ETHICS OF ALLOCATING AN ARTIFICIAL KIDNEY

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INTRODUCTION

More than 100,000 people in the United States await kidney transplantation, while 400,000 people live with end-stage kidney disease that requires hemodialysis, the most common treatment for advanced kidney failure. However, the kidney transplantation method is hindered by the scarcity of available donors and the increase of waiting times and patients' mortality while on the waiting list. Donor organ shortage and a permanent kidney replacement is now replaced with an artificial kidney made from biocompatible scaffolds in my ethical scenario. Artificial kidneys are a very beneficial innovation that are a great alternative to transplantation.

When it comes to ethical dilemmas such as deciding the allocation of treatments and services, my attitude is that if you can help someone in need, then you should. Analyzing the situation is what will help engineers to get through the process of making such difficult decisions.

MY ETHICAL SCENARIO

An 85-year old man is suffering from severe chronic kidney disease. Dialysis has not helped out because he does not have enough access ports since all of his veins have been used. His only option seems to be an artificial kidney transplant. A 45-year-old man is in the same condition.

My company has been waiting to successfully use its first artificial kidney formed from a biocompatible scaffold, so the company’s head, my employer, is ecstatic and wants me to sign off to give the artificial organ to the younger man because he has a better and longer chance of living in comparison to the older man. The transplant board at the hospital with which my company is connected has approved that the artificial kidney be used for the first time in a transplant. Another point to consider is that the artificial version of the kidney is very costly. I am stuck because I do not know how to decide between the patients since they are of different ages and there is only one artificial kidney at the moment.

TRANSPLANTATION AND ALLOCATION

Bioengineering is supposed to provide improved treatment for medical conditions and diseases. Kidney function can be replaced by either renal dialysis or transplantation. However, these methods are temporary, where transplanted kidneys have an average lifespan of about 10 to 12 years. An artificial kidney can replace those methods for a lifetime. [1] The kidney transplantation method is hindered by the scarcity of available donors and the increase of waiting times and patients’ mortality while on the waiting list. Chronic kidney disease is a health problem that affects 8-16% of the global population. It refers to the progressive deterioration of kidney function and can eventually lead to kidney failure and renal replacement therapy (RRT), which typically requires dialysis and kidney transplantation. A large proportion of the United States health care budget is taken by RRT. In addition, human dialysis results contribute to an annual mortality rate of 25%. [2]

Organ transplantation has been viewed as one of the greatest innovations in modern medicine, but 20% of recipients will experience acute rejection within 5 years of transplantation according to studies done by Dr. J. Song and his research colleagues. About 40% of recipients will die or lose graft or implant function within 10 years of transplantation. [3] These percentages should concern engineers since it is a problem that can be fixed with the creation and application of technology that we have access to and the ability to use. As regenerative medicine is heavily influencing research on kidney transplants, wearable or implantable artificial kidneys are in the process of development. They may be used for complete RRT, which would reduce morbidity and mortality in patients with acute or chronic kidney disease. Hemodialysis and peritoneal dialysis, which is a treatment for severe chronic kidney disease patients, are used in RRT, however it is not full RRT since it only replaces filtration function of the kidney, which is usually on an intermittent basis. Dialysis does not perform some of the most vital renal functions, so end-stage kidney disease patients continue to deal with medical, social, and economic issues. Patients would benefit significantly from an implantable artificial kidney that would raise life expectancy and mobility, and decrease costs and risk of infection. Such an approach could cure rather than just treat patients. [4]

These are all points that remind me what is at stake in the scenario and how helping at least one person could make all the difference. Allocation of organ transplants is more about helping others in need more than it is about who gets to have it done. My attitude, is that the more people we can help, the better. One point to be noticed is that “people who get kidneys from the waiting list are often close to death; healthier patients are left waiting”. [1] So, an artificial kidney could serve other patients who are unlikely to receive a real transplant.

MY POTENTIAL DECISIONS

If I decide to sign off the artificial kidney to the 85-year-old man, I might lose my job because I did not follow
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my employer’s direct orders. My employer is a well-known founder of the company, so losing the job would not look good on my resume to future employers. He is a powerful man who is held in high esteem by society, so my reputation may be ruined. If I decide to do the opposite of the previous situation by signing off the artificial kidney to the younger man, I will probably still be employed since I would have followed my employer’s instructions.

However, there would probably be other consequences. Depending on which patient we end up giving the artificial kidney to, the other patient may feel as if the decision was unjust and may sue our company. There might be an outburst in the news about this ethical problem since the allocation of organs for transplantation has been debated but sometimes overlooked.

Criteria for Allocation

According to the Center for Bioethics, there is a list of possible distributive justice criteria which includes the following: to each person an equal share, to each person according to need, to each person according to effort, to each person according to contribution, to each person according to merit, and to each person according to free-market exchanges. Another distributive justice criteria is equal access, which includes length of time waiting and age. Equal access distribution supporters think that “everyone should have equal access to organs because everyone could potentially benefit from the system.” [5] I believe this idea as well.

