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EQUALITY IN THE ALLOCATION OF SCARCE VACCINES

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Article abstract

In the event of a pandemic, demand for vaccines may exceed supply. One proposal for allocating vaccines is to use a lottery, to give all citizens an equal chance, either of getting the vaccine (McLachlan) or of surviving (Peterson). However, insistence on strict equality can result in seriously suboptimal outcomes. I argue that the requirement to treat all citizens impartially need not be interpreted to require equal chances, particularly where citizens are differently situated. Assuming that we want to save lives, we should also seek to use vaccine efficiently, so far as this is compatible with equality. Thus, in allocating vaccine, we may want to be sensitive to (i) different levels of need and/or (ii) effects on vaccine production. While such policies may result in unequal chances, they may even improve everyone's chances. In such cases, the resultant inequality is not a violation of impartiality, but a consequence of considering each person's claim seriously.

EQUALITY IN THE ALLOCATION OF SCARCE VACCINES

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ABSTRACT:

In the event of a pandemic, demand for vaccines may exceed supply. One proposal for allocating vaccines is to use a lottery, to give all citizens an equal chance, either of getting the vaccine (McLachlan) or of surviving (Peterson). However, insistence on strict equality can result in seriously suboptimal outcomes. I argue that the requirement to treat all citizens impartially need not be interpreted to require equal chances, particularly where citizens are differently situated. Assuming that we want to save lives, we should also seek to use vaccine efficiently, so far as this is compatible with equality. Thus, in allocating vaccine, we may want to be sensitive to (i) different levels of need and/or (ii) effects on vaccine production. While such policies may result in unequal chances, they may even improve everyone's chances. In such cases, the resultant inequality is not a violation of impartiality, but a consequence of considering each person's claim seriously.

RÉSUMÉ :

Dans le cas d'une pandémie, il est possible que la demande pour des vaccins excède l'offre. Une proposition concernant la distribution des vaccins est d'employer une loterie, afin de donner à tous les citoyens une chance égale soit de recevoir le vaccin (McLachlan) soit de survivre (Peterson). Toutefois, l'accent mis sur une stricte égalité peut produire des résultats gravement sous-optimaux. Je soutiens que l'exigence de traiter tous les citoyens de manière impartiale ne doit pas forcément être interprétée comme une exigence d'égalité des chances, particulièrement en ce qui concerne des citoyens qui sont dans des situations différentes. En supposant que nous voulons sauver des vies, nous devrions également viser à employer les vaccins de manière efficiente, dans la mesure où cela demeure compatible avec l'enjeu d'égalité. Ainsi, notre distribution du vaccin devrait tenir compte de (i) différents degrés de besoin et/ou (ii) des effets sur la production du vaccin. Bien que de telles politiques risquent de conduire à une inégalité des chances, elles peuvent néanmoins améliorer les chances de tous. Dans de tels cas, l'inégalité qui en résulte ne va pas à l'encontre de l'impératif d'impartialité, mais découle plutôt d'une considération sérieuse de la demande de chacun.

Questions about equality in healthcare provision are particularly urgent when we consider an emergency situation, such as an influenza pandemic. In such an event, demand for vaccines would exceed supply, at least in the short term. While it has been suggested that the state's primary responsibility should be to reduce the need for rationing (Wynia 2006, p. 6), this is not always possible. We cannot predict what diseases, or strains of diseases, will break out in pandemics and we cannot stockpile vaccines for all possible eventualities. This raises questions as to how the limited vaccine stock should be distributed consistently with the state showing equal concern and respect for all of its citizens.[1]

There are many possible principles for allocating scarce vaccines (Verweij 2009). One common response in pandemic planning is to draw up a hierarchy of priority groups. There is some debate as to whom is appropriately given priority. Many such plans aim to maximize the numbers of lives saved. However, other priority orderings are possible. For instance, it can be argued that it makes more sense to target the young, rather than the old, as this would save more life years (Emanuel and Wertheimer 2006). Others reject most forms of maximizing, arguing that such priority lists fail to show equal concern for everyone. Two authors in particular have argued that, in the event of vaccine shortages, the state should allocate vaccine through some form of lottery (Peterson 2008; McLachlan 2012). I will not attempt to address the fundamental question of what makes a lottery fair, which has been debated extensively elsewhere (Broome 1991; Sher 1980; Stone 2007; Saunders 2008; Vong 2015). For present purposes, I simply assume that a lottery is sometimes a fair way to distribute resources, such as doses of vaccine, when there is not enough for everyone. However, "use a lottery" is not itself a complete answer, but opens further questions as to how the lottery should be conducted.

Martin Peterson (2008) argues, on consequentialist grounds, for a lottery giving different people different chances of receiving a dose of vaccine in order to equalize their chances of survival. Thus, those who would be at greater risk of dying without any intervention are given a greater chance of getting the vaccine, so that their chances of dying are the same as everyone else's (or as close as possible to it). In contrast, Hugh McLachlan (2012, 2015) defends an equal-chance lottery on nonconsequentialist grounds, arguing that this satisfies the state's duty to treat all citizens impartially.[2] Though they concern themselves with different goods (respectively, chances of surviving and chances of getting an effective dose of vaccine) and base their arguments in different moral frameworks (prioritarian consequentialism and nonconsequentialist impartiality), both authors suggest that all citizens deserve an equal chance of receiving the good in question.[3] Both appear to assume that the state's giving equal or impartial consideration to all citizens requires giving them equal chances of something. In Peterson's case, this is more complicated, since he justifies equal chances on the basis that this brings about the best overall consequence. However, it appears that his "chance-prioritarianism" can be understood as an attempt to show equal concern for all individuals, since each individual's chances matter equally (for a given chance).

