Religious Viewpoints: Judaism

16

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Introduction

Xenotransplantation is no longer the medicine of the future. It is already here. In September 2021, a surgical team at University of Alabama at Birmingham successfully transplanted two kidneys from a genetically modified pig into a person who was declared dead according to neurological criteria. A surgical team at New York University also performed a successful porcine kidney xenotransplantation in September and then again in November of 2021. In January 2022, a surgical team at University of Maryland Medical Center successfully transplanted a genetically modified pig heart into a living patient.

The reason that the pig's genes must be altered is to decrease their chances of rejection by the recipient. Even in human organ transplantation, organ recipients are at risk of their body rejecting the transplant as a foreign, and thus harmful, intrusion in the body. Traditionally, a patient would receive immunosuppressants to prevent organ rejection, yet such medication leaves the person more susceptible to other diseases, as the body is less able to fight viral and bacterial infections. Without genetic modification, xenotransplantation may be at higher risk for rejection and for

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hyperacute rejection since the organ itself is so genetically different from the recipient's that it causes the person's immune system immediately to produce antibodies against it [1]. Genetic modification of the pig allows for its organs to be more compatible with their human recipients [2]. Genetic modification is also used to modify the animal's organs so that they only grow to a size appropriate for a human body and function effectively given human physiology [3].

The benefits of transplanting genetically modified pig organs into humans are consequential. In the United States alone, there were 24,669 kidney transplants performed in 2021 and 22,817 in 2020 [4]. There were also 3817 heart transplants in 2021 and 3658 in 2020 [1]. As of September 2021, 97,200 people were on the waitlist for a kidney transplant and 3500 people were on the waitlist for a heart transplant [5]. The ability for genetically modified pigs to serve as a ready supply of organs would greatly reduce both the wait time for people to receive organs and the number of people who die while waiting for a transplant. It would also reduce the ethical challenges that surround policies and practices related to organ donation, procurement, distribution, and allocation. Of course, these challenges will not be solved immediately. It took about two decades from the first successful human heart transplant for transplant centers to become commonplace [6]. While medical technology may move at a faster pace for xenotransplantation given the current speed of medical progress, it will still be a few years before xenotransplantation will be considered a routine procedure.

Transplanting whole pig organs is different from implanting a porcine heart valve into a human patient or using pigs to make insulin and blood thinners, since the risks and complications of transplanting whole organs is much greater and different than using pigs (or other animals) for other medical purposes. For example, one may assume that a porcine heart valve is comparable clinically to a porcine heart, just a little smaller. Yet, all porcine valves are treated to avoid rejection before they are implanted. Porcine valve implantation therefore does not come with the same risks of rejection nor the same needs to take immunosuppressive medication. Nor do the pigs who "donate" these valves require genetic modification.

There are those, such as Bruno Reichart—a cardiothoracic surgeon who performed Germany's first successful heart transplant and who is a strong xenotransplantation advocate—who argue that there should be no stigma or ethical concerns regarding porcine xenotransplantation [7]. However, stigma and seemingly ethical concerns may arise in those communities who believe that pigs are unkosher and anathema to their religious tradition.

I will not discuss at length in this chapter the Jewish medical ethics considerations regarding whether a patient should participate in a risky procedure or the debates surrounding using (and genetically modifying) animals for the purpose of medical treatment. These topics are discussed at length elsewhere, though I will make a few points on the matter. This chapter will focus primarily on the permissibility according to Jewish medical ethics of using pigs as a source of organs for xenotransplantation. First, I will give a quick word on the relationship between Jewish (medical) ethics and Jewish law.

The Relationship Between Jewish (Medical) Ethics and Jewish Law

While the relationship between Jewish law and Jewish ethics is similar to a certain degree across various denominations of Judaism, the divergence between denominations in how they respectively describe the relationship is based on how each denomination conceives of the divinity of the Jewish canon and its immutability or evolution. I write from the perspective of Orthodox Judaism. As such, both the Jewish philosophers of law and legal decisors brought in this chapter, and the way they will be interpretated, will be primarily from that vantage point.

