

Grouping Promotes Equality: The Effect of Recipient Grouping on Allocation of Limited Medical Resources



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Abstract

Decisions about allocation of scarce resources, such as transplant organs, often entail a trade-off between efficiency (i.e., maximizing the total benefit) and fairness (i.e., dividing resources equally). In three studies, we used a hypothetical scenario for transplant-organ allocation to examine allocation to groups versus individuals. Study 1 demonstrated that allocation to individuals is more efficient than allocation to groups. Study 2 identified a factor that triggers the use of fairness over efficiency: presenting the beneficiaries as one arbitrary group rather than two. Specifically, when beneficiaries were presented as one group, policymakers tended to allocate resources efficiently, maximizing total benefit. However, when beneficiaries were divided into two arbitrary groups (by hospital name), policymakers divided resources more equally across the groups, sacrificing efficiency. Study 3 replicated this effect using a redundant attribute (prognosis) to create groups and found evidence for a mediator of the grouping effect—the use of individualizing information to rationalize a more equitable allocation decision.

Keywords

decision making, judgment, morality, open data, open materials, preregistered

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Many decisions require allocation of scarce resources. For example, there are fewer transplant organs available than individuals who need them (Organ Procurement and Transplantation Network, 2014). Such decisions frequently entail a trade-off between equity and efficiency (Ubel, DeKay, Baron, & Asch, 1996a), and perceptions of fairness play a key role (for a review of the public's preferences concerning organ allocation, see Tong et al., 2010). Perceptions of equity or fairness, however, are influenced by subtle features of question presentation (e.g., Ubel, Baron, & Asch, 2001). In the current studies, we examined whether simply placing beneficiaries in groups prompted decision makers to allocate resources more equally across the groups.

Previous studies (Ubel et al., 1996a, 1996b; Ubel & Loewenstein, 1996) indicate that decision makers faced with hypothetical organ-allocation scenarios often do not

allocate organs in a way that maximizes survival. For example, when asked to allocate organs between a group of patients who had an 80% chance of transplant success and a group who had a 70% chance of success, very few participants gave most of the organs to the group with the better prognosis. When the difference in prognoses between the two groups is larger, participants were more willing to favor the group with the better prognosis (Ubel & Loewenstein, 1996), but the maximally efficient response (i.e., giving organs to everyone in the group with the better prognosis) remains rare.

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These previous studies have all presented participants with the task of allocating organs across groups of patients (e.g., Baron, 1995). Ubel and Loewenstein (1996), however, reported that the majority of their participants indicated that they would not ignore prognostic information that could be used to rank individuals; indeed, participants indicated a greater willingness to use individual-level prognostic information than group-level prognostic information. No previous study, however, has actually compared organ allocation decisions when participants are given both group-level and individual-level prognostic information.

Researchers studying grouping have extensively examined what creates the perception of different groups. The original Robber's Cave study (Sherif, Harvey, White, Hood, & Sherif, 1961) showed that simple group names can foster group identities so valued that they led to summer-long conflict. Swann et al. (2014) recently examined how the perception of shared traits can lead to group identity strong enough to die for. Although these studies demonstrate that even subtle manipulations can lead to strong group perceptions, they do so using the perspective of the group members themselves. In contrast, in the current studies, participants are third-party observers who distribute resources across the groups.

In the current studies, we first compared allocation of organs to groups and allocation of organs to individuals. We predicted that fairness considerations would be more salient when allocation was made at the group level and risk information was presented at the group level compared with any other combination of group and individual allocation and risk information presentation. Next, we examined whether the use of fairness rather than efficiency is triggered simply by presenting the individual beneficiaries as one or two arbitrary groups. Specifically, we found that when beneficiaries were presented as one group, policymakers tended to allocate resources efficiently, maximizing total benefit. However, when beneficiaries were divided into two groups, policymakers divided resources more equally across the groups, sacrificing efficiency. A final study investigated a potential cause of this grouping effect, demonstrating that when decision makers perceived the possible beneficiaries as members of separate groups, they used the individual characteristics of the beneficiaries to justify their allocation decisions.

Study 1

In Study 1, we compared allocation of organs to groups (the method used in previous studies) with allocation of organs to individuals. We also compared the effect of presenting risk information at the group level (the method used in previous studies) with presenting risk information at the individual level.

Method

Participants ($N = 470$; 40% female; mean age = 32 years) recruited from Amazon's Mechanical Turk (MTurk) responded to a scenario about allocating six kidneys across 12 patients in need of transplants. Forty-two additional participants were excluded from analyses because they gave incomplete responses. Participants were shown a three-by-four grid of the 12 patients (see Fig. S1 in the Supplemental Material available online) in which each patient was identified by a photo and first name. The patients were divided into two groups of 6 via a line down the center of screen. The 6 patients on the left half of the screen were described as having a high likelihood of transplant success and the 6 on the right as having a low likelihood of success. Thus, the most medically efficient allocation was to give the kidneys to the 6 patients on the left.