I agree that the state ought to show equal or impartial concern for all of its citizens. My argument here is that this equal consideration need not lead to giving them equal chances, either of surviving or of getting an effective dose of vaccine. Sometimes we may distribute vaccine (or chances of getting it) such that some people end up with a greater chance than others. This need not be due to objectionable partiality towards some particular group, for it need make no reference to categories such as age, race, or sex.

I consider two examples, each of which presents a plausible case for distributing chances unequally. First, there are cases where some individuals need more vaccine than others. In such cases, we might face a choice between treating one person who needs more of the vaccine or two others who need less.[4] To give everyone an equal chance, by tossing a coin, does not obviously give due consideration to each person involved. It has been argued elsewhere that, if we consider each person's claim equally, then the two should have a greater chance than the one (Kamm, 1985). The requirements of equal consideration in such cases are contested, though. Hence, I introduce a second case, where giving one person a greater chance of getting the vaccine increases everyone's chances of survival. (The particular example is one where prioritizing someone working in the pharmaceutical industry can increase vaccine production.) Giving this person priority is unfair, for the one has no special claim to better prospects than anyone else. Nonetheless, if it does not harm—and actually increases—everyone else's prospects, then it seems like good policy. This can be justified in a way similar to the difference principle (Rawls 1999), which is itself intended to reflect equal concern for all while recognizing that there is nothing to be said for making everyone worse off (Parfit 1997).

While Peterson and McLachlan may be right to reject a policy seeking to maximize the number of lives saved, on the grounds that this will be unfair to some, it does not follow that we should give everyone equal chances. Impartial consideration is compatible with taking efficiency into account, even if the results are contrary to strict equality.[5]

EQUAL CHANCES AND UNEQUAL NEED

McLachlan argues that the state has a special duty of care towards public healthcare providers, who undertake risks at its behest, which justifies giving them priority. But, with this exception, he suggests that other citizens should be given equal chances of receiving an effective dose of vaccine: "If there is not sufficient vaccine to give all other citizens equally an effective dose, the state should give them all an equal chance of receiving an effective dose… This would be the just thing to do because the state has a duty to treat each and all of its citizens impartially and they have a corresponding right to such impartial treatment" (McLachlan 2012, p. 318). This duty of impartiality, he claims, acts as a constraint on state policy and may prevent it from maximizing the number of lives saved. However, it is not obvious that impartiality always requires equal chances, particularly when individuals are differently situated.[6]

Consider a small-scale example that may illustrate this point. Suppose that Alpha is very sick and needs 100 mL of vaccine, while Beta and Gamma have been exposed to the virus but are not yet sick and need only 50 mL of vaccine each as a prophylactic. Suppose further that, as it happens, there is exactly 100 mL of vaccine available. This would be enough to cure either Alpha alone or both of Beta and Gamma. Assume that giving 50 mL to Alpha will produce no benefit whatsoever; it is simply not an effective dose for her. How should one distribute the vaccine in such circumstances?

Though he does not discuss such cases, McLachlan (2012, p. 318) proposes "the random selection of names." That is, we could put the three names into a hat and draw one out to decide who gets the vaccine, thereby giving everyone a one-in-three chance of getting an effective dose. However, note that if either Beta or Gamma is drawn, there is still enough vaccine left to treat the other. Thus, it would be possible to treat both Beta and Gamma, should either one's name be drawn, but this means that they each effectively have twice the chance of Alpha.

Option 1

Name drawn	Probability	Outcome
Alpha	1/3	Alpha is treated. No vaccine left over.
Beta	1/3	Beta is treated. Leftover vaccine used to treat Gamma too.
Gamma	1/3	Gamma is treated. Leftover vaccine used to treat Beta too.

If the aim is to give all citizens an equal chance of getting the vaccine, in the name of impartiality, then this policy is no good.

One possible solution is to say that any leftover vaccine should be wasted. If Beta is selected by the lottery, then Beta—and Beta alone—should be vaccinated. Though there is also enough vaccine left over for Gamma, it would be unfair to vaccinate her too, for she was in the lottery and lost.

Option 2

Name drawn	Probability	Outcome
Alpha	1/3	Alpha is treated. No vaccine left over.
Beta	1/3	Beta is treated. Leftover vaccine is wasted.
Gamma	1/3	Gamma is treated. Leftover vaccine is wasted.

However, the idea that impartiality requires wasting potentially life-saving vaccine seems counterintuitive. The state has a duty to protect all of its citizens. Impartiality matters where it cannot protect all and must therefore choose which citizens to vaccinate, but it would be perverse if it were to discard vaccine simply because it cannot vaccinate everyone. If that were the preferred option, then,

presumably, there would be no need for a lottery to begin with; the state might simply discard all of its vaccine and vaccinate nobody. This might be the fairest solution (Broome 1991, p. 95; cf. Lazenby 2014, p. 335–336), since it guarantees that all citizens get nothing. However, our rejection of this solution shows that we care not only about equality but also about the saving of lives (Piller 2017, p. 215).[7] Thankfully, there is another possibility. Once it is realized that Beta and Gamma can be treated together, they could be given a single lottery ticket. Thus, we can increase everyone's chance of getting vaccinated (from 33 percent to 50 percent) and avoid waste at the same time.

Option 3

Name drawn	Probability	Outcome
Alpha	1/2	Alpha is treated. No vaccine left over.
Beta and Gamma	1/2	Beta and Gamma are treated. No vaccine left over.

This proposal gives everyone the greatest equal chance of vaccination (Hirose 2007). While Beta and Gamma had a greater chance under option 1, this came at the expense of inequality, in the form of a much lower chance for Alpha. Note also that, while this particular example concerns only a two-against-one conflict, the same logic would apply in more extreme cases. For instance, suppose Alpha needed 500 mL of the vaccine, while ten other people each needed 50 mL. Again, giving everyone the greatest equal chance of receiving an effective dose of the vaccine would mean, in effect, tossing a coin between Alpha and the other ten.

