Judgment and Decision Making, Vol. 16, No. 1, January 2021, pp. 1-19

Veil-of-ignorance reasoning mitigates self-serving bias in resource allocation during the COVID-19 crisis

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Abstract

The COVID-19 crisis has forced healthcare professionals to make tragic decisions concerning which patients to save. Furthermore, The COVID-19 crisis has foregrounded the influence of self-serving bias in debates on how to allocate scarce resources. A utilitarian principle favors allocating scarce resources such as ventilators toward younger patients, as this is expected to save more years of life. Some view this as ageist, instead favoring age-neutral principles, such as "first come, first served". Which approach is fairer? The "veil of ignorance" is a moral reasoning device designed to promote impartial decision-making by reducing decision-makers' use of potentially biasing information about who will benefit most or least from the available options. Veil-of-ignorance reasoning was originally applied by philosophers and economists to foundational questions concerning the overall organization of society. Here we apply veil-of-ignorance reasoning to the COVID-19 ventilator dilemma, asking participants which policy they would prefer if they did not know whether they were younger or older. Two studies (pre-registered; online samples; Study 1, N=414; Study 2 replication, N=1,276) show that veil-of-ignorance reasoning shifts preferences toward saving younger patients. The effect on older participants is dramatic, reversing their opposition toward favoring the young, thereby eliminating self-serving bias. These findings provide guidance on how to remove self-serving biases to healthcare policymakers and frontline personnel charged with allocating scarce medical resources during times of crisis.

Keywords: fairness; self-serving bias; procedural justice; bioethics; COVID-19

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1 Introduction

During the initial global peak of the pandemic, hospitals worldwide were overwhelmed with COVID-19 patients suffering from acute respiratory distress. Consequently, shortages of life-saving supplies, including ventilators and intensive care units, forced medical workers to make tragic decisions concerning which patients to save (Mounk, 2020; Emanuel et al., 2020a). As of this writing, concerns about shortages of critical life-saving supplies have largely subsided in the developed world, but other essential resources, such as personnel, may remain scarce (Bernstein, 2020). Likewise, concerns remain about the availability of critical resources in the developing world (Woodyatt, 2020) and the possibility of subsequent waves of infection worldwide (Sun, 2020a). Additionally, the limited supply of a new vaccine and challenges associated with its distribution will result in difficult decisions about who to vaccinate first and who should continue to be at risk of contracting the virus (Sun, 2020b). In confronting such dilemmas — during the present and future crises — it's important to allocate scarce resources as fairly as possible. There is disagreement, however, about which moral principles are most fair.

In considering the allocation of limited life-saving interventions like ventilators, there has been considerable controversy about whether patients' age should be a factor (Goodwin & Landy, 2014). From a utilitarian perspective, it's generally better to save younger patients (and patients with greater life-expectancies more generally), as this saves more years of life. But some view this perspective as ageist and unethical. Roger Severino, the director of the Office for Civil Rights at the U.S. Department of Health and Human Services in the Trump administration, decried such policies as "ruthless utilitarianism" and announced his intention to investigate those who apply them (Fink, 2020). An example of an allocation procedure that ignores age is the common "first come, first served" principle.

The utilitarian principle aimed at saving more life-years and the "first come, first served" principle can both be seen as fair principles. But when they conflict, which should take precedence? It is well documented that individuals' views of what is fair are strongly influenced by their self-interest (Babcock & Loewenstein, 1997; Babcock, Loewenstein, Issacharoff & Camerer, 1995; Diekman, Samuels, Ross & Bazerman, 1997; Konow, 2000;

All study materials, preregistrations, raw data, and analyses code are publicly available on Open Science Framework (https://osf.io/nex9s/?view_only=63de515d891c4996b6fd557f32b98629).

This work was funded by Harvard Business School.

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Messick & Sentis, 1983; Thompson & Loewenstein, 1992; Wade-Benzoni, Tenbrunsel & Bazerman, 1996). For example, when participants from China and the U.S. were asked to make judgments about economic burdens each country should bear for reducing climate change, participants from both countries felt that the U.S. should pay more than China. However, Chinese participants reported that the U.S. should bear much more than 50% of the burden, while U.S. participants reported that the U.S. should bear only somewhat more that 50% of the burden (Kriss, Loewenstein, Wang & Weber, 2011). Such self-serving biases have been shown to influence perceptions of fairness in decisions related to environmental resource allocation (Wade-Benzoni, Tenbrunsel & Bazerman, 1996), in climate and labor negotiations (Charness & Haruvy, 2000; Kriss et al., 2011), financial audits (Moore, Tanlu & Bazerman, 2010), and in conflict resolution (Arad & Carnevale, 1994). Importantly, policy decisions are most at risk of being influenced by self-serving bias when there is no clear metric for measuring fairness, or when the costs and benefits associated with any particular decision will not be equally distributed (Wade-Benozi, Tenbrunsel & Bazerman, 1996). Given that these challenges are inherent in deciding how to allocate scarce resources to COVID-19 patients, it is possible that self-interest will influence which fairness principle individuals endorse. The real-world, life-and-death nature of these decisions elevates the stakes of the decision and requires an unbiased decision-making procedure.

