Informed Consent: Cultural and Religious Issues Associated with the Use of Allogeneic and Xenogeneic Mesh Products

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BACKGROUND: Our aim was to investigate the views of major religions and cultural groups regarding the use of allogeneic and xenogeneic mesh for soft tissue repair.

STUDY DESIGN: We contacted representatives from Judaism, Islam, Buddhism, Hinduism, Scientology, and Christianity (Baptists, Methodists, Seventh-Day Adventists, Catholics, Lutherans, Church of Jesus Christ of Latter-Day Saints, Evangelical, and Jehovah’s Witnesses). We also contacted American Vegan and People for the Ethical Treatment of Animals (PETA). Standardized questionnaires were distributed to the religious and cultural authorities. Questions solicited views on the consumption of beef and pork products and the acceptability of human-, bovine-, or porcine-derived acellular grafts.

RESULTS: Dietary restrictions among Jews and Muslims do not translate to tissue implantation restriction. Approximately 50% of Seventh-day Adventists and 40% of Buddhists practice vegetarianism, which may translate into a refusal of the use of xenogeneic tissue. Some Hindus categorically prohibit the use of human tissue and animal products; others allow the donation and receipt of human organs and tissues. PETA is opposed to all uses of animals, but not to human acellular grafts or organ transplantation. Some vegans prefer allogeneic to xenogeneic tissue. Allogeneic and xenogeneic acellular grafts are acceptable among Scientologists, Baptists, Lutherans, Evangelicals, and Catholics. Methodists, Jehovah’s Witnesses, and The Church of Jesus Christ of Latter-Day Saints leave the decision up to the individual.

CONCLUSIONS: Knowledge of religious and cultural preferences regarding biologic mesh assists the surgeon in obtaining a culturally sensitive informed consent for procedures involving acellular allogeneic or xenogeneic grafts. (J Am Coll Surg 2010;210:402–410. © 2010 by the American College of Surgeons)

For centuries, medicine was practiced in a very paternal fashion, without obtaining consent from patients. The notion of obtaining a written informed consent was first introduced by Walter Reed in 1900 while he was studying yellow fever in Cuba.¹ This consent document outlined the risk of the experiments and the possible benefits to participants. However, it wasn’t until many years later that the requirements of informed consent as they pertain to research subjects were defined by the Nuremberg Code of 1947, the Helsinki Declaration of 1964, and the Belmont Report of 1979.

A sentinel legal case in the United States came almost concurrently with Walter Reed’s introduction of written consent. The 1905 case of Mohr v. Williams defined informed consent for the first time regarding clinical patients.² In this case, the surgeon extended his procedure beyond what had been originally consented. The judge ruled that physicians need to advise patients of all information relevant to the procedure at hand and must review with patients all risks and benefits. Only after this information is shared may a patient enter into a contract. The contract allows the surgeon to operate only to the extent of the consent given.

It has been established that patients not only deserve to know what the options are, but also have the right to decide

Disclosure Information: Nothing to disclose.

Data presented at the joint American Hernia Society and European Hernia Society meeting, Berlin, Germany, September 2009.

Received October 27, 2009; Revised December 1, 2009; Accepted December 2, 2009.

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what treatment they wish to receive. Doctors, in turn, must respect the wishes of the patient, whether the decision is based on religion, beliefs, values, or any other source. Although doctors have held this mutual relationship to be true, the advancement of technology has shed light on new ethical dilemmas. Even when doctors try their best to be culturally and religiously sensitive to patients’ wishes, with the multiplicity of new and emerging products and technologies, it has become unclear what patients’ wishes may be regarding these products.

It has been known for several decades that allografts and xenografts provide the best chance of recovery for severe injuries such as burns. With improvements to modern medicine, there has been an unprecedented growth in biologic products derived from porcine, bovine, and human products. In fact, many medications and surgical implants in use come from bovine, porcine, or human sources. Clinical application of these products continues to expand. Acellular dermal matrices were recently introduced as suitable materials for closure of abdominal wall defects. Even some “synthetic” meshes used for hernia repair contain biologically derived components, including Parietex Composite Mesh (Sofradim Production) and C-Qur (Atrium Medical Corporation). Parietex Composite Mesh contains porcine collagen, and C-Qur is coated with omega-3 fatty acids derived from fish.