It is not clear what Peterson's recommendation would be here. First, it depends on how much priority was assigned to the worse off.[8] Option 1 gives Alpha only a one-in-three chance of survival, whereas Beta and Gamma each have a two-in-three chance of survival, because both of them can be rescued together. Option 3 would increase Alpha's chances, from one in three to one in two, but both Beta and Gamma would see their chances fall, from two in three to one in two. Prioritarianism tells us that more weight, or value, should be given to the prospects of the worse off (Alpha). Thus, if the choice were simply between Alpha and Beta, prioritarianism would recommend reducing Beta's chances of survival in order to increase Alpha's (up to the point at which Alpha is as well off as Beta). However, whether it is worth reducing the chances of two people (Beta and Gamma) by one in six in order to increase Alpha's chances by one in six depends on how much priority Alpha is given. If we give only very weak priority to Alpha, then her gain may not be enough to outweigh the gain to Beta and Gamma. Second, it is unclear whether (priority-weighted) chances are the only good to be considered in Peterson's consequentialist framework, or whether they must be balanced against conventional utility when the best overall consequences are being determined. If the latter, this would be a further reason to favour policies saving more people.

Given the indeterminacy of Peterson's proposal in such cases, the immediate discussion will focus primarily on McLachlan (though some of the later discussion is relevant to Peterson too). McLachlan does not explicitly discuss cases such as these, where there are differing levels of need. It is possible that he might consider need a relevant difference between individuals, thereby justifying differential chances. However, if this were so, then it might be justifiable to aim at maximizing the number of lives saved, and McLachlan clearly rejects this. He explicitly accepts that impartial treatment of all citizens might result in worse outcomes (2012, p. 317). Thus, it seems likely that he would favour option 3 over either option 1 (which gives some better chances than others) or option 2 (which, by being wasteful, is worse for everyone).

If this is McLachlan's position, this is interesting, since this has not been a popular solution to the analogous "numbers problem" posed by John Taurek (1977), in which a rescuer must choose between saving one person or two others. While consequentialists take the solution to be obvious (save the greater number), most nonconsequentialists who have considered this problem also think that numbers matter in some way. Some have sought to argue for a policy of saving the greater number on nonconsequentialist grounds (Scanlon 1998, p. 229–241; Hirose 2004), while others have advocated weighted lotteries that give larger groups a greater chance of rescue (Timmermann 2004; Saunders 2009). There are some who defend positions close to this, though few, if any, hold that groups of unequal sizes must be given equal chances. Taurek (1977, p. 306) suggests that, when faced with a choice between saving one person or five others, then, other things being equal, he would give each an equal chance by tossing a coin. However, he does not argue that this is obligatory; since he thinks it permissible to save either group, it could be that he considers the situation to be like that facing Buridan's ass. Other authors argue that tossing a coin is better than a weighted lottery (Hirose 2007; Huseby 2011), but they generally think that saving the greater number is better still (Hirose 2004; Huseby 2012). Broome (1998) argues that tossing a coin between groups of different sizes may be fair, because it gives everyone an equal chance of survival, but denies that this is what must be done all things considered, since sometimes (in his view) the extra value of saving more lives, without a lottery, outweighs the unfairness of doing so. Hence, if this is McLachlan's position, it is not a popular one, even among nonconsequentialists.

While I cannot review all of the now-extensive literature on this "numbers problem" here, it should be noted that the various solutions proposed can be (and often are) defended as alternative interpretations of equal or impartial concern for all involved. For instance, Frances Kamm (1985) and Jens Timmermann (2004) have each defended proposals analogous to option 1 here. Though this proposal does mean that some will have a greater chance of being saved than others, it can be seen as giving each an equal "baseline chance" (Kamm 1985, p. 185). Circumstances may be such that, after Beta has been picked, it is still possible to save Gamma, but this does not necessarily justify depriving Gamma of her own independent chance. Scanlon (1998, p. 232) claims that Gamma could

reasonably reject any procedure for vaccine allocation that effectively ignores her presence by treating the choice between Alpha on the one hand and Beta and Gamma on the other the same as a choice simply between Alpha and Beta.[9]

To settle on the best account of impartial treatment in such cases is beyond the scope of the present article. My aim is simply to point out that the requirements of impartiality are hotly contested. Moreover, one cannot simply assume that impartial treatment will result in people getting equal chances of vaccination (as McLachlan does) or equal chances of survival (as Peterson does). We might arrive at unequal chances without showing any partiality for particular individuals.

FURTHER OPTIONS

Continue to assume that we have 100 mL of vaccine, all of which Alpha needs, but which is also enough to treat both Beta and Gamma. Since there is enough for Beta and Gamma, there is at least a prima facie case for treating this as two 50 mL doses of vaccine, though it happens that Alpha needs a double dose. It is not obvious that Alpha's chances of getting a double dose should be equal to Beta's chances of getting one dose. We might, instead, implement a two-stage procedure.

Option 4

Allocate the first dose by lottery, giving each person a one-in-three chance of receiving it. Then allocate the second dose by lottery, between those still in need. This means that if either Beta or Gamma won the first lottery, they would no longer be in need and the second lottery would be fifty-fifty between the remaining two. However, if Alpha won the first lottery, she would still be in need, so the second lottery would also give each of the three a one-in-three chance to receive the second dose.

Alpha will survive only if she wins both lotteries, so her chance of survival is one in nine. Beta and Gamma are symmetrically situated, and each have an eleven-in-eighteen chance of survival.[10] In this case, the chances of Beta surviving are over five times greater than the chances of Alpha surviving, even though they each were given an equal chance to get each dose of drug that they needed.