Unlike the relationship between secular medical ethics and law, where the two domains are separate yet inform each other in terms of how to analyze medical ethics cases [8], how to determine standards of proper conduct [9], and how to create good health policy and practices [10], Jewish medical ethics and Jewish law (or Halakha) are isomorphic. In the words of Rabbi Immanuel Jakobovits, "[T]he Jewish concept of medical ethics is the very reverse of that commonly accepted in civilized countries of the world" [11]. One reason for this overlapping relationship is theological. The Torah is perceived as a divine document that lays out moral ways to live; ethics is, therefore, not a separate domain of inquiry but part of Jewish law itself (Iggrot Moshe Even HaEzer 2: 11). Another reason is that, even if one wants to imagine an ethics that is separate from Jewish law, the moral values inherent in the Torah are expressed through discussion of the Halakha and its application to contemporary (medical) situations [12]. As such, analysis of an issue through the lens of Jewish (medical) ethics will necessitate reference to Jewish legal and other canonical sources.

Participating in Risky Procedures

A patient considering a heart transplant is most likely in a halakhic category where it would be permissible to undergo a treatment that may extend his or her life beyond 12 months but nevertheless has a risk of hastening death. Of course, as the probability of success increases and the risk of the procedure decreases, there is greater rabbinic consensus towards permissibility (Responsa Tzitz Eliezer 10: 25; Responsa Ahiezer Yoreh Deah 16: 6; Iggrot Moshe Yoreh Deah 2: 58 and 3: 36). Because those with kidney failure can undergo dialysis for years, there is less consensus among the rabbinic decisors over the permissibility of undergoing a kidney transplant. However, if the patient desires the transplant to improve his or her quality of life, it is permitted (Responsa Tzitz Eliezer 4: 13: 2). This is especially the case as heart and kidney transplantations have become "routine" and the probability of success is now quite high. As of 2014, the International Society of Heart and Lung Transplantation indicates a current 1-year survival rate of 84.5% and a 5-year survival rate of 72.5% for heart transplantation [13]. Currently, the survival rate for kidney transplant recipients is 95% at 1 year and around 90% at 3–5 years [14]. While the survival rates for porcine xenotransplantation are unavailable today as it

is still an experimental procedure, as xenotransplantation becomes more commonplace and as survival rates reach the levels equivalent to other more common procedures, the ethical permissibility of undergoing such a procedure will also be more acceptable among the rabbinic decisors.

Using (and Genetically Modifying) Animals for the Purpose of Medical Treatment

In the realm of Jewish medical ethics, concern over genetically modifying animals and using their organs for transplantation would fall under the discussion of *tza'ar ba'alei hayyim*, i.e., causing pain to animals. There is a dispute among the rabbinic decisors as to whether the halakhic prohibition is Torah mandated or a rabbinic enactment (BT Bava Metzia 32b-33a). Typically, the distinction between the two is in the severity of punishment warranted for one who transgresses and in how to evaluate a situation where transgression is only a potential outcome rather than a definitive one. Regardless of the disagreement over category, the Talmud nevertheless warns that *tza'ar ba'alei hayyim* is a grave sin and warrants severe punishment (BT Bava Metzia 85a).

Despite the importance of this prohibition, one does not violate *tza'ar ba'alei hayyim* if the harm to the animal serves a benefit. For example, it is permissible to kill animals for food and to use them for labor (Terumat HaDeshen II: 105). Benefit should not be construed as simple enjoyment, since one of the reasons for the prohibition is to engender in people the trait of mercy (Teshuvot HaGeonim [Harkavy] I: 375), and, as such, activities such as hunting for pleasure is typically deemed reprehensible (Nodah b'Yehudah Yoreh Deah 6). Yet, treating animals in ways that, though potentially harmful, provide tangible benefit to humans and that limits unnecessary pain to the animal is deemed acceptable according to Jewish law. Moreover, Rabbi Moshe Isserles states explicitly in his gloss to the *Shulhan Arukh* that anything that is needed for medical treatment sets the transgression of *tza'ar ba'alei hayyim* aside (Shulhan Arukh Even HaEzer 5: 14). In the case of genetically modifying pigs to harvest their organs for transplant, there should be no prohibition related to *tza'ar ba'alei hayyim* if the animals are not subject to unnecessary pain and suffering in the process. All procedures that are necessary for the eventual treatment of human beings needing the transplant, such as killing the animals in order to harvest their organs, would also be permissible (Shevut Ya'akov Yoreh Deah 3: 71).