It is widely known that Jehovah’s Witnesses are prohibited from receiving blood transfusions. Yet it is unclear how they would feel if a human-derived mesh were placed in their bodies. In addition, many people are aware of the dietary restrictions for Jews, Muslims, and Hindus. However, it is unclear whether these dietary restrictions translate into restrictions regarding the receipt of surgical products or medications containing animal or human tissue.

In general, there is a lack of knowledge about what the major religions in the United States think about the use of animal- or human-derived surgical products. There have been studies regarding the effectiveness and cost of certain biologic surgical products, but very few on this ethical dilemma. One such study evaluating the acceptability of mesh implantation looked at the beliefs of prominent religious groups in the United Kingdom. In addition, Easterbrook and Maddern, in Australia, sought to define restrictions among Jews, Muslims, and Hindus. However, these studies do not reflect the religious variation that exists within the United States.

The purpose of this study was to investigate the views of major organized religious and cultural groups in the United States regarding the use of biologic mesh for soft tissue repair. Our aim was to clarify preference and/or restriction for the implantation of human, bovine, or porcine tissues.

METHODS

We obtained initial demographic information regarding religious composition of the United States from the American Religious Identification Survey (ARIS) conducted by Trinity College. Data extracted from this survey (Table 1) estimated that the US population is 76% Christian, 3.9% other religions, 15.0% no religion, and 5.2% unknown (declined response). Representative religions identified as Christian were chosen to include Catholic (25.1%), Baptist (15.8%), Lutheran (3.8%), Jehovah’s Witness (0.8%), Seventh Day Adventist (0.4%), and Church of Jesus Christ of Latter-Day Saints (also known as Mormons) (1.4%). Representative “other” or non-Christian religions included Judaism (1.2%), Buddhism (0.5%), Islam (0.6%), Hinduism, and New Religious Movements (NRMs) and other religions (1.2%), including Scientology. We also chose American Vegan and People for the Ethical Treatment of Animals (PETA) as representative cultural groups with potentially strong beliefs regarding the use of animal tissue.

Wherever possible, a representative at the national or regional level was identified for each religion or cultural group using their official Web sites. In the cases of Judaism, Buddhism, Islam, and Hinduism, which are composed of multiple sects, nationally recognized religious ethicists of the same respective belief were identified. Upon identification of the appropriate contact person, standardized questionnaires were distributed to the respective religious or cultural authorities. Questions in the survey solicited views on the consumption of beef and pork products and the acceptability of human-, bovine-, or porcine-derived acellular grafts for soft tissue repair. An interview was requested at the time of survey distribution to allow interviewees to editorialize or further explain comments. Where granted, all interviews were conducted by the lead investigator.

RESULTS

All religious and cultural groups contacted returned at least a brief summary response to the main questionnaire regarding the acceptability of use of human, porcine, or bovine tissue.

Catholicism

Response was obtained from the St Louis Archdiocese Archbishop’s Vicar for Moral Issues and Biotechnology. Catholicism does not prohibit either the consumption of
bovine or porcine products or the use of bovine or porcine products in surgery. Allogeneic products currently produced from cadavers are also acceptable surgical products. However, an issue could arise if the surgical product originated from aborted fetal tissue. It is acceptable to use aborted fetal tissue if not complicit in the abortion. But they are concerned that use of such products could create a market for aborted fetal tissue. Of note, they also oppose embryonic stem cell research because it necessitates destruction of embryos.

Regarding human organ and tissue transplantation or implantation, Pope John Paul II stated, “The body cannot be treated as a merely physical or biological entity, nor can its organs and tissues ever be used as items for sale or exchange... Accordingly, any procedure which tends to commercialize human organs or to consider them as items of exchange or trade must be considered morally unacceptable, because to use the body as an object is to violate the dignity of the human person.”

Methodist
We were referred to the Director of Alcohol, Other Addictions, and Health Care at the General Board of Church and Society of the United Methodist Church. She stated that


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<td>207,983,000</td>
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<td>228,182,000</td>
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*This refers only to Jews by religion and not to the total Jewish ethnic population.
†Agnostics and atheists were combined in 1990.
there are no dietary restrictions among Methodists regarding porcine or bovine products. Although the Methodist Church does not have an official position on the acceptability of porcine and bovine mesh products, the church has issued other general statements regarding health and health care issues. We were referred to their main Web site for their positions on health care. Among their beliefs, “The United Methodist Church in its Social Principles regards health-care as a basic human right, as well as a responsibility both public and private. As the position of the Church elaborates, ‘We encourage individuals to pursue a healthy lifestyle and ... also recognize the role of governments in ensuring that each individual has access to those elements necessary to good health.’” This statement is important because it delineates the Methodist belief that health care is a human right.