One oddity of this policy is that it might give Alpha the second dose of the drug, even when she did not win the first, even though this is (by hypothesis) useless to her. Thus, this policy is wasteful, by which I mean not simply that it does not maximize the number of lives saved, but that it may give one (and only one) dose of vaccine to Alpha, though this will do no good. To illustrate this, suppose that Gamma wins the first dose. In this case, we may think that there is no point in holding a second lottery. Though Alpha and Beta are both still needy, the remaining dose is no use to Alpha, though it would save Beta. Hence, we might prefer a policy that avoids this waste, which I call option 5.

Option 5

Allocate the first dose by lottery, giving each person a one-in-three chance of receiving it. If Alpha wins the first dose, then allocate the second dose by lottery, giving each person a one-in-three chance of receiving it. However, if Beta wins the first lottery, give the second dose to Gamma, since it is no use to Alpha. And, conversely, if Gamma wins the first lottery, give the second dose to Beta.

Again, Alpha gets the two doses needed only if she wins both lotteries, which is a one-in-nine chance. Here, however, Beta and Gamma have even better prospects, since there is no danger of wasting the second dose. Their chances of survival are now seven in nine, since Beta will certainly be saved either if she wins the first lottery (one in three) *or* if Gamma wins the first lottery (one in three) *or* if Alpha wins the first lottery but she (Beta) wins the second lottery (one in nine).

Compared to option 4, this option is what economists term a "Pareto improvement." It is no worse for anyone—Alpha's chances of survival are not reduced—but this option improves the prospects of both Beta and Gamma. It does this by eliminating the chance of wastefully giving the second dose to Alpha in cases where she did not win the first dose (this does not make Alpha worse off, in terms of health outcomes). Note, however, that this is not simply a maximizing strategy; while Beta and Gamma each enjoy a greater chance of survival than Alpha, they are not automatically saved. Furthermore, option 5 still involves some risk of the *first* dose being wasted, since Alpha may win that but not the second. Since this is still wasteful, we might prefer a policy that avoids this too.

Option 6

Allocate the first dose by lottery, giving each person a one-in-three chance of receiving it. If Beta wins the first dose, then give the second to Gamma, and vice versa. So far, this is the same as option 5, but, if Alpha wins the first dose, then give her the second dose too, in order to avoid waste. (This is option 1 from the previous section.)

Here, Alpha has a one-in-three chance of survival, whereas Beta and Gamma each have a two-in-three chance of survival (because if either of them wins the first lottery, then, in effect, they both win). This is better for everyone than option 4 is; however, for Beta and Gamma it is worse than option 5. Even though it is more efficient, by reducing any chance of waste, their chances of survival are reduced from seven in nine to six in nine. However, this loss is necessary in order to improve Alpha's chances of survival. Furthermore, Beta and Gamma are still twice as likely to survive as Alpha is. This itself might be thought objectionably unfair. There is, however, another policy option that gives all three an equal chance of survival.

Option 7

Since giving the first dose to Beta will mean giving the second to Gamma, and vice versa, they can effectively "share" chances (cf. Hirose 2007, p. 50). Thus, allocate both doses together, giving a 50 percent chance to Alpha and a 50 percent chance to Beta and Gamma. (This is option 3 from the previous section.)

This way, everyone has a 50 percent chance of survival (or of receiving an effective dose of vaccine). Furthermore, no vaccine is ever wasted, unlike in options 4 and 5. However, this option is inefficient when judged on the expected consequences, for the expected number of lives *lost* is 1.5, and it can also be argued that it is unfair to Gamma, since her presence makes no difference to the procedure (Scanlon 1998, p. 232).

This is not an exhaustive list of options. Two others worth mentioning are (i) a policy that aims to maximize the total number of lives saved by giving the vaccine to Beta and Gamma without a lottery and (ii) a policy that gives the drug to no one, which would be perfectly equal but highly inefficient. Since these can be taken to represent opposing ideals—one giving absolute priority to efficiency over equality, and the other absolute priority to equality over efficieny—they are useful options to consider. I label the maximizing policy option 8 and the policy of leaving everyone to die option 9.

These six policies, along with their consequences, can be summarized as follows. For ease of comparison, I have expressed each person's chance of survival in eighteenths, even though some fractions could be simplified (e.g., six eighteenths to one third).

COMPARISON OF OPTIONS 4 THROUGH 9

Policy	A's chance	B's chance	C's chance	Inequality?	Wasteful? (Probability)	Expected deaths
Option 4	2/18	11/18	11/18	Y	Y (5/9)	1.67
Option 5	2/18	14/18	14/18	Y	Y (2/9)	1.33
Option 6	6/18	12/18	12/18	Y	N	1.33
Option 7	9/18	9/18	9/18	N	N	1.5
Option 8	0/18	18/18	18/18	Y	N	1
Option 9	0/18	0/18	0/18	N	Y (1)	3

If our *only* concern were fairness or equality, then we might choose option 9, though it is highly suboptimal (everyone dies). Assuming that we wish to save lives, we should seek an option that saves as many lives as possible consistent with impartial treatment. McLachlan (2012, p. 318) agrees with this, though he thinks impartial treatment precludes option 8. As we saw in the previous section,

McLachlan might endorse what is here option 7, since this gives each person the greatest chance of receiving an effective dose of vaccine compatible with everyone else receiving the same chance. However, while this is egalitarian and does not involve gratuitous waste, it also involves more expected deaths than either option 5 or option 6. Thus, if our aim is indeed to save as many lives as we can, consistent with impartial treatment, we ought to consider whether either of these options is consistent with impartiality.