Pigs Are Not Kosher, and So Not Jewish

The Torah states that a person may eat any animal that has split hooves and chews its cud (Leviticus 11: 1–7). So as not to misinterpret the permission to include animals that have one criterion but not the other, the Torah continues to state that those animals which chew their cud yet do not have split hooves or which have split

hooves yet do not chew their cud are forbidden to be eaten. For the latter category, the Torah gives the explicit example of the pig.

The explicit mention of the pig as a prohibited animal is only part of the reason for the revulsion that people who aspire to live within the norms and values of the Jewish tradition have for the animal. For example, one does not see the same revulsion for the camel, the rock-badger, or the hare, which are the three animals explicitly mentioned in the Torah that a person is prohibited to eat because they chew their cud yet do not have split hooves.

Jewish pig revulsion and the status of the pig as anathema to Jewish identity is seen both in Jewish sources that view pork as a specific marker of non-Jewish cuisine and identity and in Greek and Roman sources, where the absence specifically of pork indicates Jewish cuisine and identity [15]. The relationship between consumption and identity, akin to the common expression, "You are what you eat," speaks not only to the symbolic aspect of what one chooses to put into one's body. It also encompasses the social aspect regarding with whom one may eat given dietary restrictions [16]. The pig as a symbol of otherness is therefore both a personal and social marker.

Rabbinic sources provide a few reasons for why the pig has such an antithetical status to Jewish identity to the point where one avoids even mere mention of its name when possible. In the Talmud, to reference a pig, a rabbi would sometimes call the animal a *davar aher*, i.e., "other thing," rather than use its proper name (BT Shabbat 129a, Pesahim 3b). One source provides a historical reason. The Talmud relates that when two members of the Hasmonean monarchy were fighting, one brother besieged the city of Jerusalem. At first, the brother would allow, despite the siege, for the purchase of sheep for the daily sacrifices in the Temple. However, to weaken the spiritual resolve of the city inhabitants, one day he delivered a pig instead of the required sheep for the sacrifice. The offense to the religious devotion of the Jewish people was so great that the Talmud relates that the land of Israel quaked over an area of 400 parasangs by 400 parasangs. At that time, the Sages placed a curse on those who would raise pigs (BT Bava Kamma 82b). This incident has continued throughout the centuries to be mentioned in rabbinic literature as a disgraceful attempt to mock the religiosity of the Jewish people, and the pig continues to serve as a symbol of religious sacrilege. Other rabbinic sources maintain the theme of sacrilege, yet the pig becomes a display of hypocrisy rather than open rebellion. The pig as a symbol of religious hypocrisy comes from the image of a pig displaying its split hooves. The rabbinic literature uses such an image to conceive of the pig as pretending or signifying that it is kosher while knowing that it is not (Genesis Rabbah 65: 1). The power of the pig as a symbol of non-Jewish or hypocritic Jewish identity is evident in the derogatory term, Marrano, meaning "pig," which was used to refer Jews in fifteenth-century Spain who were forced to convert to Christianity but may have secretly lived or at least identified as Jews.

