated with higher scores on the combined measure ($\beta = -.16$, $t(466) = -2.55$, $p = .011$). Sex also predicted responses, with higher scores associated with men ($\beta = .26$, $t(466) = 1.98$, $p = .048$). Hospital training (e.g. “Have you ever worked or studied as a health professional (e.g. nurse, doctor, therapist, etc)?”) was also associated with higher scores ($\beta = .42$, $t(466) = 2.44$, $p = .015$). No effects were observed with other demographic or personal factors included. These effects are exploratory, have not been adjusted for multiple comparisons, and are only included here to guide future research.

4.3. *Discussion*

This experiment examined the effect that allocation stage (initial allocation versus reallocation) has on attitudes toward allocation principles. We found that the only evaluation positively affected by advancing the allocation stage was order. Participants disagreed that resources should be initially allocated to new patients based on order; resources should instead be allocated according to prioritarian or utilitarian principles. At the reallocation stage, however, participants did not agree that resources should be taken from one patient and given to another, with the exception being the recovery or death of a patient who initially received resources.

5. Experiment 3

Experiment 3 tested the effect of disadvantage for at-risk patient groups on layperson attitudes toward a utilitarian allocation principle.

5.1. *Method*

Six hundred and thirty-nine people participated in the study. Their mean age was 39 years (range = 18-89, SD = 13), 38.5% were female, and 94.2% reported native competence in English (see supplemental materials for complete demographic details). Participants were randomly assigned to one of 8 conditions in a 2 (Principle: utilitarian, equitable) $\times$ 4 (Group: race, disability, elderly, addiction) experimental design. Participants read a scenario and answered questions similar to those used in Experiments 1 and 2. In each scenario, a hospital adopts a triage policy that allocates scarce lifesaving resources to those with the best chances of recovery, consistent with the utilitarian principle to save the most lives. The triage team then discovers that this policy disadvantages members of certain groups. Specifically, they discover that because members of these groups have a lower chance of recovery than others, they end up receiving less priority for lifesaving resources. Participants were randomly assigned to conditions varying the group that was affected (e.g. people of color, people with disabilities, the elderly, or people with substance use disorders). Participants were also randomly assigned to conditions manipulating the way that the triage team reacts to this discovery that allocation is biased. In one condition, the team reaffirms the utilitarian principle that perpetuates the biased outcome. In the other condition, the team adopts an equitable policy that eliminates the biased outcome. Below are examples taken from the race utilitarian condition and the elderly equitable condition:

Race utilitarian condition. The triage team discovers that due to prior risk factors, people of color have a lower chance of recovering from the infection and are thus not receiving the same priority as others for lifesaving resources. The triage team commissions a study into the causes of prior risk factors. But they do not change their policy so that people of color receive the same priority as others. As a result of this, fewer people of color will recover from the infection but more people will recover in total.

Elderly equitable condition. The triage team discovers that due to prior risk factors, elderly people have a lower chance of recovering from the infection and are thus not receiving the same priority as others for lifesaving resources. The triage team commissions a study into the causes of prior risk factors. And they also change their policy so that elderly people receive the same priority as others. As a result of this, more elderly people will recover from the infection but fewer people will recover in total.

Beneath the scenario, on the same page, participants responded to the following items:

1. The triage team changed their policy regarding lifesaving resources.
(comprehension 1)
2. The policy the triage team decided on is a good one. (test 1)
3. I would choose this hospital over others if I or someone I loved needed lifesaving treatment. (test 2)

Responses to the comprehension check were collected by a dichotomous yes/no answer. Items two and three were evaluated with Likert scales identical to those used in Experiments 1 and 2.

5.2. Results

Our research question was to determine how participants evaluated a utilitarian allocation principle when it disadvantaged at-risk patient groups. To answer this question, we first excluded those participants who did not pass the comprehension check (see preregistration). One hundred and fifteen participants were removed for not answering this correctly, leaving a total sample of five hundred and twenty-four participants. We examined the relationship between responses to our two dependent variables, policy and hospital, using a Spearman-Brown prediction formula. The Spearman-Brown test coefficient was .885. We averaged these variables into a single combined measure for analysis. Multiple linear regression was conducted with the combined measure as the dependent variable and with allocation principle, patient group, an interaction of principle and group, self-reported biological sex, and age as predictors.