I think a case could be made that option 5 reflects impartial concern for all, since it gives each person who can potentially benefit from a dose of vaccine an equal chance of receiving that dose. (Thus, Alpha gets a chance of receiving the first dose, but no chance of receiving the second if she did not get the first, as then she can no longer benefit.) However, Alpha might object that requiring her to compete for each dose separately results in her having a *much* lower chance of getting the vaccine that she needs than either Beta or Gamma. Holding separate lotteries might be said to exacerbate her initial misfortune in needing more.

It is not clear whether the same objection can be made to option 6 though. Here, the first dose is allocated via an equal-chance lottery, then the second dose allocated in whatever way avoids waste (which means it goes to Alpha if she won the first lottery, but not to her if she did not). To be sure, her chances of getting an effective dose are lower than the chances of Beta and Gamma doing so, but it could be argued that this reflects their lesser need, rather than partiality in the system.[11] While Alpha's disadvantage could be mitigated, by the adoption of option 7, we have already seen that this option could be criticized for failing to show proper concern for Gamma (Scanlon 1998, p. 232). Though a weighted lottery has the effect that some are more likely to survive than others, it can also be seen as showing impartial concern for each individual.

I do not propose to settle, here, the best interpretation of impartiality. My argument, thus far, is merely that this is more complex and contested than McLachlan's references to equal chances would have us believe. Indeed, showing impartial (or equal) concern for everyone does not necessarily require giving them equal chances of anything. It may be that equal concern leads to unequal outcomes. We might read McLachlan's proposal to prioritize healthcare workers as a tacit admission of this point, though it is not clear to me whether he takes this to be compatible with impartial treatment or a justifiable departure from impartiality. In any event, there are other cases where it seems we might want to depart from strict equality or impartiality. An obvious example is where an unequal distribution would make everyone better off.

IMPARTIALITY AND FECUNDITY

In the previous section, I posited a natural inequality (in need) and illustrated how this may result in reasonable disagreement about the requirements of equal consideration. In this section, I wish to consider a different complexity—a case where bestowing the vaccine on one person increases the chances that others

can benefit. I call this fecundity, since one benefit produces further benefits. For example, suppose that Alpha is involved in the pharmaceutical industry in the manufacture of vaccines. If Alpha receives an effective dose of vaccine, then the supply of vaccine will be increased. In such circumstances, it may be reasonable to give Alpha a greater chance of getting some of the initial vaccine, because doing so need not reduce—and may increase—everyone else's chance of getting the vaccine.

Suppose we have ten individuals, labelled Alpha through Kappa, and two doses of vaccine. With no relevant differences among individuals, it would seem reasonable to allocate the vaccine randomly, giving an equal chance (20 percent) to each individual. But what if Alpha works in the manufacture of vaccine? Let us suppose that if she receives one of the two initial doses, whether as a result of a lottery or not, then she can produce two further doses, which can be randomly allocated among the remaining individuals. Should this alter our distribution and, if so, how?

Option 10

One option is to say that Alpha should not enjoy any special privilege as a result of her occupation. She is no more likely to be exposed to infection than anyone else, so Peterson's proposal that those at greater risk should have greater chances of getting the vaccine, in order to equalize their chances of survival, does not apply. Similarly, McLachlan's suggestion that the state must protect those health-care workers who assume risk in their occupation does not apply. Thus, it may seem that Alpha should not enjoy any greater chance of receiving the vaccine than anyone else, even though giving her a greater chance could result in more lives saved. This option looks, at first sight, as though it would treat others unfairly.

However, first appearances are deceptive here. Suppose that one refuses to give Alpha any special privilege and runs the lottery as before, giving each individual a 20 percent chance of survival. In this case, Alpha has a 20 percent chance of survival, but the others actually have a greater chance of survival. Since the other nine individuals are identically situated, it will suffice to consider only Beta. Beta, like Alpha, has a 20 percent chance of receiving one of the two initial doses of vaccine. However, Beta also has an additional chance of being saved because, if Beta does not receive one of the initial doses, but Alpha does, then Beta might receive one of the two additional doses that Alpha will produce.

There is an 80 percent chance that Beta will not get one of the initial doses. In two ninths of those cases, where Beta does not get a dose, Alpha does.[12] There is an almost 18 percent (sixteen-in-ninety) chance that Alpha will get a dose and not Beta. In these cases, there will then be two extra doses and eight people still in need. So, in these cases, Beta will now have a one-in-four (25 percent) chance of getting one of these extra doses. That means that Beta enjoys an extra four-in-ninety chance of survival. Therefore, her overall chances of survival are

twenty-two in ninety, which is higher than Alpha's eighteen-in-ninety chances because, self-evidently, Alpha can never be the one to benefit from her producing the extra vaccine.

This seems unfair. While each individual receives the same 20 percent chance of getting one of the *initial* vaccine doses, Beta has a greater chance of receiving a vaccine dose than Alpha, because Beta gets a second chance to benefit if Alpha survives. Refusing to give Alpha any extra chance not only reduces the overall good that can be done, but also consigns her to a lower chance of survival than anyone else. Even if our aim is merely to give everyone an equal chance of receiving an effective dose of vaccine, we might seek to "compensate" Alpha for this, by giving her a higher chance of getting one of the initial doses. Doing this has two benefits. First, we can give Alpha the same chances of survival as everyone else. Second, by making it more likely that Alpha survives—and hence more likely that the two additional doses of vaccine are produced—we make it more likely that more lives are saved.