The philosopher John Rawls (1971) proposed a famous thought experiment, aimed at identifying the governing principles of fairness in an unbiased way. Rawls imagined decision-makers who've been denied all knowledge of their personal circumstances. They don't know whether they, as individuals, are rich or poor, healthy or ill, or in possession of special talents or abilities. Nor do they know the social groups to which they belong, as defined by race, class, gender, etc. The decision-makers are assumed to be purely self-interested, but their decisions are constrained by the absence of information that they could use to select principles favorable to their personal circumstances. Rawls referred to this epistemically restricted state as being behind a "veil of ignorance" (for additional accounts of the veil, see Harsanyi 1955, 1975). Rawls conceived of this thought experiment as a device for helping people in the real world think more clearly and impartially about the organizing principles of society. A just social order, he argued, is one that selfish people would choose if they were constrained to choose impartially, in the absence of potentially biasing information.

Here we measure the effect of veil-of-ignorance reasoning on participants' judgments about how to fairly allocate ventilators to patients hospitalized with COVID-19. Because this study was run with American participants during a peak in the coronavirus crisis in the United States, when hospitals were facing potential ventilator shortages, it serves as a unique test of this decision-making procedure to produce impartial, unbiased judgments about an immediate, urgent, and critical real-world problem.

1.1 Prior Research on Judgments Under the Veil of Ignorance

Previously, we examined the influence of veil-of-ignorance reasoning on judgments in response to moral dilemmas (Huang, Greene & Bazerman, 2019). This experimental paradigm consists of a two-stage procedure. For participants in the veil-of-ignorance condition, in the first stage they engage in a veil-of-ignorance exercise, where they consider a veil-of-ignorance version of a moral dilemma. During this exercise, they indicate what they would want a decision-maker to do if they did not know who among those affected by the decision they would be. In the second stage, participants complete measures for the dependent variable: they respond to a standard version of the same dilemma, reporting their moral judgment regarding the proposed action. Participants in a control condition would complete these same dependent measures in the second stage only.

To illustrate our application of veil-of-ignorance reasoning in prior research, consider the well-known *footbridge* dilemma, in which one can save five people in the path of a runaway trolley by pushing a person off of a footbridge and into the trolley's path (Thomson, 1985). The utilitarian option is to push, as this maximizes the number of lives saved, but relatively few people favor the utilitarian option in this case (Greene et al., 2001). In the veil-of-ignorance (VOI) condition, we asked participants to imagine they had equal odds of being any of one of the six people affected by this dilemma, and asked them what they, from a purely self-interested perspective, would want the decision-maker to do. Would you want the decision-maker to push, giving you a 5 out of 6 chance of living? Or would you want the decision-maker to not push, giving you a 1 out 6 chance of living? After participants in the VOI condition completed this VOI reasoning exercise, we then presented them with the standard version of the footbridge dilemma. In the control condition, participants completed no reasoning exercise before responding to the standard footbridge dilemma. We found that participants in the VOI condition, compared to those who did not first receive the VOI intervention, were more likely to make the utilitarian choice in response to the standard moral dilemma. In other words, participants who first considered what they would want (self-interestedly) from behind the veil, compared to those who did not engage in any reasoning exercise beforehand, were later more likely to approve of saving more lives in the original footbridge dilemma. Across a range of dilemmas involving autonomous vehicles, charitable giving, and healthcare we found that first engaging in veil-of-ignorance reasoning shifted subsequent moral judgments toward the greater good.

Importantly, we found that these effects depended on the impartial thinking induced by veil-of-ignorance reasoning and could not be explained by other factors. To elaborate, engaging in the VOI intervention requires numerical reasoning, probabilistic reasoning, and perspective-taking, as well as taking an impartial stance, none of which participants did in the control condition. While these task features are all components of VOI reasoning that could potentially induce increased utilitarian responding, the most distinctive feature of VOI reasoning is its relation to impartiality, whereby one has an equal probability of being each person affected.

To ensure that the effects seen in our prior research were due to the impartial nature of VOI reasoning rather than other features of the VOI procedure, we ran several additional experiments in which we controlled for the effects of numerical reasoning, probabilistic reasoning, and perspective-taking on moral judgment. For example, in one such study (Huang, Greene & Bazerman, 2019, Study 5; N=735; pre-registered) participants were asked to make moral judgments about an autonomous vehicle (AV) that may be programmed to save a group of pedestrians in its path by swerving into a wall, killing the vehicle's passenger. Alternatively, the vehicle can be programmed to continue on its path, killing the pedestrians but allowing the passenger to live. In the VOI condition of this study, participants reported on what they would want the AV to do, given a 1 in 10 chance of being the passenger in the AV, and 9 in 10 chance of being one of 9 pedestrians. In the control condition, participants first completed a version of the dilemma in which the probabilities were *reversed*. That is, participants were told that they had a 9 in 10 chance of being the passenger in the AV and a 1 in 10 chance of being one of the 9 pedestrians. This reversed-control condition controlled for nearly all the component features of VOI reasoning, such as probability calculation, numerical thinking, and perspective-taking. Critically, the only difference between the reversed-control condition and the VOI condition was impartial thinking: those in the VOI condition imagined having an equal probability of being each person affected. In both conditions, after the VOI or reversed-control interventions, participants judged the moral acceptability of an AV being programmed to minimize the total loss of life (i.e., to be utilitarian), for example, saving 9 pedestrians by swerving into a wall, but killing the AV's passenger. Critically, this response to the subsequently presented standard dilemma was the dependent variable across both conditions. Because it is the impartiality of VOI reasoning that gives it its moral force, we did not expect reversed-control reasoning to have the same effect as VOI reasoning. As predicted, participants in the VOI condition, compared to those in the reversed-control condition, gave more utilitarian responses to the original AV case.