A contemporary example that speaks to the case of how pig revulsion, as an expression of Jewish identity, can influence how a person may respond to the possibility of porcine xenotransplantation can be seen by the 2006 episode, "Save Me," from the popular television show, *Grey's Anatomy*. When Drs. Burke and Karev tell

a couple that their daughter needs a heart valve replacement, they suggest using a porcine valve, since it is considered the standard of care for her condition. The mother responds, "I don't care what you have to do. Save my daughter's life." When the daughter is told that they will be using a porcine valve, she adamantly refuses, saying, "You're letting them put a pig, a freaking non-kosher, *traif* mammal, into my chest, into my heart! The very essence of my being!" [17]. The daughter's visceral response against using a porcine valve is based on her feelings that incorporating a part of a pig into her body will somehow affect her religious being more deleteriously than death itself. At the end of the episode, the doctors settled on using a bovine valve instead of a porcine one. However, according to the rules of *kashrut* (dietary restrictions), eating an improperly slaughtered cow has the same gravity of transgression as eating a pig. Therefore, if the daughter is concerned about putting a "non-kosher, *traif* mammal," into her chest, she should detest the idea of the bovine valve as much as a porcine one. Yet she doesn't. While this example clearly makes certain assumptions regarding different denominations of Judaism, it does provide a clear example of how the symbol of the pig as anathema to Jewish identity can influence a person's understanding of whether using a porcine valve or a pig organ would be appropriate or disdained within the framework of their own religious tradition.

However, despite one's potential revulsion to the pig, from the perspective of Jewish law and Jewish medical ethics, the prohibition against its consumption is not because the animal is disgusting or antithetical to Jewish identity. The Talmud states,

> The Sages taught: "You shall do My ordinances (*mishpatai*)." [This refers to] matters that [even] had they not been written, [it would have been] logical that they be written… "And you shall keep my statutes (*hukotai*)." [This refers to] matters that Satan would challenge [because the reason for these commandments is not known or subject to reason.] These are [the prohibitions] against eating pork… And lest you say these are meaningless acts, the verse states: "I am the Lord," i.e. I am the Lord, I decreed these and you have no right to doubt them (BT Yoma 67b).

Another rabbinic source similarly states, "Rabbi Elazar ben Azariah says that one shouldn't say, 'I abstain from pork because I don't like it.' Rather [he should abstain] because of God's commandment" (Sifra Kedoshim 9). The difference between abstaining from consuming pork because one recognizes the divine command prohibiting its consumption and abstaining from pork because of a desire not to embody—both in the archaic/literal sense and the contemporary/metaphorical sense—an anti-Jewish identity is a significant distinction when it comes to xenotransplantation and Jewish medical ethics.

Pigs Are Not Kosher, but…

Halakhic discussion over whether one is permitted to use a prohibited object in an atypical fashion begins with two recorded statements made by Rabbi Yohanan in the Talmud. The first statement said in the name of Rabbi Yohanan is, "With regard to

all prohibitions in the Torah, one may be flogged for violating them only if he eats the prohibited item in its usual manner of consumption." The example the Talmud provides for what this statement excludes is prohibited fat eaten raw. The reason for the exemption is that it is not the usual way to eat prohibited fat; therefore, the person is not punished for its transgression. This implies that Rabbi Yohanan's statement refers to consumption prohibitions. Rabbi Yohanan's second statement is, "With regard to all prohibitions in the Torah, one is flogged for violating them only if he derives enjoyment from the prohibited item in the usual manner." The Talmud notes that this excludes both placing the fat of an ox that the court determined should be stoned to death (and thus one is prohibited to derive any benefit from the animal) on one's wound and, *a fortiori*, eating prohibited fat that is raw. There is no difference between the two statements when considering those substances that are prohibited to eat, such as pork, eaten in an atypical way. Yet the second statement is more expansive than the first in that it exempts from punishment not only direct consumption when such consumption is atypical, but it also exempts from punishment any form of enjoyment when using a prohibited substance in an abnormal way (BT Pesahim 24b).