Option 11

Alpha is given a 25 percent chance of receiving one of the two initial doses of vaccine. The other nine have their chances of receiving one of these doses reduced accordingly (to 19.44 percent). However, while Beta has a lesser chance of getting one of the *initial* doses, she is more likely to benefit from a second chance, because it is more likely that Alpha will survive. In fact, Beta's overall chances of survival also come to 25 percent, the same as Alpha.[13]

This option rectifies the inequality in option 10 by increasing Alpha's chances of getting one of the initial vaccine doses. Further, because this also increases the probability that Alpha can produce additional vaccine, it actually increases everyone's chances of survival. True, Beta's chances are not increased to the same extent as Alpha's. Beta sees an increase only from 24 percent to 25 percent, while Alpha's chances increase from 20 percent to 25 percent. But this is because Beta already enjoyed a greater chance than Alpha in option 10 (24 percent as opposed to 20 percent), which is precisely what seemed unfair about it. Option 11 redresses this inequality without making Beta and the others worse off. Presumably, then, all ten individuals involved would prefer option 11 to option 10, since it increases their chances of survival.

I assume that both Peterson and McLachlan would prefer option 11 to option 10. Whether we are concerned with equalizing individuals' chances of survival or their chances of getting an effective dose (which, given my simplifying assumptions, amount to the same thing here), option 11 results in equal chances. The lesson, however, is that we might have to weight the lottery, giving some more chance than others of winning the lottery, in order to equalize everyone's chances of getting the vaccine. We cannot simply assume that an equiprobable lottery gives each person the same chance of receiving the vaccine when the outcome of the lottery also influences how much vaccine is available.

However, while option 11 is an improvement on option 10, it is not the best that we can do from the point of view of efficiency. Since giving one dose to Alpha will result in two additional doses, more than replacing what was used, it is possible to increase everyone's chances still further.

Option 12

Give the first dose to Alpha, without a lottery. Allocate the other of the initial doses, and the two extra doses produced by Alpha, by lottery, giving each of the other nine individuals an equal chance. Allocating three doses between nine people means that each has a one-in-three (33.33 percent) chance of receiving a dose of vaccine.

If we do this, then there is a further Pareto improvement: everyone's chances of survival are increased. However, once again, Alpha enjoys a larger share of the benefit than the other nine. The result is that we depart from the equality of option 11. In this case, Alpha receives the vaccine for certain, which makes her much more likely to benefit than anyone else. The fact that Alpha's survival is instrumentally useful does not give her any greater claim to the vaccine, though. Thus, while it may be rational for all involved to consent to Alpha receiving one of the initial doses, it is nonetheless unfair (Broome 1991). It is an unfairness that we should almost certainly tolerate, since it increases everyone's chances of receiving the vaccine, so to insist on equality would represent a particularly harsh form of levelling down (Parfit 1997, p. 211). If we are prepared to compromise equality for the sake of efficiency by allocating the vaccine by lottery in the first place, rather than giving it to no one, then we ought also to prioritize efficiency here.

In fact, Peterson seems clearly committed to this conclusion, since he rejects equality as a moral ideal, on the grounds that it may require levelling down, and instead endorses a form of prioritarianism (2008, p. 324–325). According to prioritarianism, a benefit of given magnitude produces more moral value when given to someone who is worse off than someone who is better off. This diminishing marginal value of benefits favours an equal distribution of benefit where the total amount of benefit is fixed and benefits can be reallocated without cost. For example, the prioritarian will think a world where everybody has $10 better than a world where half have $5 and half have $15, because giving $5 to the poorer people produces more moral value than is lost when it is taken from the rich. However, the prioritarian denies that there is any gain to be had by making the rich poorer. If we were unable to make the poor any better off, but we could reduce everyone to having $5, then those who value equality as such seem committed to thinking that this would be in one respect good, since it would be more equal (Parfit 1997, p. 210–211). The prioritarian, in contrast, thinks that this would be an unmitigated loss.[14] Though we are presently concerned with distributing (chances of getting) a vaccine, rather than money, the same is true here. There is simply nothing to be gained from making the better off (Alpha) worse off, if we cannot thereby improve the lot of the worse off.

McLachlan's attitude is harder to predict. On the one hand, McLachlan is clearly committed to the value of equality, even when it results in more deaths (McLachlan 2015, p. 193). On the other hand, his case for giving everyone equal chances is that the state ought to treat its citizens "the same in relevant respects *unless there are relevant reasons for treating them differently*" (McLachlan 2012, p. 317, emphasis added). When he introduces priority for frontline healthcare workers, he refers to there being "at least one relevant reason for treating some citizens differently" (McLachlan 2012, p. 318)—namely, the fact that their occupation puts them in danger. This reason does not extend to those whose work involves production of vaccines who, I assume, are at no greater risk of infection than anyone else. Nonetheless, it is possible that the case I am considering, in which giving Alpha priority benefits everyone else, represents another relevant reason to depart from equal chances. Further, he suggests that, "if all rational people could be expected to favour a particular policy [this] might be an indication that a policy is impartial" (McLachlan 2015, p. 194), though he suggests that this may be neither necessary nor sufficient to establish impartiality.

I would suggest that, if we find ourselves in these circumstances, we ought to favour option 12. If we take the perspective of those involved, then what they care about is maximizing their own chances of survival. They ought not to care what chances others have, except insofar as those chances affect their own chances. (Indeed, if anything, they ought to welcome more others surviving along with them.) It would not help Beta to reduce Alpha's chances of survival if this did not increase Beta's chances, and this is true *a fortiori* where Beta's chances are actually lessened. To reduce everyone's chances for the sake of equality would be to make a fetish of equality. The only reason to care about equality is that we are distributing a good, hence people should prefer inequality if it means more of that good for all.

This situation is similar to Rawls's famous original position (Rawls 1999, p. 15–19). Here, Rawls assumes that parties are concerned only with their absolute position and not with how they stand relative to others. Thus, he proposes that they would reject strict egalitarianism in favour of the difference principle, which permits inequalities that benefit all (*ibid*, p. 65–73).[15] Rawls intends the difference principle to apply to the basic structure of society and only to certain goods (*ibid*, p. 6–10). Nonetheless, my proposal is an application of similar reasoning to the problem at hand. That is, I suggest that vaccine ought to be distributed equally unless an unequal distribution benefits everyone. This policy satisfies the requirement to treat everyone impartially. It explains why we should prefer allocating effective doses of vaccine by lottery to giving everyone an equal but ineffective share of the vaccine. And it also tells us that if prioritizing Alpha improves everyone's chances of survival, this is what we should do.