Thus, our prior work implies that people who engage in VOI reasoning, compared to participants in control conditions, are more likely to make the utilitarian choices in response to moral dilemmas. Moreover, these studies show that these utilitarian judgments are motivated by an increase in impartial thinking induced by veil-of-ignorance reasoning and not merely by component features of VOI reasoning such as probability calculation, numerical thinking, and perspective-taking. In the present research we take these alternative hypotheses to have been ruled out as complete explanations of the VOI effect, but we acknowledge that they may contribute to the net effect of VOI reasoning. Here, we focus on the net effect of VOI reasoning, including any effects that can be attributed to its components. In other words, it is not our purpose here to control for all of the component features of VOI reasoning that are necessary, but not sufficient, for its operation.

1.2 The Present Studies

Our past work has demonstrated that veil-of-ignorance reasoning can effectively increase impartiality, leading participants to favor utilitarian judgments in response to moral dilemmas (Huang, Greene & Bazerman, 2019). Prior research also suggests that veil-of-ignorance reasoning may mitigate the effects of self-serving bias on perceptions of fairness (Kriss et al., 2011). The present project builds on this past research in three ways.

First, we test the efficacy of VOI reasoning on mitigating self-serving bias in a dilemma in which utilitarian values are pitted directly against other moral considerations. Here we ask participants to judge whether it is morally acceptable to forgo giving a single remaining ventilator to an older patient who arrived at the hospital just before a younger patient. A first-come-first-served fairness principle would argue that the older patient should receive the ventilator. However, a utilitarian principle would have the ventilator go to the younger patient who has more years left to live. We expect that self-serving bias may lead older participants to be less likely to endorse the utilitarian principle, one that advocates sacrificing the older patients in favor of saving younger ones. However, we hypothesize that when participants make their decisions from behind the veil of ignorance and are asked to imagine they have equal chance of being either patient in this scenario, the self-serving bias will be reduced and utilitarian judgments will increase overall.

Second, prior research in moral psychology has primarily focused on outcomes that vary in the number of lives to be saved (e.g., in the footbridge dilemma, 5 on the tracks vs. 1 on the footbridge), rather than the number of life years. The COVID-19 crisis has foregrounded age as an important factor in the allocation of scarce resources such as ventilators, since the disease disproportionately affects older people. Prior literature on decision-making in healthcare has extensively studied age as a factor in determining which individuals should have priority in life-or-death situations. When faced with the distribution of scarce resources, empirical studies in economics, medicine, and bioethics show that people tend to prioritize younger individuals rather than older individuals (e.g., Cropper, Aydede & Portney, 1994; Johannesson & Johansson, 1997; Rodriguez & Pinto, 2000; Busschbach, Hessing & Charro, 1993; Tsuchiya, Dolan & Shaw, 2003; Lewis & Charny, 1989). Psychological studies have also found that people – particularly the young – generally tend to value younger compared to older lives (Li et al., 2009). People also tend to value younger lives when considering positive rights such as who to save (Goodwin & Landy, 2014), including in the domain of AVs (Awad et al., 2018). This general prioritization of younger individuals is usually attributed to the idea that individuals with the greater number of projected "quality adjusted life years" (QALYs) should be prioritized. Health policy has generally utilized the notion of QALYs in allocating healthcare resources (e.g., Cubbon, 1991; Singer et al., 1995; Williams, 1996). In the present studies, the moral dilemma concerns maximizing the number of life-years saved, rather than the number of lives saved. We ask participants whether a hospital's only remaining ventilator should be given to an older patient who arrived at the hospital first ("first come, first served") or a younger patient who arrived moments later ("save the

most life-years").

Third, the present study moves beyond philosophical dilemmas and focuses on more realistic dilemmas generated by the COVID-19 crisis. As mentioned above, these data were collected from American participants at a peak of the pandemic in the United States, a time when ventilator shortages were a very real and salient concern. While we focus in this study on the allocation of ventilators, the pandemic continues to raise structurally similar dilemmas, such as the prioritization of recipients for vaccines. Some may argue that the vaccine should be distributed to those who are most vulnerable to the virus (e.g., people over age 60), while others may argue that the vaccine should be distributed on a "first come, first served" basis. We note, however, that in at least some versions of the vaccine dilemma, utilitarian reasoning favors older patients because they are more vulnerable to the diseases. Positions in these debates may be motivated by self-serving bias – that is, each group may favor the fairness principle that supports their own interests. While self-serving bias has been well-documented in the judgment and decision-making literature, few interventions have been shown to effectively mitigate self-serving bias. The results of this research could help inform fairness guidelines for frontline decision-makers when faced with these challenging dilemmas.