Regarding the acceptability of allogeneic products, we were informed that organ and tissue donations are encouraged. In fact the Methodist Church participates in National Donor Sabbath. “National Donor Sabbath is observed on the Friday through Sunday that falls two weekends before Thanksgiving . . . Nearly every religion in the United States officially supports organ and tissue donation or supports the individual choices of its members. Donation is viewed by most religions as an act of compassion and generosity. Temples, churches, mosques, and other places of worship observe the National Donor Sabbath in their own ways.” It is the position of the Methodist Church that health care should not be a commodity nor should organs and tissues that are donated. Profiting from tissue grafts and organs is not acceptable.

Further clarification regarding the acceptability of allogeneic products was offered regarding potential products engineered through embryonic stem cell research. “There has been a great deal of scientific interest recently generated by research on human stem cells . . . The use of adult stem cells and stem cells derived from umbilical cord blood raise few moral questions . . . Given the reality that most, if not all . . . excess embryos will be discarded, we believe that it is morally tolerable to use existing embryos for stem cell research purposes . . . The same judgment of moral tolerability would apply to the use of embryos left from future reproductive efforts if a decision has been made not to introduce them into the womb. We articulate this position with an attitude of caution, not license. We reiterate our opposition to the creation of embryos for the sake of research.”

**Baptist**

Communication was with the Vice President of Public Policy and Research of the Southern Baptist Convention. There are no dietary or surgical restrictions regarding bovine or porcine products for Baptists. There would only be an issue with human tissue implantation if it came from aborted human fetuses or destructive embryonic research. If tissue was engineered from human embryos without harming the embryo, this would be an acceptable source.

**Lutheran**

Responses came from the Director of the Department for Studies: Church in Society Program Unit of the Evangelical Lutheran Church in America (ELCA). His responses are direct quotes from the body of the ELCA’s social statements. These social statements form the contemporary expression of the Lutheran understanding of social issues and effectively articulate their official teachings and policies. Regarding these social statements, “Church members are called upon to give social statements serious consideration as they form their own judgments . . . Social statements help shape the conscience of Christians by appealing to their faith, moral convictions, and reason.”

Regarding the consumption of pork and beef, “We will welcome the interaction of differing views and experiences in our discussion of environmental issues such as: . . . personal habits in food consumption . . . treatment of animals in . . . laboratory research . . . ” Furthermore, he stated, “It should be noted that while the ELCA does not teach against consuming meat products per se, it does encourage stewardship of the creation and awareness of the reasons for hunger in a world in which no one should have to go hungry. Both of these teachings may lead some to not consume meat products at all and they encourage all to be conscious of levels of meat intake.” There was no further clarification regarding the acceptability of use of bovine or porcine surgical products.

Regarding the use of human tissue or organs in implantation or transplantation, “ELCA affirms that it regards the donation of organs, tissue, and whole blood as an act of stewardship and as an appropriate means for contributing to the health and well-being of other persons, recognizes that the donation of live organs (eg, a kidney) can be an expression of sacrificial love for a neighbor in need, and recognizes that the donation of whole blood and renewable tissue (eg, bone marrow) by those who are able can be an expression of care for a neighbor in need.”

**Jehovah’s Witnesses**

The following response was received from Hospital Information Services for Jehovah’s Witnesses. “Aside from the fact that all of Jehovah’s Witnesses refuse blood transfusions for Bible-based religious reasons, all other medical matters are left up to the decision of each individual Witness patient.” They sent an informational kit entitled “Medical Alternative to Blood Transfusion.” The packet contained the statement, “Jehovah’s Witnesses love life and
do whatever is reasonable to prolong it. For this reason, they seek out quality health care and accept the vast majority of medical treatments. However, for Bible-based religious reasons, Jehovah’s Witnesses do not accept blood transfusions. Instead, they request nonblood alternatives.23 Jehovah’s Witnesses base their prohibition of blood transfusions on their interpretation of Acts 15:28-29 from the Bible. They will also not store their own blood for autotransfusions blood based on their interpretation of Leviticus 17:11, 13 and Deuteronomy 12:16, 24; 15:23 found in the Bible.