Note that, while I have focused on what might be termed a "positive" case—where there is a reason to prioritize Alpha because she can produce more vaccine and thereby increase the number of people vaccinated—there is also a parallel

"negative" case for prioritization, where leaving someone unvaccinated would increase danger to others. Some groups may be more likely to spread infection than others. For example, the homeless—because they are more likely to move around—may increase risk to others (Buccieri and Gaetz 2013, p. 189–190). Suppose we have five individuals, each of whom has an equal chance of being one of three who will be infected, but we have only one dose of vaccine. Allocating that vaccine by lottery gives each person a 20 percent chance of protection and a 48 percent chance of being infected without vaccination. But now change our assumptions. Suppose that if we were to give the vaccine to Delta, a homeless person, the spread of disease would be reduced and only two people would be infected. The other four would be denied the vaccine, but their chances of infection would be reduced to 40 percent.[16] Again, it would be rational for all to agree to this prioritization, since everyone's chances of avoiding infection would be increased. To be sure, Delta may seem a less "worthy" candidate for prioritization than Alpha, because Delta exposes others to risk, rather than providing protection. The homeless, like many other at-risk groups, are stigmatized, and this may affect public attitudes towards such prioritization (Kaposy and Bandrauk 2012). However, statistically, the cases are equivalent. More people will contract infection if Alpha (in the first example) or Delta (in the second example) is not vaccinated. The case for prioritizing them has nothing to do with their moral worth or desert, but simply with the fact that giving them the vaccine improves everyone else's chances.

The lesson, I suggest, is that equal consideration of everyone does not necessarily mean giving everyone equal chances. As pointed out above, giving everyone equal chances is compatible with giving everyone zero chance, but this would be equal neglect, rather than equal concern. If we are to show not only equal but also *maximal* concern for each person, then we ought to favour increasing each person's chances of survival, whenever it is possible to do so consistent with similar concern for others.

It might be worried that this would inevitably lead to a form of consequentialism according to which we ought to show equal concern and respect for all by maximizing the number of lives saved (other things being equal).[17] This is not so. I believe that consequentialism is best understood as offering another interpretation of impartial concern for all. However, consequentialists focus on the good of all as a collective, rather than on the good of each.[18] Thus, they ignore the separateness of persons (cf. Rawls 1999, p. 23–24). If one focuses only on maximizing total prospects of survival, then it makes no difference whether we increase Alpha's chances or Beta's. The impartial consequentialist is indifferent between giving them each a 50 percent chance, on the one hand, and giving Alpha a 100 percent chance and Beta no chance at all, on the other. Moreover, consequentialists would prefer a world in which Alpha has a 90 percent chance and Beta a 20 percent chance, since it increases the overall good. However, the distribution of chances does matter to the individuals concerned. If Beta's chances are reduced from 50 percent to 20 percent, it is no compensation to her that Alpha enjoys a greater increase, from 50 percent to 90 percent.

Thus, Beta may have reasonable grounds to reject a principle that treats this simply as an improvement. Perhaps there is a point at which Beta ought to accept a loss because what others have at stake is greater. For example, maybe Beta should accept her chances being reduced from 50 percent to 49 percent if we can thereby increase Alpha's chances from 50 percent to 99 percent. But Beta is not required to be perfectly indifferent between her own chance to receive the vaccine and Alpha's. Hence, we might reject consequentialism as failing to show due concern for each person.

A rejection of consequentialism should not, however, be confused with a rejection of efficiency. The difference between consequentialists and nonconsequentialists is a difference about *why* particular choices are right or wrong (McLachlan 2015, p. 193). In very many cases, they agree about what is right or wrong. Thus, we should not assume that any policy aiming to maximize the number of lives saved is necessarily consequentialist and reject it for that reason. Peterson (2008) demonstrates that not all consequentialists will favour maximizing the number of lives saved. Conversely, some nonconsequentialists may favour a policy that seeks to maximize the number of lives saved (Scanlon 1998). As long as everyone stands to benefit from the adoption of this policy, even if not necessarily benefiting equally, it may be that this is what would follow from a nonconsequentialist approach to morality, such as Scanlonian contractualism.

CONCLUSION

I do not offer a complete policy recommendation for allocating vaccines. My point is merely that the proposal to give "equal chances" to everyone is not as simple or as appealing as it first appears. Any policy will have to be sensitive to differences, in need and productive capacity, between people. Otherwise, what initially looks like equal chances might turn out to give some people a much greater chance of survival than others. However, once these considerations are admitted as relevant, we face a question as to how they ought to be balanced against equality. I have tentatively suggested that we ought to prefer unequal situations when everyone is better off. To privilege a strictly equal allocation here, by passing up opportunities for Pareto improvements, is to engage in levelling down. Thus, while I believe that policymakers should show equal concern for all citizens, I suggest that this may permit, or even require, departures from equality in the distribution of (chances of getting) vaccine.

NOTES

[1] I confine myself to a case of a single state allocating doses of vaccine amongst its citizens (or residents). Given that a pandemic is likely to cross state boundaries, there are further questions about whether the state is justified in prioritizing its own citizens at all or whether it may be required to distribute vaccines to foreigners. I do not address these matters here, although I think there may sometimes be a case for giving vaccines to noncitizens/nonresidents.