Across two experiments, we examine the effect of VOI reasoning on the allocation of resources for COVID-19 patients, with a focus on self-serving judgments. We test the following pre-registered prediction: People who engage in veil-of-ignorance reasoning, prior to making an explicit moral judgment, will subsequently make more utilitarian moral judgments. We also examine effects of participant-age. We report on an initial study (N=414) and a high-powered replication (N=1,276).

2 Study 1

2.1 Method

Study 1 (pre-registered, AsPredicted #38403) followed precisely the methods of prior research, employing the two-stage experimental paradigm described above (Huang, Greene & Bazerman, 2019). Participants were randomly assigned to one of two conditions in a between-subjects design. Participants in both conditions responded to the standard version of the ventilator dilemma in stage two. Here participants were told that a doctor must decide whether to give the last available ventilator in their hospital to a 65-year-old patient who arrived first and who was already being prepped for the ventilator, or to a 25-year-old patient who arrived moments later. Participants were told to assume that whichever patient is saved will live to age 80 and that the ventilator is equally capable of saving either patient. Furthermore, participants were told that a "first come, first served" principle is preferred by some ethicists because it does not discriminate by age. They were also told of the utilitarian principle, which favors saving the most years of life. Participants then indicated their moral judgment using both a dichotomous measure ("Is it morally acceptable for the doctor to give

the last ventilator to the younger patient?") and a scale measure ("To what extent is it morally acceptable for the doctor to give the last ventilator to the younger patient?").[1] These two measures served as our dependent variable of moral judgment, and were consistent across the VOI and control conditions.

In the control condition, participants responded only to the standard version of the ventilator dilemma (in stage two) and did not complete any exercise beforehand (in stage one). As explained above, the present research uses this simple control condition because our focus is on the net effect of VOI reasoning. Once again, prior research using more complex control conditions showed that the net effect of VOI reasoning cannot be explained solely in terms of necessary component processes such as probabilistic reasoning, perspective-taking, and numerical reasoning (Huang, Greene & Bazerman, 2019). Because these component processes are necessary for VOI reasoning, they cannot be separated from it in practice. Thus, the present experiments employ a control condition corresponding to the procedural question that will be faced by real-life decision-makers who might draw on the present research: Should we use VOI reasoning or not?

In the VOI condition, participants were presented with the VOI version of the ventilator dilemma (in stage one), prior to responding to the standard version of the ventilator dilemma (in stage two). In the VOI version of the ventilator dilemma, we asked them to imagine that they have a 50% chance of being the older patient and a 50% chance of being the younger patient. The implications were explained as follows: "If the doctor follows the 'first come, first served' principle and gives the ventilator to the older patient, you have a 50% chance of being a 65-year-old who gets to live another 15 years, and a 50% chance of dying at age 25. If the doctor follows the utilitarian principle and gives the ventilator to the younger patient, you have a 50% chance of dying at age 65, and a 50% chance of being a 25-year-old who gets to live another 55 years."

Participants in the VOI condition indicated what they would like the doctor to do, from a purely self-interested perspective, using a dichotomous measure ("Do you want the doctor to give the last ventilator to the younger patient?") and a scale measure ("To what extent do you want the doctor to give the last ventilator to the younger patient?"). To be clear, responding to this question is a key feature of our VOI manipulation, and should not be confused with the dependent variable of moral judgment in the standard version of the ventilator dilemma. Having participants choose a course of action from "behind the veil" – without knowledge of which patient in the scenario they might be – is consistent with Rawls's conception of how VOI decision-making is implemented. After answering these questions, participants in the VOI condition moved on to the second stage. Here they were

[1]Here we asked participants whether and to what extent giving the ventilator to the younger patient is "morally acceptable", but other phrases could have been used with the potentially different results. Asking whether a specific action is "morally acceptable" elicits an evaluation of a single option, rather than an explicit comparison between the two options. This may encourage a more deontological mindset. By contrast, we might have asked which of the two options is "morally better" and to what extent. Using this alternative wording might have encouraged a more utilitarian/consequentialist mindset.

presented with the standard version of the ventilator dilemma, and responded to both the dichotomous and scale measures of moral judgment. Once again, responses to these moral judgment questions were our primary dependent measures and were used across the VOI and control conditions.

In both conditions, after participants responded to the dilemma(s), they completed comprehension checks (one for each dilemma). We hypothesized *a priori* that only participants who engaged in careful and attentive thinking would be affected by the VOI manipulation, and therefore we excluded from analysis participants who failed at least one comprehension check. However, because more participants failed a comprehension check question in the VOI condition, we also present results including all participants. This provides assurance that our conclusions are not artifacts of differential rates of exclusion across conditions.

At the end of their sessions, all participants assessed their prior familiarity with the testing materials, supplied basic demographic variables (age, gender, religious identity, political interest, political leaning, and political party), and were asked for general comments. We have uploaded all study materials, preregistrations, raw data, and analyses code to the Open Science Framework (https://osf.io/nex9s/?view_only=63de515d891c4996b6fd557f32b98629). All statistical analyses were conducted using R statistical software.