Maimonides rules that the second formulation of Rabbi Yohanan's statement is authoritative. He writes in his *Mishne Torah*, "One is not liable for partaking of any of the prohibited foods unless one partakes of them in a manner in which one derives enjoyment…" (Mishne Torah Forbidden Foods 14: 10). One should note that when the Talmud states that a person is exempt from punishment, it typically means that the action is still prohibited but that the court cannot exact a penalty. It also means that the prohibition itself (and not just the punishment) may be pushed aside if there is a conflicting value or need, such as to fulfill the commandment of preserving one's health. Therefore, Maimonides writes, "When is this the case that we only heal ourselves with the substances that are prohibited in a situation of danger? When they are used in the manner of their enjoyment. For example, we feed the sick person insects or creeping animals, or *chamets* [leavened bread] on Passover or we feed him on Yom Kippur. But [if] it is not used in the way of its enjoyment, for example, we make a bandage or plaster from *chamets* [leavened bread] or from *orlah* [fruit from a tree in its first three years], or we give him to drink something bitter mixed with forbidden foods, since, there is no enjoyment to his palate, it is permissible even not in a situation of danger…" (Mishne Torah Foundations of the Torah 5: 8). The permissibility to override a transgression is measured by weighing both the relative severity of the transgression and the relative gravity of the situation.

Rabbi Yosef Karo rules in accordance with Maimonides' position. He writes that in a situation of danger one may use a prohibited food substance in a manner through which one derives enjoyment and, in situations that are less serious, in a manner through which one does not derive enjoyment. For those substances that are prohibited even to derive benefit, in situations of danger one may still use them in ways that do not derive enjoyment (Shulhan Arukh Yoreh Deah 155: 3). Rabbi Zechariah Mendel ben Aryeh Leib cites rabbinic authorities who make a distinction between consuming a prohibited food for the sake of medical treatment in a way that is not enjoyable and using the substance in other ways. He writes that one who inhales

something prohibited to eat through his nostrils is not liable even if he benefits from a *kazayit* [an olive-size amount] since it is not the way of eating (Be'er Heitiv Yoreh Deah 84: 37). Even though someone in need of an organ transplantation would be in such a position of danger that it would be permissible to receive a pig organ, given Rabbi Leib's distinction, receiving a pig organ for transplant is not even considered to be "consumption" of a prohibited food, let alone enjoyment.

Despite its permissibility, a patient may nevertheless be concerned that receipt of the pig organ would lead to spiritual pollution, i.e. *timtum halev* [polluted heart], which itself may cause the person to develop a bad character. The concept of *timtum halev* is derived from the verse, "You shall not draw abomination upon yourselves through anything that swarms; you shall not make yourselves impure therewith and thus become impure" (Leviticus 11: 43). In the Talmud, the school of Rabbi Yishmael teaches regarding this verse, "Sin pollutes the heart of a person who commits it, as it is stated: "And do not impurify yourselves with them, so that you should not be thereby impure." Do not read that term as: 'be impure [*venitmetem*]'; rather, read it as: 'be polluted [*venitamtem*]'" (BT Yoma 39a). This concept of spiritual pollution is codified by Rabbi Moshe Isserles in his gloss on the *Shulhan Arukh*, "The breastmilk of an Egyptian is like that of a Jewess, yet one should not have their child suckle from an Egyptian if it is possible to suckle from a Jewess since the breastmilk of an idolator will pollute the heart and cause him to have a bad nature. So shouldn't a Jewish nursemaid eat prohibited food nor should a child himself [eat prohibited food] because it will cause [spiritual/character] damage in his old age" (Shulhan Arukh Yoreh Deah 81: 7). The suckling child would not be consuming prohibited food, nor would the child, due to his age, be transgressing a commandment when eating food prohibited to others. Yet there is still a concern over the milk's or the food's influence on the spiritual nature and/or character of the child. Rabbi Zylberstein, however, has noted that such spiritual defilement may only result when the food sustains a healthy person and not when consumed medicinally. He also states that when used not in a manner of oral consumption, one need not worry about *timtum halev* (Shi'urei Torah l'Rof'im II: 84). A patient receiving a pig organ through a transplant would therefore not need to worry that the transplant may lead to spiritual pollution.