There was a significant effect for allocation principle, patient group, and their interaction (see fig 3 and table 9). Principle was a significant predictor of responses, with greater scores when the hospital policy switched to equitable allocation as compared to upholding utilitarian allocation and allowing bias to continue ($\beta = 1.02$). Patient group also predicted responses with higher scores associated with elderly ($\beta = .60$) and addiction ($\beta = .86$) conditions compared to the race condition. The differential impact of principle on the elderly ($\beta = -.82$) and addiction ($\beta = -1.39$) conditions was associated with lower responses as compared to the race condition.

Table 9. Experiment 3: Multiple linear regression predicting the combined measure.

Predictors	Beta	CI	p
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(Intercept)	3.62	2.97 4.28	< .001
Principle	1.02	0.47 1.57	< .001
Group			
Disability	0.31	-0.26 0.88	.285
Elderly	0.60	0.01 1.18	.045
Addiction	0.86	0.29 1.44	.003
Sex	< 0.01	-0.29 0.28	.997
Age	0.01	-0.00 0.02	.230
Principle*Disability	-0.57	-1.35 0.21	.151
Principle*Elderly	-0.82	-1.61 -0.03	.041
Principle*Addiction	-1.39	-2.17 -0.60	.001

N= 524, $R^2 = 0.038$, Adjusted $R^2 = 0.021$. Reference class for Principle is Utilitarian; reference class for Group is Race; reference class for Sex is Female.

Figure 3. Experiment 3. Mean response for each group grouped by principle. Scales ran 1 (SD) – 7 (SA). Dots overlay distributions and show means with 2 SEM.

Follow-up independent samples t-tests revealed that the principle/group interaction occurred because adopting equitable triage policy did not significantly impact mean response between disability, elderly, or addiction conditions, but it did impact responses between race conditions ($t(129) = -3.429$, $p = .001$, $d = .06$) (see table 10).

Table 10. Experiment 3. Independent sample t-tests.

	Utilitarian		Equitable		t	df	p	MD	95% CI		d
	M	SD	M	SD							
Race	3.90	1.81	4.91	1.56	-3.429	129	.001	-1.01	-1.59	-0.43	-0.60
Disability	4.20	1.77	4.66	1.60	-1.605	133	.111	-0.47	-1.04	0.11	-0.28
Elderly	4.48	1.43	4.68	1.51	-0.744	126	.458	-0.20	-0.72	0.33	-0.13
Addiction	4.74	1.43	4.39	1.67	1.275	128	.205	0.35	-0.19	0.90	0.22

Follow-up one sample t-test show that when a hospital adhered to utilitarian allocation, responses were significantly above the neutral midpoint of 4 in elderly and addiction conditions (see table 11). When the hospital adopted equitable allocation, however, responses were significantly above the midpoint for all conditions except for addiction.

Table 11. Experiment 3. One sample t-tests.

	t	df	p	MD	95% CI		d
Utilitarian							
Race	-0.42	61	.676	-0.10	-0.56	0.36	0.05
Disability	0.87	60	.389	0.20	-0.26	0.65	-0.11
Elderly	2.50	54	.016	0.48	0.10	0.87	-0.34
Addiction	3.95	57	<.001	0.74	0.37	1.12	-0.52
Equitable							
Race	4.87	68	<.001	0.91	0.54	1.29	-0.59
Disability	3.57	73	.001	0.66	0.29	1.03	-0.41
Elderly	3.84	72	<.001	0.68	0.33	1.03	-0.45
Addiction	1.98	71	.052	0.39	-0.003	0.78	-0.23

An exploratory analysis was conducted to determine the influence of demographic and personal factors on responses. We conducted a multiple regression analysis with the combined measure as the dependent variable that included principle, group, an interaction of principle and group, race, sex, age, highest level of education completed, religiosity, social liberalism, economic liberalism, hospital experience, and hospital training as

predictors. Religiosity predicted responses, where higher response (“I consider myself a religious person”) was associated with higher scores on the combined measure ($\beta = .14$, $t(506) = 4.36$, $p < .001$). Hospital experience (e.g. “Have you been admitted to the hospital any time in the last 5 years?”) was also associated with higher scores ($\beta = .33$, $t(506) = 2.18$, $p = .03$). There was weak evidence for an effect of general level of education, with higher levels of education associated with higher scores ($\beta = .11$, $t(506) = 1.72$, $p = .0857$). No effects were observed with other demographic or personal factors included. These effects are exploratory, have not been adjusted for multiple comparisons, and are only included here to guide future research.