Sample. Participants were recruited online through Prolific. We aimed to recruit 200 participants per condition, post-exclusion. We expected to exclude approximately 33% of the original sample based on prior work and therefore recruited an initial sample of 590 participants. We obtained a final sample of 414 participants (265 in the control condition, 149 in the VOI condition) following exclusions for duplicate IDs (12 participants) and failing at least one comprehension check (164 participants). All exclusion criteria were determined *a priori*.

2.2 Results

Analyses with exclusions. As predicted, in responding to the standard ventilator dilemma (in stage two), participants in the VOI condition were more likely to make the utilitarian judgment that it was morally acceptable to give the last ventilator to the younger patient (65.78%, 95% CI: [57.80%, 72.94%]), as compared to participants in the control condition (53.21%, CI: [47.18%, 59.14%]; logistic regression, *odds ratio* = 1.69, CI: [1.12, 2.57]), $p = .013$). (See Figure 1.) There was a an almost-significant difference between average response on the scale measure in the VOI condition (M=4.38, CI: [4.10, 4.66]), and the control condition (M= 4.09, CI: [3.88, 4.30], linear regression, raw $\beta = .30$ (CI: [−.05, .65]), $t(412)=1.66$, $p = .098$).

Furthermore, participants in the VOI condition, in responding to the VOI version of the ventilator dilemma (in stage one), also overwhelmingly endorsed the utilitarian course of action when engaged in veil-of-ignorance reasoning: 73.15% of participants (CI: [65.68%, 79.84%]) reported that if they had an equal chance of being the younger or older patient they would (self-interestedly) want the doctor to give the ventilator to the younger patient.

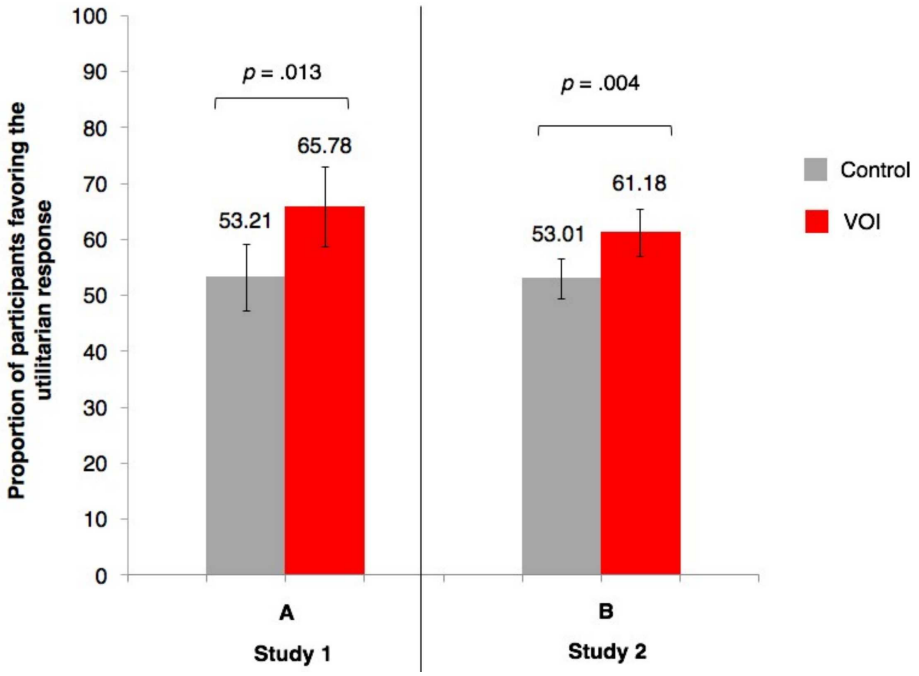

FIGURE 1: Dichotomous responses for both studies. Primary analyses with exclusions. p-values from logistic regression. Error bars indicate 95% CI. (A) Study 1; (B) Study 2.

Here, we did not examine participant-age, as our sample included very few participants over the age of 60 (11 in the VOI condition and 17 in the control condition). We consider participant-age in Study 2.

Analyses with all participants. The VOI condition is more complex than the control condition, leading to higher rates of exclusion for that condition due to failed comprehension. To ensure that our results are not artifacts of differential levels of exclusion between the two conditions, we reran our analyses using the full sample of 578 participants (which excludes 12 participants for duplicate IDs).

As predicted, in responding to the standard ventilator dilemma, participants in the VOI condition were more likely to make the utilitarian moral judgment (62.94%, CI: [57.19%, 68.34%]), compared to participants in the control condition (54.11%, CI: [48.37%, 59.75%], logistic regression, *odds ratio* = 1.44, CI: [1.03, 2.01]), p = .032). Participants' responses to the scale measure were consistent with their dichotomous judgments. On average, participants in the VOI condition judged it more morally acceptable to give the ventilator to the younger patient (M=4.49, CI: [4.28, 4.69]), as compared to participants in the control condition (M=4.13, CI: [3.93, 4.33], $t(576)$=2.47, β =.36, CI: [.07, .64], p = .014). Consistent with our post-exclusion analysis, in the full sample, participants in the VOI condition overwhelmingly endorsed the utilitarian course of action when engaged in veil-of-ignorance reasoning in the VOI version of the ventilator dilemma (74.13%, CI: [68.85%, 78.97%]).