Participants were randomly assigned to condition in a 2×2 design. One factor manipulated whether likelihood of transplant success was conveyed at the group or individual level. In the group-likelihood condition, the labels "Chance of Success: High" and "Chance of Success: Low" appeared over the left and right groups, respectively. In the individual-likelihood condition, there were no group labels. Instead, "chance of success: high" appeared under each of the six patient photos on the left of the screen, and "chance of success: low" appeared under each of the six patient photos on the right of the screen.

We also orthogonally manipulated whether participants allocated kidneys at the group or individual level. Participants in the group-allocation condition distributed kidneys to each of the two groups by deciding how many kidneys should go to each group. They typed one number in each of two text boxes above the groups, with the constraint that the two numbers had to sum to six. Participants in the individual allocation condition clicked "give kidney" or "don't give kidney" for each of the 12 patients, with the constraint that they had to give kidneys to 6 patients and deny them to the other 6. When a patient was selected to receive a kidney, an image of a kidney appeared on his or her photograph, and when a patient was selected not to receive a kidney, a red X appeared. Note that the combination of the group-likelihood and the group-allocation conditions is analogous to the procedure used in previous studies (Baron, 1995; Ubel et al., 1996a, 1996b).

Results

We performed a 2×2 logistic regression on percentage of participants who allocated all kidneys to the patients who had a high likelihood of success. Allocation decisions were more efficient in the individual-likelihood

Table 1. Efficiency of Kidney Allocation in Study 1

Allocation condition	Mean number of kidneys allocated efficiently		Percentage of participants who allocated kidneys perfectly efficiently	
	Group-likelihood condition	Individual-likelihood condition	Group-likelihood condition	Individual-likelihood condition
Group allocation	4.79 (1.17)	5.00 (1.23)	40%	55%
Individual allocation	5.10 (1.12)	5.51 (0.96)	52%	75%

Note: Values in parentheses are standard deviations.

condition (64%) than in the group-likelihood condition (46%), $\chi^2(1, N = 470) = 17.49$, natural logarithm of the odds ratio ($\ln OR$) = 0.41, 95% confidence interval (CI) = [0.22, 0.60], $p < .0001$. In addition, allocation decisions were more efficient in the individual-allocation condition (64%) than in the group-allocation condition (47%), $\chi^2(1, N = 470) = 13.09$, $\ln OR = 0.35$, 95% CI = [0.16, 0.54], $p = .0003$. There was no interaction between the likelihood condition and the allocation condition, $\chi^2(1, N = 470) = 1.18$, $\ln OR = -0.11$, 95% CI = [-0.30, 0.09], $p = .28$ (see Table 1).

Discussion

Previous research on organ-allocation decisions has presented information on likelihood of transplant success at the group level and asked participants to allocate organs to groups of participants. Study 1 illustrates that decision makers used organs more efficiently when they operated at the level of individual patients. This result has important implications, because allocation policy decisions are made at the group level, but actual organ-allocation decisions are made at the individual level. Our results suggest that the responses of participants in the studies by Ubel et al. (1996a, 1996b) were particularly inefficient, because the questions prompted them to allocate at the group level. Study 1 indicates that thinking about patients as individuals rather than as part of a group influenced whether decision makers sought to maximize the benefit gained from the organs or sought to spread the scarce organs somewhat evenly across the two groups. We explored this possibility directly in the subsequent studies.

Studies 2 and 3

In Studies 2 and 3, we used the individual-likelihood and individual-allocation conditions used in Study 1; however, we manipulated whether the patients were presented as one unified group (and hence treated as individuals) or whether they were divided into two groups. We predicted that fairness concerns would be more salient in the condition with two groups and that

consequently the efficiency of allocation would decline in this condition.

In Studies 2 and 3, MTurk participants responded to a kidney-allocation scenario similar to that in Study 1. In both studies, the patients were presented as one group of 12 (unified condition) or as two groups of 6 (grouped condition). In the unified condition, a title was centered above the images. In the grouped condition, a black vertical line separated the two columns of patients on the left from the two on the right, with a title centered over each group. In both studies, the grouping was confounded by design with likelihood of transplant success, such that all patients in one group had a high likelihood of success, whereas all those in the other group had a low likelihood of success.