Church of Jesus Christ of Latter-Day Saints

We were directed to the Public Affairs Department for an official response. Although Latter-Day Saints have prohibitions against alcohol, tobacco, green and black tea, coffee, and illicit drugs, there is no church policy regarding the consumption of pork or beef products. The official response regarding the use of allogeneic, bovine, and porcine surgical products was “no opinion.” They strongly agree that patients should have the right to choose whether or not to accept offered treatments.

Seventh-Day Adventist Church

Correspondence was directed by the Seventh-Day Adventist Church to Dr Mark Carr, Associate Scholar and Director of the Center for Christian Bioethics at Loma Linda University, Adventist Health Sciences Center. In following the Seventh-Day Adventist faith, approximately 50% of North American Adventists are vegetarians. The official stance of the Adventist Church is an encouragement to avoid all meats, with a stronger encouragement to avoid unclean or nonkosher meats, as described in the Bible (Leviticus 11). Nonkosher foods include, but are not limited to, noncloven hoof animals, nonruminants (pork), birds of prey, fish without fins or scales, and shellfish. The church also discourages the use of alcohol, tobacco, illicit drugs, coffee, and other beverages containing caffeine. Dr Carr described Adventism as “intensely Protestant.” Official statements, guidelines and other documents are guidance only. An example can be found regarding the church’s guidelines on abortion.24 Conservative Adventists are more strictly adherent to guidelines issued by the church.

Although the Seventh-Day Adventist Church encourages vegetarianism and prohibits consumption of pork, there are no restrictions regarding the use of bovine or porcine surgical products. Of note, some Adventists may desire nonanimal alternative products due to their vegetarian lifestyle. Allogeneic surgical products are acceptable for use without restriction.

Evangelical

We contacted the National Association of Evangelicals. The Vice President of Communications informed us that the Evangelical Church does not have an official statement regarding the use of allogeneic or xenogeneic grafts. She directed me to the Christian Medical and Dental Association (CMDA) as a representative body for Evangelicals for possible further clarification. The CMDA is composed of 18,000 members who represent multiple conservative, traditional Christian faiths. The Chair of the CMDA Ethics Committee stated that there has been no concern among members of the CMDA regarding the use of biologic mesh products and that the CMDA also has no official statement regarding the use of biologic meshes. The CMDA is opposed to embryonic stem cell research. If allogeneic grafts were engineered from embryonic stem cells in the future, the CMDA would be opposed to their use.

Judaism

Answers to survey questions were obtained from Dr Aaron Mackler, Associate Professor of Theology at Duquesne University, who is an expert in both bioethics and Jewish law. He is an ordained rabbi and serves as the Medical Ethics Subcommittee Chair on the Committee for Jewish Law and Standards of the Conservative movement. Answers given reflect Judaism as a whole, or where answers differ among different movements they are specified.

In observance of Jewish dietary laws (Kashrut), Jews may eat only foods deemed as kosher (see Seventh-Day Adventists above). Mammals and fowl must also be slaughtered in a specific fashion to be considered kosher. Although there are laws regarding the oral consumption of the aforementioned products, there are no laws regarding the nondietary use of nonkosher products. So there are no restrictions on the use of porcine surgical or medical products, even if the product is “consumed,” as is the case with porcine biologic mesh products. There are no restrictions on the use of bovine products either. The Jewish faith has no opinion on the use of animal surgical products and would not prefer alternatives if they were more costly or less effective.

Jewish law will also allow the use of allogeneic surgical products or transplants. However, there is concern in Judaism regarding the harvesting and use of organs and tissues. The central issue involves true “death” of the patient. If vital organs are removed before the patient is dead, there is a moral objection. Among Orthodox Jews there is deep disagreement about brain death. Some authorities say that if a patient is brain dead but on a ventilator, he or she is still alive, but others would say the patient is dead. Reform and Conservative Jews approve organ or tissue donation from brain dead patients on a ventilator. Currently there is dis-
Buddhists believe in Ahimsa, a code of conduct of non-violence or of not killing or injuring living beings. This belief leads some Theravada Buddhists to practice vegetarianism. Some Mahayana Buddhists live in regions with very brief growing cycles and rely on meat protein. This leads to a more “practical” approach to Ahimsa by most Mahayana Buddhists. There is no principle within Buddhism that prohibits the consumption of pork or beef meat products, nor is there a prohibition against receipt of bovine or porcine surgical products. In the pharmacopeia used by some Buddhists, animal-derived products are included. In fact, there is a strong use of food or animal products as antidotes. However, Buddhist teachings may lead some followers to refuse biologic tissues obtained through the intentional killing of animals. The receipt of allogeneic mesh products is not prohibited.