3 Study 2

3.1 Method

Study 2 (preregistered; AsPredicted #38496) was an exact replication of Study 1 using a larger sample.

Sample. Sample size was determined by a (two-tailed) power analysis for a logistic regression to detect an effect size equivalent to the effect found in Study 1 (*odds ratio* = 1.44, with 48% probability in the control condition) at 90% power. This yielded a target sample size of 1,276. Using an estimated 30% exclusion rate (determined by the exclusion rate of Study 1), we recruited 1,813 participants from Prolific. Applying the same exclusion criteria as Study 1, we excluded 35 participants with duplicate study IDs and 522 participants who failed at least one comprehension check, leaving 1,256 participants (764 in the control condition, 492 in the VOI condition). Again, we report analyses with and without exclusion for failed comprehension.

3.2 Results

Analyses with exclusions. Consistent with our Study 1 results, participants in the VOI condition judged that it is more morally acceptable to give the last ventilator to the younger patient in the standard ventilator dilemma, as compared to participants in the control condition. This was observed using both our dichotomous measure (VOI: 61.18%, CI: [56.80%, 65.40%]; Control: 53.01%, CI: [49.46%, 56.53%], logistic regression, *odds ratio* = 1.40, CI: [1.11, 1.76]), $p = .004$) (see Figure 1) and our scale measure (VOI: M=4.41, CI: [4.26, 4.56]; Control: M=4.03, CI: [3.91, 4.16], $t(1254)$=3.76, β =.38, CI: [.18, .57], $p < .001$).

Furthermore, as predicted, participants in the VOI condition overwhelmingly endorsed the utilitarian course of action when engaged in veil-of-ignorance reasoning in the VOI version of the ventilator dilemma, reporting that they would want the doctor to give the ventilator to the younger patient if they did not know which patient they would be (77.44%, CI: [73.61%, 80.98%]).

To examine the effects of age, we divided participants into three age categories, younger (18–30; N=491), middle-aged (31–59; N=655), and older (60+; N=110). We ran an interaction model that analyzed the effect of condition (VOI vs. control), as well as the effect of participant-age, and the interaction between condition and participant-age, on moral judgment in the standard ventilator dilemma.

We observed significant effects of participant-age. Participants in the older age category (*odds ratio* = .26, CI: [.15, .44], $p < .001$), as well as the middle age category (*odds ratio* = .47, 95% CI: [.34, .64], $p < .001$), were less likely to make the utilitarian judgment compared to participants in the younger age category. Moreover, there was a significant interaction between condition and participant-age. In other words, the effect of the VOI manipulation

on moral judgment differed by participant-age. The VOI intervention was more likely to shift moral judgment in the utilitarian direction for participants in the older age category, compared to participants in the younger age category (*odds ratio*$_{older\ vs.\ younger}$ = 3.98, CI: [1.63, 10.01], p = .003). Similarly, the VOI intervention was more likely to shift moral judgment in the utilitarian direction for participants in the middle age category, compared to participants in the younger age category (*odds ratio*$_{middle\ vs.\ younger}$ = 2.02, *95% CI:* [1.24, 3.31], p = .005). (See Table 1.)

TABLE 1: Proportion of participants in Study 2 (N=1,256) making the utilitarian choice as a function of age group and condition. Percentages from dichotomous measure (brackets indicate 95% CI).

	Control	VOI
With exclusions		
Age 18–30	65.75% [60.12%, 70.97%], N=292	61.81% [54.87%, 68.30%], N=199
Age 31–59	47.37% [42.51%, 52.28%], N=399	60.55% [54.43%, 66.35%], N=256
Age 60+	32.88% [23.11%, 44.39%], N=73	62.16% [45.81%, 76.15%], N=37
All participants		
Age 18–30	64.74% [59.42%, 69.72%], N=329	63.42% [58.16%, 68.38%], N=339
Age 31–59	47.45% [42.97%, 51.97%], N=470	59.92% [55.48%, 64.19%], N=484
Age 60+	32.93% [23.65%, 43.76%], N=82	55.41% [44.00%, 66.27%], N=74

Within the VOI condition, there was no effect of participant-age (all $p > .80$), despite the significant effect of participant-age overall. Thus, the VOI treatment eliminated the tendency for older participants to oppose favoring younger patients, as observed in the control condition. (See Table 1.)

Using the scale measure for moral judgment, we also tested the effects of condition, participant-age, and the interaction between condition and participant-age, on moral judgment. We similarly observed a significant effect of age. Participants in the older category (linear regression; $\beta = -1.46$, CI: [−1.89, −.1.02], $p < .001$), as well as the middle category ($\beta = -.65$, CI: [−.90, −.39], $p < .001$), rated the utilitarian action as on average less acceptable, as compared to participants in the younger category. We also observed a significant interaction between participant-age and condition. The VOI manipulation shifted moral judgment more in the utilitarian direction for the older group, compared to the younger group ($\beta_{older\ vs.\ younger}$ = 1.28, CI: [.54, 2.02], p = .001). Similarly, the VOI manipulation shifted moral judgment more in the utilitarian direction for the middle group, compared to the younger group ($\beta_{middle\ vs.\ younger}$ = .55, CI: [.14, .96], p = .008). (See Table 2.)