The general public’s organ distribution preferences given scenarios of two people in need of an organ transplant were swayed by a person’s good or bad lifestyle choices according to research in 2001. Another distributive justice criteria to consider is maximum benefit. Medical need and probable success of a transplant are examples of maximum benefit. The number of life years gained is used to measure how successful transplants are. [5]

Proceeding from the Scenario

According to the Biomedical Engineering Society (BMES), bioengineers must use their knowledge, skills, and abilities to “enhance the safety, health, and welfare of the public.” [6] The National Society of Professional Engineers (NSPE) also supports this idea. Engineering has a huge impact on people’s quality of life. So, I need to approach my job with honesty and integrity. NSPE says to “avoid deceptive acts”. [7] I might have to lie to one of the patients about the current availability of an artificial kidney. I would not be comfortable doing that because I would be denying a patient possible treatment. However, BMES does not give many guidelines on how to approach allocation of organs/services in the clinical aspect. BMES emphasizes awareness of patient rights. [6] When it comes to forming a decision, I need to keep in mind that all forms of life are to be treated with respect, the fact that patients have rights, and that I must work to make a positive difference in others’ lives.

According to Brennan and Rector’s The Kidney, major ethical problems that Dr. Belding Scribner and his colleagues faced included patient selection for dialysis and donor selection for transplantation. I can tell that my scenario has been common in the past even in the 1940s. [8] In an article about ethics in nephrology, there was a discussion about whether or not age is a legitimate criterion for priority in end-stage renal disease treatment. The question “how old is too old?” was addressed. An expert committee of the Institute of Medicine concluded that “age was considered and explicitly rejected by the committee as a patient acceptance criterion, as it does not measure the ability of an individual to benefit from the treatment.” Surveys of medical professionals were conducted and indicated that more than 72% favored preference for younger over older dialysis patients when distributing donor kidneys. According a separate survey of doctors in Finland, 18% of them would refer patients older than 80 for coronary bypass operations. [9] All of these situations are applicable to my scenario because of age being a factor of allocation. Looking at global perspectives is helpful because not every country will have the same laws as in another country.

By analyzing the different situations, I can say that making a decision in my scenario will be complicated and difficult since there is really no right or wrong answer. I will probably have to face consequences either way. Some people may believe that giving the artificial kidney to the younger man would be discriminating against the older man just because of the disabilities that come with his age. Others may believe that giving the artificial kidney to the older man would allow me to continue my job. However, I would feel morally obligated to try to be as equal and fair as possible when it comes to giving patients proper treatment.

Approaching a Decision

I do not think I have a solid decision for my scenario. In the past, decisions on who would or would not receive treatment were left to public committees. It was agreed that various criteria like age cold be used to make decisions. Another consideration is who is likely to benefit the longest form the artificial kidney transplant, which is what my employee was looking at.

In a New York Times article, Dr. Daniel Callahan, the director of the University of Utah Medical Center, mentioned using a lottery system because it would probably be the fairest option since it would be completely random chance. Even though a lottery system was suggested in 1983, which was a long time ago, I am leaning towards the option as a solution to my scenario. I might approach my employer and ask him if it would be okay to do this since there would only be a limited amount of candidates that we already have in the lottery. I believe that would help solve the issue of
who would get the artificial kidney transplant. I also believe that it would be the fairest solution in this case, since picking the transplant receiver would be hard to do with other criteria and factors that I have discussed.

**RECOMMENDATIONS TO ENGINEERS**

I would advise engineers who are facing a similar ethical issue like mine to analyze the situation completely and wholly. I would suggest that they look at all of their options and the consequences for those decisions carefully. I think that as long as their individual decision is based on the specific codes of ethics and the complexity of their ethical dilemma, then they should be able to at least lean towards a decision and finally go through with it. They need to be aware and accepting of any and all consequences when making their decision so that nothing takes them by surprise.

**Educating Future Engineers**

Engineers face ethical issues every day. In order to keep young engineers in the loop, early education about issues in the professional world is crucial. Engineers can gain a better perspective about issues they may encounter in the future. Young engineers can develop more gracefully with early education, so they should start learning as soon as possible. They should be exposed to ethical concerns because they can strengthen their critical thinking abilities and can take their responsibilities in society seriously. Treatment for kidney disease can be further developed to improve public health. Such a procedure is worth pursuing. Future engineers can look at research challenges and ethics to develop ideas that will help them approach complicated scenarios like mine.

**CONCLUSION**

Making decisions in the engineering world when it comes to ethics is a complex process. The scenario needs to be carefully analyzed and you need to be mindful of the fact that your decision can greatly impact others and yourself. Gaining perspective is probably one of the main keys to making an ethical decision. Even if you do not have a solid footing in terms of making a decision, doing research and hearing what others have to say or have said in the past is a great way of dealing with it and getting you to lean towards a decision you find ethically just.

**REFERENCES**


**ADDITIONAL SOURCES**


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FIGURE 1 [3]
Mars Rover Curiosity’s tool turret and flexible arm

The drill used to collect rock samples on Mars is located on the “tool turret” at the end of Curiosity’s robotic arm, as shown in Figure 1. In May of 2013, the drill bored into a specifically targeted area of Mars rock and obtained a powdered sample of the rock [4]
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