**Hinduism**

Responses were coordinated through Sannyasin Arumugaswami, managing editor of *Hinduism Today* magazine. He commented that Hinduism is very much decentralized and there is not one standard set of beliefs. Each Hindu has his or her own individual tradition, scripture, and scholar to refer to. In fact, Hinduism could be more closely related to a collection of religions than 1 central faith. In response to our survey questions, Sannyasin Arumugaswami obtained 2 responses, 1 from a religious leader (guru) and another from a scriptural expert.

The guru contacted was Satguru Bodhinatha Veylan-swami, known as Guru Mahasannidhanam and 163rd preceptor of the Nandinatha Sampradaya’s Kailasa Parampara. In Hindu tradition, followers are advised to consult their guru on important issues in their life, which would include major medical treatments. His response was, “In our line-age, we take a strict view and would not recommend the use of animal products for hernia repair. Similarly, we advise against the use of bovine bone in dental surgery. As we believe in cremation, we also don’t recommend the use of cadaver parts. This is our way of looking at the issue based on the teachings of our lineage, and doesn’t constitute the sole Hindu view.”

The scriptural expert solicited was Dr S Bharatharatham, of Chennai, India. He is one of the foremost experts in the Saiva Agamas, which are key scriptures in the Saiva sect of Hinduism. He stated, “The Hindu system categorically prohibits any substance made of animal products for the treatment of human diseases. It always recommends medicines prepared from the herbs or combination of alchemic substances. Sastra Chikitsa, meaning surgery, is recommended without using animal products. Hernia is called antra vrudhi or antra sramsah in the Agamic texts. Some verses quoted from the Sarvokta Agama in the commentary...
of Bhatta Ramakhantha recommend yoga asanas known as vruddhi nirodhsana and sramsa nirodhasana for hernia treatment."

Regarding the issue of organ and tissue donation, we were referred to an article in Canadian Hindu Link. "Hindus are not prohibited by religious law from donating their organs. This act is an individual’s decision. . . . Donation of tissue or organs to save a life takes precedence over the requirement that the dead should be cremated whole, un-mutilated from head to toe. . . . If the organs harvested from a dead body can save human lives, the best creation of God, so be it."26

**Scientology**

Official response from the Public Relations Department for the Church of Scientology International was, “There is nothing in Scientology that prohibits the use of animal byproducts or the consumption of any animal flesh. Scientologists would have no objections to the type of treatment you are researching.”

**People for the Ethical Treatment of Animals (PETA)**

Communication was obtained through the official Web site, www.peta.org. We received the following in response to the question regarding the appropriateness of the use of animals and humans for biologic mesh. “PETA is opposed to the use of animals and animal tissues for experimentation, medical training and clinical treatments. This would include the production and use of biologic mesh, which utilizes organs and tissues that are removed from the bodies of pigs and cows who are killed (or harmed in any way) for these purposes. We do not endorse any practice that involves exploiting or harming an individual, human or non-human, for the benefit of others.” Further discussion clarified that under no circumstances would PETA condone the use of any animal product for implantation (including biologic mesh and porcine valves). PETA would strongly advocate for the use of human-derived product as long as it has been ethically obtained. PETA strongly encourages people to be organ and or full-body donors and has no moral objection to allogeneic organ transplantation.

**Veganism**

The survey was discussed with the president of American Vegan. She was prompt to point out that there is no consensus vegan statement. Traditional vegan practices include abstinence from consumption of meat products, including pork and beef. In accordance with that practice, vegans may desire to not have bovine or porcine surgical products implanted, unless the procedure is "totally necessary" and there is no alternative available. Even if the alternative were more costly and potentially less effective, vegans may prefer to not have animal products implanted. Allogeneic products are a definite preferable alternative to animal surgical products.