5.3. *Discussion*

This experiment examined how participants evaluated utilitarian resource allocation when it disadvantages at-risk patient groups. We found that participants’ attitudes depended on the patient group affected. Participants significantly approved of a utilitarian allocation principle even if it disadvantaged the elderly and those with substance use disorders. When it disadvantaged people of color or people with disabilities, participants neither significantly agreed nor disagreed. However, abandoning utilitarian allocation that disadvantaged people of color significantly increased evaluations ($d = 0.60$). Lastly, we found that participants negatively evaluated equitable resource allocation when it advantaged patients with substance use disorders, though this trend was not statistically significant.

6. General Discussion

This study investigated public attitudes of U.S. residents toward ethical principles for allocating scarce resources in the COVID-19 pandemic. Participants generally agreed with principles favoring resource allocation to patients with the best chances of surviving treatment when resources were scarce, but they also strongly agreed with prioritarian allocation. Additionally, participants did not agree with utilitarian allocation when reallocating scarce resources between existing patients. Although participants generally agreed with utilitarian allocation at initial distribution of resources, they favored giving priority to those patients who received the resources first during reallocation. Across experiments, participants strongly disagreed with allocation based on social usefulness. Lastly, participants were ambivalent toward utilitarian allocation if people of color and people with disabilities were disadvantaged. However, participants approved of utilitarian allocation, even if it disadvantaged elderly or people with substance use disorders. Rejecting utilitarian allocation that disadvantaged people of color for equitable allocation significantly improved participant judgments.

These findings provide preliminary insight into public attitudes toward the ethical principles of COVID-19 triage. Utilitarian allocation serves as a backbone for many—if not most—current triage policies, but the present findings reveal several contexts in which the public is likely to disagree with this approach. Optimizing triage policies to acknowledge these attitudes may improve public trust in health systems as the COVID-19 pandemic unfolds.

Although participant attitudes were complex and multifaceted, we found less support for utilitarian allocation than previous studies [21, 27]. Using survey designs

featuring non-clinical “life-boat dilemmas” [28], researchers have found that laypeople favor saving many lives over saving one drowning victim [27]. These researchers also found similar results using clinical scenarios. When allocating scarce resources between two critically ill newborns, most participants choose to allocate to the infant with the best chances of survival.

These findings are partially consistent with prior research on public attitudes toward resource allocation in public health emergencies. Daugherty Biddison and colleagues conducted a series of stakeholder engagement activities designed to cultivate deliberative democracy on triage policies [21]. They found that, in Howard County, Maryland, 83% of participants said utilitarian allocation is “always or often” acceptable, whereas only 33% of participants from East Baltimore, an area with many traditionally black communities, agreed.

Researchers have also found support for utilitarian allocation among health care professionals [22]. Utilizing a modified Delphi procedure [see 29], Christian and colleagues found that experts agreed that patients should be excluded from receipt of scarce resources in public health emergencies if they “have such a low probability of survival that significant benefit is unlikely” [30]. This coheres with several other expert recommendation documents published by national medical organizations [7, 31-33].

There are several reasons why we may have detected lower approval of utilitarian allocation relative to previous studies. First, the present study was conducted in the midst of the COVID-19 pandemic, one of the worst and enduring public health emergencies in the past 100 years. Previous survey research was conducted during outbreaks of MERS-

Coronavirus, Ebola, and Avian Flu, but these emergencies lacked the pointed and concrete threat to resource allocation as presented by COVID-19.

Second, the present results show the strongest opposition to utilitarian allocation in cases involving reallocation and disadvantage, which were not the focus of prior studies [though see 23 for concern over withdrawing ventilators]. Indeed, these issues have been at the forefront of media, scholarly, and government reports in the current pandemic. In the United States, people of color have increased COVID-19 mortality due to prevalent comorbidities, such as diabetes or hypertension, which often result from unjust structural inequalities in social determinants of health [34]. Moral intuitions to mitigate or redress this injustice may underly anti-utilitarian attitudes.

Third, the present results might also vary based on background and demography of participants in ways that we did not detect. In contrast, some previous research has examined attitudes germane to geographically, racially, and socioeconomically defined communities, finding significant differences in attitudes between groups. In at least one study, participants from white socioeconomically advantaged communities strongly favored utilitarian principles, whereas participants from historically marginalized communities did not [21].