TABLE 2: Participants' rating of moral acceptability of the utilitarian choice in Study 2 (N=1,256) as a function of age group and condition. Means from scale measure (brackets indicate 95% CI).

	Control	VOI
With exclusions		
Age 18–30	4.51 [4.31, 4.71], N=292	4.47 [4.24, 4.71], N=199
Age 31–59	3.86 [3.70, 4.03], N=399	4.38 [4.17, 4.59], N=256
Age 60+	3.05 [2.66, 3.45], N=73	4.30 [3.75, 4.85], N=37
All participants		
Age 18–30	4.48 [4.29, 4.67], N=329	4.47 [4.29, 4.66], N=339
Age 31–59	3.86 [3.70, 4.02], N=470	4.36 [4.20, 4.51], N=484
Age 60+	3.16 [2.78, 3.54], N=82	4.27 [3.87, 4.67], N=74

In each of the three age-groups, the majority of participants endorsed taking the utilitarian course of action when engaged in veil-of-ignorance reasoning (Younger: 82.91%, *95% CI*: [77.04%, 87.53%]; Middle: 75.39%, *95% CI* [69.74%, 80.28%]; Older: 62.16%, *95% CI*: [45.81%,76.15%]). A significantly greater proportion of younger than older participants reported that they would want the doctor to give the ventilator to the younger patient (logistic regression, *odds ratio* = 2.95, *95% CI*: [1.36, 6.28] $p = .005$). There was an almost-significant difference between the middle and older age-groups (logistic regression, *odds ratio* = 1.86, *95% CI*: [.89, 3.81] $p = .091$).

Analyses with all participants. As in Study 1, we reanalyzed all of our data using the full sample of 1,778 participants (excluding 35 with duplicate IDs) to rule out artifactual effects of our exclusion criteria. Once again, we found that participants in the VOI condition were more likely to make the utilitarian judgment in the standard ventilator dilemma (60.87%, CI: [57.63%, 64.01%]), as compared to participants in the control condition (52.55%, CI: [49.25%, 55.84%], logistic regression, *odds ratio* = 1.40 (*95% CI:* [1.16, 1.70]), $p < .001$). Likewise, participants in the VOI condition rated the utilitarian action as more morally acceptable (M=4.39, CI: [4.28, 4.51]), as compared to participants in the control condition (M=4.03, *95% CI:* [3.91, 4.14], $t(1776)=4.41$, $\beta = .37$, *95% CI:* [.20, .53], $p < .001$). Finally, participants in the VOI condition overwhelmingly preferred the utilitarian course of action when engaged in veil-of-ignorance reasoning in the VOI version of the ventilator dilemma (74.36%, CI: [71.43%, 77.14%]).

Once again, we divided participants into three age categories (younger N=668; middle-aged N=954; older N=156). As in Study 1, we analyzed the effect of condition (VOI vs. control) on moral judgment in the standard ventilator dilemma, controlling for participant-age, and controlling for the interaction between condition and participant-age.

There was a significant effect of participant-age. Participants in the older age category

(logistic regression, *odds ratio* = .27, CI: [.16, .44], $p < .001$), as well as the middle age category (*odds ratio* = .49, CI: [.37, .66], $p < .001$), were less likely to make the utilitarian judgment, as compared to the younger age category. We also observed significant interaction effects between condition and participant-age. The VOI intervention was more likely to shift moral judgment in the utilitarian direction for participants in the older age category, compared to participants in the younger age category (*odds ratio* $_{older\ vs.\ younger}$ = 2.68, CI: [1.31, 5.56], $p = .008$). Similarly, the VOI intervention was more likely to shift moral judgment in the utilitarian direction for participants in the middle age category, compared to participants in the younger age category (*odds ratio* $_{middle\ vs.\ younger}$ = 1.75, 95% CI: [1.17, 2.64], $p = .007$). (See Table 1.)

Within the VOI condition, there was no effect of age (all $p \geq .20$), despite the significant effect of age overall. Thus, the VOI treatment eliminated the tendency for older participants to oppose favoring younger patients, as observed in the control condition. (See Table 1.)

Using the scale measure, we observed a significant effect of age, with participants in the older category (linear regression $\beta = -1.32$, CI: [−1.74, −.90], $p < .001$), as well as the middle category ($\beta = -.62$, CI: [−.87, −.38], $p < .001$), rating the utilitarian action as on average less acceptable, as compared to the younger category. We observed a significant interaction between age category and condition. The VOI manipulation shifted moral judgment more in the utilitarian judgment for the older group compared to the younger group ($\beta_{older\ vs.\ younger}$ = 1.12, CI: [.51, 1.72], $p < .001$), and for the middle group compared to the younger group ($\beta_{middle\ vs.\ younger}$ = .50, CI: [.16, .85], $p = .004$). (See Table 2.)