Study 2

Method. In Study 2, we manipulated whether the patients were presented in a grouped or unified format and whether they were presented with identifying information. Participants ($N = 246$; 52% female; mean age = 32 years) were randomly assigned to conditions in a 2 (identifying information or no identifying information) \times 2 (grouped or unified) design. Half the participants saw a photograph of each potential recipient and, below that, age, first name, and likelihood of transplant success (low or high; see Fig. S1 in the Supplemental Material). The other half of the participants saw a gray box containing a patient number (e.g., "patient 2") and, below that, the likelihood of transplant success (low or high), but they saw no patient names or ages. Patients were grouped under the titles "Mountainview Hospital" and "Sunnyvale Hospital" (grouped condition) or "Mountainview-Sunnyvale Hospital" (unified condition).

Results. We performed a 2 \times 2 logistic regression on percentage of participants who allocated all kidneys to high-likelihood patients. There was a large main effect of identifying information, $\chi^2(1, N = 246) = 46.87$, $p < .0001$, a main effect of grouping, $\chi^2(1, N = 246) = 4.16$, $p = .041$, and no significant interaction between the information

Table 2. Efficiency of Kidney Allocation in Studies 2 and 3

Study and condition	Mean number of kidneys allocated efficiently		Percentage of participants who allocated kidneys perfectly efficiently	
	Grouped condition	Unified condition	Grouped condition	Unified condition
Study 2				
Identifying information	4.53 (1.30)	4.80 (1.35)	31%	39%
No identifying information	5.30 (1.36)	5.69 (0.93)	73%	87%
Study 3				
High success on right side of screen	5.29 (1.20)	5.63 (0.95)	71%	85%
High success on left side of screen	5.23 (1.28)	5.45 (1.10)	68%	76%

Note: Values in parentheses are standard deviations.

condition and the grouping condition, $\chi^2(1, N = 246) = 0.90, p = .34$ (see Table 2). Thus, the grouping manipulation made participants less efficient, and this effect was not diminished when identifying information was removed. Two additional studies reported in the Supplemental Material replicated this grouping effect.

Study 3

Method. In Study 3, we examined causal mechanisms underlying the grouping effect. It is possible that participants in Study 2 inferred a structural disparity between the two groups that caused them to allocate less efficiently in the grouped condition. We sought to rule out this account by using birthday months, which are uninformative as to possible structural disparities, as the group labels in Study S2 (see Supplemental Material). In Study 3, to further rule out this account, we used labels for the two groups that conveyed no information that was not already conveyed by the individual patient information. Specifically, the groups were labeled simply as “high chance of success” or “low chance of success.” In addition, after participants made their allocation decision, they gave open-ended responses about how they allocated the kidneys and rated two items about fairness. We examined these responses as possible mediators of the grouping effect.

Participants ($N = 1,000$; 42% female; mean age = 31 years) were randomly assigned to conditions in a 2 (unified or grouped) \times 2 (high success on right side of screen or high success on left side of screen) design. Four participants were excluded from analysis—3 for giving incorrect answers to two of three comprehension check questions and 1 for allocating seven kidneys instead of six. Each patient was displayed with a photograph, first name, and chance of transplant success (high or low). We counterbalanced whether the patients on the left or right of the screen were designated as having a high chance of transplant success. In the grouped condition, the groups were

labeled “high chance of success” and “low chance of success”; in the unified condition, a centered label read “low and high chance of success.” After allocating the kidneys, participants answered an open-ended question about how they made their allocation decisions and then used a 7-point rating scale (1 = *never thought about it*, 7 = *thought about it a lot*) to indicate the extent to which they had thought about each of two issues during the study: “Kidneys should be distributed equitably” and “It’s not fair for one group to monopolize all the kidneys.” Finally, they answered three attention-check questions and provided demographic information. The materials and analysis plan for Study 3 were preregistered at Open Science Framework (<https://osf.io/k29e6>).

Results. We performed a 2×2 logistic regression on percentage of participants who allocated all kidneys to high-likelihood patients. There was a main effect of grouping, $\chi^2(1, N = 996) = 14.62, \ln OR = 0.29, 95\% CI = [0.14, 0.44], p = .0001$, which indicates that, compared with participants in the grouped condition, participants in the unified condition were more likely to be perfectly efficient in their allocation (see Table 2). In addition, participants allocated kidneys more efficiently when the patient pictures on the right side of the screen were those with the high likelihood of success, $\chi^2(1, N = 996) = 5.48, \ln OR = 0.18, 95\% CI = [0.03, 0.32], p = .019$, but there was no interaction between grouping and screen side, $\chi^2(1, N = 996) = 1.93, \ln OR = -0.10, 95\% CI = [-0.25, 0.04], p = .16$.

Responses to the two fairness rating questions were perfectly correlated with each other ($r = 1.00$). The results of a bias-corrected bootstrap mediation model (Hayes, 2009) with 5,000 resamples indicated that the indirect effect of grouping via fairness ratings was only marginal, $95\% CI = [-0.1081, +0.0026], p = .08$.