[2] More precisely, McLachlan (2012, p. 318) suggests that the state should first of all prioritize public healthcare workers, and then give everyone else an equal chance of receiving an effective dose of the vaccine. It is not clear whether he intends this to extend to nonprofessional workers who support healthcare provision (see Draper et al. 2010). In any case, I set aside this qualification and focus only on the lottery stage.

[3] McLachlan (2015, p. 192–193) remarks, "The point is not to distribute the vaccine (or anything else) impartially or equally but to treat citizens justly. Citizens have a moral right to be treated impartially that corresponds to the moral duty of the agents of the state to treat them impartially." This sounds more hospitable to the claims made in this paper but, at least in his 2012 paper, he gave the impression that impartial treatment requires equal chances.

[4] Note that "needy" here refers only to how much vaccine each needs; they are no worse off in terms of the potential harms that they face, for they each will die if they do not get the vaccine that they need.

[5] My position is that the state owes citizens something like equal consideration or treatment as equals, but this need not require giving them equal amounts of anything, be it vaccine, chances of vaccine, etc. I believe this point is relatively familiar in discussions of distributive justice—besides Rawls (1999), see also Anderson (1999), Dworkin (2000), and Scheffler (2003). Thus, the novelty of the present paper lies not in making this general point, but in applying it to the allocation of vaccines and thereby challenging the assumption, common to Peterson and McLachlan, that citizens must be given equal chances of something.

[6] One might also make a stronger claim: that equal chances are not even *compatible* with impartiality, since using a lottery leads to unequal outcomes. Even though a lottery is fair in some sense, it generates outcome unfairness.

[7] Some, such as Hooker (2005, p. 340–341) and Saunders (2010, p. 45–49), suggest that fairness consists not simply in equal or proportionate satisfaction, but in greatest equal or proportionate satisfaction. On such a view, wasting vaccine is not merely suboptimal, but also unfair. On Broome's view, it is bad all things considered, because suboptimal, but not unfair.

[8] Peterson does not elaborate on the degree of priority to be given to the worse off. He argues (2008, p. 325) that prioritarianism requires equalizing chances, but this is only so in "zero-sum" contexts, where we can take some chance from one person and give it (the same amount) to another. It is not true where numbers are unequal (2008, p. 327), as in cases like the present one, where reducing Alpha's chances in favour of Beta and Gamma produces a higher overall total.

[9] Though, for objections to Scanlon's argument, see Lang (2005, p. 330) and Saunders (2009).

[10] This is the sum of (i) their chance of winning the first lottery (1/3), plus (ii) their chance of winning a second lottery when Alpha wins the first (1/9), plus (iii) their chance of winning a second lottery when the other of them wins the first (1/6). These can be converted into chances out of 18 as follows: 6/18 + 2/18 + 3/18, which sums to 11/18.

[11] There mere fact that Alpha has a lower chance of getting an effective dose does not show objectionable partiality. Suppose there were only 80 mL available. In this case, presumably we should toss a coin between Beta and Gamma, giving Alpha no chance (as to give her the vaccine would be wasteful). Here, Alpha would have no chance at all of getting an effective dose of

vaccine, but this is because of her greater need, rather than because the allocation is partial. A similar argument might be made on behalf of option 6. Alpha's lesser chance is the result of her greater need, not partiality.

[12] There are ninety possibilities in all (1/10 x 1/9). Each individual has an 18/90 chance of getting one dose, made up of the 9/90 chance of being drawn in the first lottery and the 9/90 chance of being drawn in the second. However, of the 18 cases in which Beta gets a dose, 2 also involve Alpha getting the other dose. Thus, the chance of Alpha getting a dose and Beta not is 16/90.

[13] Consider 144 possibilities. Alpha gets an initial dose in 36 out of 144 cases. Of the 108 out of 144 in which Alpha does *not* get one of the initial doses, Beta will get a dose in 24 of them (2 out of 9). Meanwhile, of the 36 where Alpha does get an initial dose, Beta gets the other initial dose in four of them (1 out of 9). These sum to give Beta a 28/144 (or 19.44 percent) chance of receiving an initial dose. Now consider the 32 cases where Alpha gets an initial dose, but Beta does not. In eight of these (one in four), Beta will get one of the extra doses. Thus, Beta's overall chances of survival increase from 28/144 to 36/144, or 25 percent.

[14] Matters are trickier where redistribution involves some loss. For instance, if we can go from $5 and $15 to $8 and $10. Here, taking $5 off the rich produces only a $3 gain for the poor and some loss (perhaps because higher taxes are a disincentive). Whether this is an all-things-considered moral improvement depends on how much priority is given to the worst off. Some prioritarians may favour this, while others may not.

[15] In canonical formulations, Rawls focuses on benefits to the worst off, but if the comparator is perfect equality, then we can benefit the worst off only by benefiting everyone. Rawls (1999, p. 72) also introduces a "lexical" interpretation of the difference principle, according to which we should allow Paretian benefits to the better off. If we follow this line, then we should accept a policy that increases the chances of some, provided that it does not diminish anyone else's chances. I thank an anonymous referee for pushing me on this point.

[16] Note that I am focusing on the chance of survival, rather than on the chance of receiving a dose of vaccine. McLachlan (2012, p. 318) argues that the state should concern itself with distributing vaccine, rather than chances of survival. However, this is criticized by Wardrope (2012), and McLachlan (2015, p. 192-193) seems to partly concede the point that vaccine is not an end in itself.

[17] The "consequentialism" that I am concerned with here is the traditional sort concerned with maximizing a sum of individual goods (e.g., welfare). There are other forms of consequentialism, such as Peterson's, that focus on other values.

[18] This is the mode of reasoning apparently underpinning the UK government's 2007 *Responding to Pandemic Influenza: The Ethical Framework for Policy and Planning*, which McLachlan (2012, p. 317) opposes.

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