**DISCUSSION**

The use of biologic mesh products is continuing to expand, with multiple new products and applications. A previous study in the United Kingdom demonstrated a lack of basic knowledge by physicians of the source material of many biologic products. It is impossible for proper informed consent to be obtained if the surgeon is ignorant of product components. It is the responsibility of the medical community to have a clear understanding of the materials being used and the issues of informed consent that may arise due to religious and cultural concerns.

It is imperative that surgeons understand that patients may have strong beliefs regarding the use of allografts or xenografts. With an appropriate knowledge of religious and cultural preferences regarding biologic mesh products, surgeons will be more capable of performing a culturally sensitive informed consent for procedures involving acellular allogeneic or xenogeneic grafts or other products containing animal substrate or origin.

So is it, then, an acceptable practice for physicians to discuss religious practices with their patients? Many physicians have been trained that it is inappropriate for them to speak with patients about religion and spirituality.27-29 But one group of ethicists argued that for physicians there is just as much legitimacy in discussing the religious and spiritual beliefs of patients as there is in asking about such private matters as their sexual relationships because both might be relevant to medical treatment.30 In fact, a study conducted by King and associates demonstrated that 77% of hospitalized patients wanted physicians to consider their spiritual needs, and in a separate study, two-thirds of patients in an outpatient setting said they would be interested in having a physician inquire about their religious or spiritual beliefs if they became gravely ill.31

Cohen and coworkers argued, “Most physicians have had in their practice patients who, on the basis of their religious and spiritual beliefs, have rejected surgery, medication, blood products, life-sustaining technology, certain methods of childbirth, or other forms of medical care that physicians consider necessary . . . . It is better to learn about a potential disagreement early, when there is still time to address it, than in the midst of a wrenching crisis later, when it may be too late to resolve it.” An examination of Jehovah’s Witnesses’ refusal of blood products showed that it caused a low amount of frustration among physicians. This is possibly due to the fact that there is a clear line between medical and religious reasoning.32 Not all patients...
will view biologic grafts as acceptable, possibly based on their religious, spiritual, or cultural beliefs. A clear understanding of the reasoning behind this refusal to receive such products may aid physicians in the care of their patients and improve patient-physician relationships. Regarding religiously related conflict in medical encounters, Curlin and colleagues\(^\text{29}\) stated, "There is no bright line that can be drawn between discussion of medicine and discussion of religion. Therefore, when conflict occurs, moral (ie, religious) counsel inheres in medical recommendations. Science tells patients what they can do, but physicians also tell patients what they should do, and the latter is always a moral exercise."

In Cohen and colleagues\(^\text{30}\) examination of the "fine line" regarding physician inquiries into patients' religious and spiritual beliefs, they found reason to "recommend that physicians in overall charge of the medical care of patients for an extended period of time . . . ask patients about their religious and spiritual beliefs in several sorts of clinical contexts (further clarified to include before undergoing major surgery and after trauma) and provide them with care that takes these beliefs into account."

It may be the natural tendency of physicians to under-estimate the importance of religion in their patients' lives because religious belief is considerably more prevalent among the general population than among physicians.\(^\text{31}\) If physicians ignore the important role that faith has in their patients' decision making process, the outcomes may be unsatisfactory to all involved.\(^\text{32}\) And in cases in which a disagreement has arisen due to discrepancies between the physician's plan of care and a patient's religious or spiritual beliefs, chaplains may need to serve as intermediaries.\(^\text{30}\) Chaplains are more appropriately trained to offer sensitive spiritual care than are physicians.\(^\text{33}\) Perhaps a narrowly targeted approach to ascertaining the importance of religious, spiritual, or cultural beliefs is warranted by physicians. One group of chaplains argued that, "Attempts by physicians to integrate religious interests into medical practice are not nearly as well justified or simple as the literature suggests . . . For many patients, religious pursuits are a private matter, whether or not there is evidence of a solid link between religious activity and health . . . Physicians are not trained to engage in in-depth conversations with their patients about their spiritual concerns."\(^\text{29}\)

It is also important for physicians to realize that although patients may state that they belong to a certain religion or cultural group, they may not share the same beliefs and values as the leaders or other members of that group. All patients must be approached on an individual basis, especially in matters involving consent.\(^\text{30}\)

Author Contributions
Study conception and design: Jenkins, Yip, Melman, Frisella, Matthews
Acquisition of data: Jenkins
Analysis and interpretation of data: Jenkins, Matthews
Drafting of manuscript: Jenkins
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