Participants’ open-ended responses regarding how they made their allocation decisions were coded both by a coder naive to the study design and hypotheses and by author H. Colby. Interrater agreement was 89%, and

analyses were performed on the naive rater's codes. Responses were coded as mentioning chance of transplant success (85% of responses), fairness (6%), or individual characteristics of the patients, including age, gender, race, and physical appearance (16%; e.g., "I considered their race, sex, and appearance"). A single participant could receive multiple codes. Although the frequency with which chance of transplant success was mentioned differed only marginally between the grouped (83%) and unified conditions (88%), $\chi^2(1, N = 996) = 3.80$, $p = .051$, and frequency of fairness reasons did not differ at all (8% vs. 5%), $\chi^2(1, N = 996) = 2.34$, $p = .13$, frequency of mention of individual characteristics of the patients was higher in the grouped condition (20%) than in the unified condition (13%), $\chi^2(1, N = 996) = 9.05$, $p = .0026$. Furthermore, the results of a bias-corrected bootstrap mediation model with 5,000 resamples indicated that mention of individual characteristics mediated the effect of grouping on efficient kidney allocation, 95% CI = [-0.216, -0.046].

Discussion

Decision makers were less efficient when allocating organs between groups than when allocating them across individuals and were also less efficient when risk information was provided at the group level than when risk information was provided at the individual level (Study 1). Dividing beneficiaries into groups decreased the efficiency of resource-allocation decisions because decision makers tended to spread the resources across the groups (Studies 2 and 3). The grouping manipulation decreased efficiency of allocation when the group labels were informative (hospital names, Study 2), clearly uninformative (birthday months, Study S2), or redundant (risk information, Study 3). Even the least informative of these groups was sufficient to create a perception of groups that led to changes in kidney distribution.

The grouping effect may occur because decision makers apply an equality heuristic (Messick & Schell, 1992) or a 1/ N rule (Gigerenzer, 2008) to allocation problems, and these heuristics are more applicable when the beneficiaries are presented in groups than when the beneficiaries are presented individually. The mediation analysis in Study 3 indicated that when beneficiaries were divided into two groups rather than being in one group, decision makers were more likely to appeal to any available individual characteristics, such as race, gender, or appearance, when making allocation decisions. As a result, decision makers were less likely to allocate all the kidneys to the patients with a high chance of success. It seems that dividing beneficiaries into groups made decision makers reluctant to allocate all the resources to one group, and so they looked for individuating characteristics of the beneficiaries that

would justify giving some of the kidneys to individuals in the group with the poorer prognosis. When individuating characteristics were not available, as in the no-identifying-information condition of Study 2, however, participants nevertheless still gave some of the kidneys to individuals in the group with the poorer prognosis. The appeal to individuating characteristics therefore appears to be a rationalization rather than the true basis for spreading the scarce resources across groups.

In our study, using transplant organs, dividing resources across groups led to the undesirable outcome of reduced efficiency; however, there are other situations in which creating groups may lead to more desirable outcomes in scarce-resource allocation. Recent work by Bohnet, van Geen, and Bazerman (in press) demonstrated that gender bias was reduced when a group having as few as two employees was presented for evaluation rather than a single employee. This suggests that if managers making decisions about hiring or promoting employees were to have candidates grouped by gender instead of presented as individuals, they might be prompted to spread jobs across the groups more evenly, which would lead to the hiring or promotion of more women.

Although dividing resources across groups may be beneficial in many situations, allowing decision makers to spread risk or reduce unwanted inequities, decision makers overapply such heuristics. Although separating potential beneficiaries into groups may seem to help simplify a complex allocation decision, such a grouping may have the unexpected side effect of significantly reducing allocation efficiency when tough choices about the allocation of scarce life-saving resources need to be made.

Author Contributions

All authors developed the study concept and contributed to the study design. Programming and data collection were performed by H. Colby. G. B. Chapman performed the statistical analyses. H. Colby drafted the manuscript, and J. DeWitt and G. B. Chapman provided critical revisions. All authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information can be found at <http://pss.sagepub.com/content/by/supplemental-data>

Open Practices



All data and materials have been made publicly available via Open Science Framework and can be accessed at <https://osf.io/wk3ve/>. Study 3 was preregistered at <https://osf.io/k29e6/>. The complete Open Practices Disclosure for this article can be found at <http://pss.sagepub.com/content/by/supplemental-data>. This article has received badges for Open Data, Open Materials, and Preregistration. More information about the Open Practices badges can be found at <https://osf.io/tvyxz/wiki/1.%20View%20the%20Badges/> and <http://pss.sagepub.com/content/25/1/3.full>.

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