Fourth, different results may obtain when broadening allocation cases to consider conflicting values and principles. Subsequent research by Huang and colleagues, examining allocation of scarce ventilators during the COVID-19 pandemic, also found less support for utilitarian allocation[35]. When forced to choose between a 25-year-old or 65-year-old patient, participants allocated ventilators at chance rates. It was only after an intervention to prime utilitarian thinking that participants were inclined to allocate scarce

lifesaving resources to younger patients at greater than chance rates. This study is notable as it suggests at least some initial resistance to utilitarian allocation could be reduced through education materials.

Additionally, endorsement of utilitarian allocation appears to wane significantly with advancing stages of resource distribution. Although participants endorse prioritarian and utilitarian principles during initial allocation, egalitarianism is preferred in the dilemma of forcibly withdrawing resources from one patient to give to another. This effect may be due to intuitions that forcible withdrawal is tantamount to killing. Experts argue that, in a pandemic, forcible withdrawal is justified because it is not theoretically different than withholding resources [12, 36]. But even if this is true in theory, the public may disagree in practice [37]. Indeed, recent work on clinician and layperson attitudes toward notions of “killing” and “letting die” demonstrates that the distinction rests on foundational moral and causal judgments in social cognition [38]. Specifically, researchers found that, if a patient wants to die during withdrawal of care, the cause of death is associated with illness. But if the patient does not want to die, the cause of death is associated with clinicians’ behavior. To extent these processes pertain to reallocation judgments, it suggests that there will be deep resistance to forced reallocation.

Lastly, compared to previous work, our findings suggest that public support for utilitarian allocation that result in bias varies with regard to which group is disadvantaged. Approval of utilitarian allocation that is biased against the elderly may be due to intuitions about the number of “life-cycles” a patient has experienced. Studies by Daugherty Biddison and colleagues [21] and Huang and colleagues [35] show that laypeople will allocate resources to younger patients in certain conditions, potentially reflecting the belief that

quantity of life-years saved is just as or more important as the quantity of lives saved. Additionally, approval of utilitarian allocation that is biased against people with substance use disorders might be due to latent negative stigmas toward drug use and addiction. One possibility is that laypeople perceive this behavior as a choice, whereas race and disability are not, which leads them to tolerate some inequities generated by utilitarian-based triage policies over others.

7. Limitations

This study has several limitations. First, participants were recruited using Mechanical Turk, which has strengths and weakness relative to non-web-based sampling and should be replicated in other samples before drawing strong conclusions [39, 40].

Second, while we investigated several principles of resource allocation, we only focused on a small number of instantiations and interpretations. Future work might reveal different, perhaps favorable, attitudes toward utilitarian allocation when instantiated in other ways, such as policies that explicitly maximize the number of life-years saved.

Third, our study did not explore the degree to which evaluations of different allocation principles are linked. Many scholars agree that optimal triage policies will no doubt involve a multi-principle approach [9]. For example, initial allocation of resources might follow from a utilitarian principle, but granular distinctions between patients, or “tie breakers”, might follow from social usefulness or egalitarian principles. Future work that assesses the complexity of complete triage policies, rather than distinct underlying principles, might reveal these relationships.

Fourth, while participants were recruited from a national sample, this may obscure the needs of individual communities. COVID-19 will stress communities and health systems differently throughout the pandemic. It is a matter of debate whether triage policies ought to be standardized across communities and health systems, as drawing inferences from a national sample might suggest.

8. Conclusion

This study furthers our understanding of attitudes toward ethical principles underlying triage policies during the COVID-19 pandemic. Understanding these attitudes can provide valuable insight into how health systems can better serve the public. We do not necessarily recommend that health policies be adopted solely based on public opinion. However, policies and practices that depart radically from public opinion are unlikely to be regarded as optimal or fully ethically legitimate. Triage policies can be enhanced by consulting the communities impacted by them. Engaging communities helps policymakers identify competing values, such as prioritizing the most vulnerable or ensuring racial justice in resource allocation. Moreover, no approach to triage will function well if patients categorically refuse to present to hospitals that adopt negatively viewed policies. The ability to anticipate potential resistance to triage policies can assist health systems improve public relations and communicate their rationale more effectively.

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