If a patient is nevertheless repulsed by the idea of receiving a pig organ, Jewish medical ethics and American medical ethics begins to part ways regarding how one may respond. According to American law and medical ethics, a competent patient has a right to refuse treatment, even if such refusal may lead to the patient's death and even if the patient knows that such treatment will lead to his or her death (Superintendent of Belchertown State Sch. v. Saikewicz). Moreover, a fundamental component of patient autonomy—both according to U.S. law and secular medical ethics—is the right of informed consent and refusal. As the American Medical Association Code of Ethics states, "Patients have the right to receive information and ask questions about recommended treatments so that they can make well-considered decisions about care" (Code of Medical Ethics Opinion 2.1.1). While American medical ethics once held that there were rare times when physicians may invoke therapeutic privilege, which is the decision to withhold information from a

patient for fear that disclosure may cause serious mental or physical harm to them, this is no longer a morally justifiable position according to the American Medical Association (Code of Medical Ethics Opinion 2.1.1).

According to Jewish law, however, patients have traditionally not had a right to refuse treatment and may be forced to be treated if necessary (Teshuvot HaRadvaz 4:1139; Magen Avraham Orakh Hayyim 328: 2). This is especially the case if refusal is based on misguided piety (Mor Uketziah 328). In situations where treatment will nevertheless lead to a prolonged life of pain and suffering, the patient has religious sanction to determine whether to undergo treatment (Iggrot Moshe Hoshen Mishpat 2: 74). Moreover, if being pressured to be treated may lead to significant negative psychological or other effects, deference to patient wishes may be acceptable (Iggrot Moshe Hoshen Mishpat 2: 74). Rabbi Feinstein also rules that actual coercion is never an acceptable treatment option (Iggrot Moshe Hoshen Mishpat 2: 74). Because Jewish law prioritizes compliance with Jewish law, including the commandment to preserve life and health, over misguided piety, there are some rabbinic authorities that deem it permissible not to reveal to the patient that the organ comes from a pig (Shi'urei Torah l'Rof'im II: 84). However, whether a physician may rely on this suggestion in practice depends on whether it is also permitted not to reveal such information according to the jurisdiction in which the physician practices.

Jewish Pig Farms for Organ Transplant

The pig heart and kidneys that were used in the recent xenotransplantations came from Revivicor, a subsidiary of United Therapeutics, a Maryland-based biotech company. The viability for transplant of such genetically modified pig organs means that other companies will also begin to raise pigs for the purpose of harvesting their organs for transplant. The Mishna, however, rules unequivocally that a Jew may not raise pigs (Mishna Bava Kamma 7: 7). The Talmud explains that the reason for the prohibition is the Sages' curse on those who raise pigs, made after the dispute between the members of the Hasmonean monarchy (BT Bava Kamma 82b). The Mishna also rules that, in general, one may not engage in the business of trading non-kosher animals (Mishna Shevi'it 7: 3). Rabbenu Tam notes that the Mishna specifically mentions pigs, even though it mentions all non-kosher animals elsewhere, because one may raise other non-kosher animals to engage in trade for nonculinary purposes, such as trading their hides. However, one may not raise pigs even when the intent is to engage in nonculinary business (Tosafot BT Bava Kamma 82b). The distinction noted by Rabbenu Tam is recorded in the *Shulhan Arukh* and its commentaries. Rabbi Yosef Karo writes, "It is forbidden to do business in anything that is specifically for eating and Biblically prohibited, even though it is not forbidden to derive benefit from it." (Shulhan Arukh Yoreh Deah 117: 1). Rabbi Shabbatai ben Meir HaKohen comments that this rule excludes horses, donkeys, and camels which are generally used for work, even if people may eat them. It also includes animals that, while typically raised as food, are specifically being raised for nonculinary purposes. He then cites Rabbi Karo's reference, in his commentary,

Bet Yosef, to Rabbenu Tam who excludes pigs from this leniency (Shakh Shulhan Arukh Yoreh Deah 1). For this reason, Rabbi Zylberstein recommends that Jews do not engage in the business of raising pigs for the purpose of harvesting their organs for transplant even when Jewish patients may receive them for transplant. The reason is that religious prohibitions may be pushed aside for the sake of saving a life, but it is not certain that raising these pigs will definitively lead to saving a life as one does not know if any particular pig will be an organ donor. Rabbi Zylberstein does, however, state that if not raising genetically modified pigs for transplant would lead to a potential danger, such as if biotech companies would not give these organs to Jews, then it would be permissible for Jews to engage in raising pigs to have a supply of organs for transplant (Shi'urei Torah l'Rof'im II: 84).