In each of the three age-groups, the majority of participants endorsed taking the utilitarian course of action when engaged in veil-of-ignorance reasoning (Younger: 82.30%, *95% CI*: [77.87%, 86.00%]; Middle: 71.28%, *95% CI* [67.10%, 75.14%]; Older: 58.11%, *95% CI*: [46.64%, 68.76%]). A significantly greater proportion of participants in the younger age-group (logistic regression, *odds ratio* = 3.35, *95% CI*: [1.95, 5.75] $p < .001$) and middle age-group (*odds ratio* = 1.79, *95% CI*: [1.08, 2.95] $p = .023$), compared to the older age-group, reported that they would want the doctor to give the ventilator to the younger patient.

4 General Discussion

In two pre-registered studies, we show that veil-of-ignorance reasoning favors allocating scarce medical resources to younger patients in response to the COVID-19 ventilator dilemma. Participants who first engaged in veil-of-ignorance reasoning, compared to participants who did not engage in veil-of-ignorance reasoning, were subsequently more likely to approve of a utilitarian policy that maximizes the number of life-years saved. These findings, predicted based on prior research (Huang, Greene & Bazerman, 2019), make three further contributions.

First, and most straightforwardly, these results apply directly to an ongoing crisis in which competing claims to fairness must be resolved. While the ventilator shortage in the developed world is currently less acute than many feared, it is likely that the COVID-19 crisis will continue to generate moral dilemmas of a similar form. These may be due to limited resources of other kinds such as medical personnel (Bernstein, 2020), the further spread of the disease in the developing world (Woodyatt, 2020), or structurally similar dilemmas arising from the distribution of vaccines (Emanuel, 2020b; Sun, 2020b; Ahuja, 2020). Moreover, it is likely that bioethical dilemmas of this general form will arise in future public health crises. The present research indicates that VOI reasoning can be a useful tool, grounded in a principle of impartiality, for decision-makers confronting difficult decisions during such crises.

Second, the present results underscore the power of VOI reasoning to eliminate self-serving bias. Self-serving bias is pervasive, and few interventions have been shown to effectively mitigate it. We demonstrate an effective intervention to mitigate self-serving bias in moral dilemmas. In Study 2, few older participants (33%) in the control condition favored prioritizing younger patients. But after engaging in veil-of-ignorance reasoning, most older participants (62%) favored doing so, just like younger participants. Indeed, the VOI manipulation completely eliminated self-serving bias among older participants, despite a sizable effect in the control condition.

Third, the present results demonstrate that VOI reasoning can be applied not only to dilemmas varying numbers of lives saved (Huang, Greene & Bazerman, 2019), but also to dilemmas varying numbers of life-years saved. As noted previously, this is important for bioethical decision-making, in which QALYs are commonly – but controversially – regarded as a legitimate factor in the allocation of medical resources (Cropper, Aydede & Portney, 1994; Johannesson & Johansson, 1997; Rodriguez & Pinto, 2000; Busschbach, Hessing & Charro, 1993; Tsuchiya, Dolan & Shaw, 2003; Lewis & Charny, 1989). Likewise, age may also prove to be an important and contentious factor for decisions involving new technologies, such as AVs (Awad et. al., 2018), which may access information about age in new ways. Of course, the "quality" in QALYs depends on who makes those judgments, for what purposes, and under what circumstances (e.g., Ubel, Loewenstein & Jepson, 2003; Loewenstein & Ubel, 2008; Ne'eman, 2020).

The present experiments use a simple control condition, as in Experiments 1–3 of Huang, Greene and Bazerman (2019). In that prior work, Experiments 4–7 employed more sophisticated controls aimed at distinguishing the distinctive effects of veil-of-ignorance reasoning from component factors such as perspective taking, numerical reasoning, and anchoring. That work showed that the veil-of-ignorance effect depends critically on assigning probabilities that align with principles of impartiality. Here we employ a simple control because our aim is to assess the net effect of veil-of-ignorance reasoning, not to distinguish it from its components. For present purposes, we assume that the mechanisms behind the present results are comparable to those responsible for our prior results, which were the

bases for our pre-registered hypotheses.

The empirical findings, of course, cannot provide definite answers for the normative questions raised by this dilemma. Nevertheless, healthcare professionals confronting distributional dilemmas must adjudicate between competing claims of fairness in the absence of definitive answers. Our starting point is neither that policies should favor the young over the old, nor that physicians should generalize freely from our findings to prioritize patients based on specific features such as identity, ability, or socioeconomic status (Ne'eman, 2020). Rather, we show that veil-of-ignorance reasoning could provide a widely respected and transparent standard for adjudicating claims of fairness. This procedure will result in different policies — some of those policies may favor the young, while other policies may favor others — depending on the specific context and circumstances of the dilemma involved. Insofar as one respects the veil-of-ignorance standard for impartiality, our findings provide concrete guidance on how to remove self-serving biases from decisions made by policy-makers and front-line professionals charged with allocating scarce resources during this crisis, and others that may follow.

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