Conclusion

For a patient who aspires to live within the norms and values of the Jewish tradition, it would certainly be permitted to receive a pig organ if such a xenotransplantation could save his or her life. Yet the challenge for such patients may not only be in whether Jewish law permits it. It may also include how their aversion to consuming pig speaks to their Jewish identity. For such patients, it is important to understand how their own conceptions of Jewish identity impact their aversion and how rabbinic sources in the Jewish tradition can help allay the abhorrence they may have. In such cases, it is best to explain how pig organs are not kosher, but we can use them for xenotransplantation.

References

1. Ekser B, Cooper DK. Overcoming the barriers to xenotransplantation: prospects for the future. Expert Rev Clin Immunol. 2010;6(2):219–30.
2. Hryhorowicz M, Zeyland J, Słomski R, Lipiński D. Genetically modified pigs as organ donors for xenotransplantation. Mol Biotechnol. 2017;59(9–10):435–44.
3. Kemter E, Schnieke A, Fischer K, Cowan PJ, Wolf E. Xeno-organ donor pigs with multiple genetic modifications–the more the better? Curr Opin Genet Dev. 2020;64:60–5.
4. United network for organ sharing. Transplant trends. https://unos.org/data/transplant-trends/
5. Armstrong M. Statista. Organ transplant waiting lists in the U.S. https://www.statista.com/chart/26574/number-of-people-us-waiting-for-organ-transplant-by-type/
6. Stolf NA. History of heart transplantation: a hard and glorious journey. Braz J Cardiovasc Surg. 2017:423–7.
7. de Quetteville H. The telegraph. Why putting animal organs inside people could be the future of medicine. https://www.telegraph.co.uk/health-fitness/body/putting-animal-organs-inside-people-could-future-medicine/
8. Schneider CE. Bioethics in the language of the law. Hastings Cent Rep. 1994;24(4):16–22.
9. Foster C, Miola J. Who's in charge? The relationship between medical law, medical ethics, and medical morality? Med Law Rev. 2015;23(4):505–30.
10. Campbell AT, Sicklick J, Galowitz P, Retkin R, Fleishman SB. How bioethics can enrich medical-legal collaborations. J Law, Med Ethics. 2010;38(4):847–62.

11. Jakobovits I. The role of Jewish medical ethics in shaping legislation. In: Rosner F, editor. Medicine and Jewish Law. Northvale: Jason Aronson; 1990. p. 1–18.
12. Lichtenstein A. Abortion: a halakhic perspective. Tradition: J Orthodox Jew Thought. 1991;25(4):3–12.
13. Lund LH, Edwards LB, Kucheryavaya AY, Benden C, Christie JD, Dipchand AI, Dobbels F, Goldfarb SB, Levvey BJ, Meiser B, Yusen RD. The registry of the international society for heart and lung transplantation: thirty-first official adult heart transplant report—2014; focus theme: retransplantation. J Heart Lung Transplant. 2014;33(10):996–1008.
14. Briggs JD. Causes of death after renal transplantation. Nephrol Dial Transplant. 2001;16(8):1545–9.
15. Rosenblum JD. "Why Do You Refuse to Eat Pork?": Jews, food, and identity in roman palestine. Jew Q Rev. 2010;100(1):95–110.
16. Ohnuki-Tierney E. Rice as self. Princeton University Press; 1994.
17. Grey's Anatomy. "Save Me." https://greysanatomy.fandom.com/wiki/Save_Me/Transcript