

Religious Barriers to Measles Vaccination

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Abstract In 2014, the United States has experienced an increase in measles activity, the most since the elimination of the virus in 2000. The measles infection occurs in unvaccinated individuals. Communities and individuals choose to not vaccinate for a number of reasons, primarily citing religious and philosophical motives. Objections based upon religion most often center on the use of aborted human fetus tissue used in the *rubella* component of the combined vaccine products, and animal derived gelatins used in vaccine production. Objections among religious communities may also not be faith based, rather in some cases concerns related to lack of safety and efficacy of the vaccination result in refusal.

Keywords Measles · Vaccines · Religion · Faith · MMR vaccine

Introduction

Due to aggressive vaccination programs measles has not been an endemic disease in the United States (US) since 2000 [1]. However, due to international travel and the global economy the measles virus has been imported to the US from endemic areas of the world, leading to sporadic outbreaks especially among unvaccinated populations [2]. In 2014, the US has experienced the largest amount of measles activity since the elimination of the virus with 18 different outbreaks and 592 cases officially reported as of August 25, 2014 [3, 4]. A majority of the US outbreaks occurring in 2014 were imported from the Philippines where the disease is still endemic. Individuals traveling from endemic regions of the world import the virus while they are still contagious and introduce it to others.

Measles, or rubeola, is an extremely contagious acute respiratory disease that is caused by the measles virus. The virus is a single stranded RNA virus whose only natural host are humans; it is a member of the genus *Morbillivirus* which is part of the *Paramyxoviridae* family. There are several immunoglobulins that can be tested for in the blood to confirm a measles case. Symptoms of the infection include fever, cough, runny nose and conjunctivitis which are then followed by a rash that can appear over the entire body. The characteristic measles rash usually appears 14 days after the individual is exposed to the virus. Secondary complications include ear infections, pneumonia, encephalitis and in the most severe cases death. Serious complications associated with measles occur more frequently in pediatric and elderly populations. In 2012, the infection was responsible for an estimated 1,22,000 deaths worldwide [5]. The incubation period is approximately 7–21 days long. Infected individuals are considered contagious 4 days prior to the presentation of rash and

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continue to shed virus for 4 days following presentation of the rash. Transmission of the virus occurs through the air via aerosolized droplets from breathing, sneezing or coughing. The virus is highly contagious; nearly anyone exposed to the virus without immunity will contract measles. The R_0 (basic reproductive number) has been reported to range from 11 to 18. This high level of transmissibility underscores the need for continued vaccinations, especially among travelers entering parts of the world where measles remains endemic.

Many communities have made themselves particularly vulnerable to outbreak by choosing not to vaccinate for a myriad of reasons, most notably religious and philosophical [6]. When the measles virus infects an individual in one of these unvaccinated communities it is highly transmissible and often spreads to all members. The purpose of this paper is to describe the religious objections as they specifically relate to the measles vaccination.

Methods

A comprehensive literature search was conducted in August 2014 to identify peer-reviewed publications authored on religious objections to vaccination specifically pertaining to the measles vaccine. The search used Medline through Ovid, Google Scholar, and PubMed. Searches were performed using the keywords “Measles”, “Vaccines”, “Religion”, “Faith”, “Measles Vaccine”, “Measles, Mumps, Rubella Vaccine”, “Measles-Mumps-Rubella Vaccine”, and “MMR Vaccine”. After individually searching these terms, they were combined in a number of ways using ‘AND’. From this search, the terms were exploded and focused in order to map the terms to the subject headings. Articles regarding the manufacturing/production of the MMR vaccine, measles outbreaks, and religious views on vaccination were obtained. Citations contained in the reference sections of relevant articles were also reviewed to expand the literature search to include additional citations. The authors reviewed only English language papers.

Measles Vaccine

Vaccination against measles is available in two commercially available vaccines, M-M-R[®] II (Measles, Mumps, and Rubella Virus Vaccine Live) and ProQuad[®] (Measles, Mumps, Rubella, and Varicella Virus Vaccine Live), both of which are manufactured by Merck & Co, Inc. M-M-R[®] II is indicated for individuals 12 months or older, whereas ProQuad[®] is indicated only for children 12 months through 12 years of age [7, 8].

History of Vaccine

The first measles vaccine was licensed in the US in 1963. While both the live attenuated vaccine and inactivated vaccines were available originally, the inactivated vaccine was withdrawn due lack of efficacy and the appearance of atypical measles in some recipients. Multiple live attenuated strains of the vaccine have been licensed; however, only the Edmonston–Enders strain remains available. The Edmonston–Enders strain provides a more attenuated strain that results in significantly fewer reactions than other strains. In 1971, the combined measles-mumps-rubella vaccine was licensed, with the combined measles-mumps-rubella-varicella vaccine following in 2005 [9].

Efficacy

After administration of the measles vaccination via M-M-R[®] II, antibodies are detectable in 95 % of patients in about 12 days. In addition, immunity occurs within 10 days and persists for at least 15 years. It is thought that most individuals experience permanent immunity to each virus [10]. Similar antibody and immunity response is seen in ProQuad[®] [11]. Perhaps, the best way to evaluate the efficacy of measles vaccinations is the dramatic decrease in the number of cases since vaccine initiation and approval. Over a 99 % reduction in deaths was seen from the pre-vaccine era to 1981 [12].

Components and Manufacturing

The components and processing of M-M-R[®] II and ProQuad[®] may include substances that are of human and animal origin leading to religious based vaccination objections. Examples of such components include human diploid cells, human albumin, bovine excipients, or porcine excipients.

Human Diploid Cells

Human diploid cells are immature cells that contain large quantities of chromosomes. These cells play a critical role in vaccine production as they provide a reliable medium for the replication of multiple viruses. Additionally, human diploid cells may be artificially and indefinitely propagated [13]. Two specific strains of human diploid cells, WI-38 and MRC-5, are excellent for vaccine production. Viruses, including measles, cannot replicate independently; therefore, WI-38 and MRC-5 human fetal fibroblasts allow for preparation of viral vaccines [14]. Both cell lines were obtained from fetuses that were aborted for reasons not associated with vaccine production. The WI-38 line was isolated from fetal lung cells from a fetus that was aborted because the parents felt they had too many children [6]. The MRC-5 line was isolated from fetal lung cells from 14-week fetus that was aborted due maternal psychiatric reasons [15].

The measles and mumps viruses do not require human diploid cells to replicate. Rather, these viruses are propagated in chick embryo cell cultures for both the M-M-R[®] II and ProQuad[®] [7, 8]. However, the varicella virus present in ProQuad[®] is propagated in the MRC-5 cells during production [8]. Furthermore, the rubella virus (known as strain RA 27/3) was isolated from kidney fibroblasts obtained from a fetus aborted due to rubella. The isolated strain was then serially propagated into human diploid cells, specifically WI-38 cells [16]. The RA 27/3 strain is present in both the M-M-R[®] II and ProQuad[®] vaccines [7, 8].

Recombinant Human Albumin and Human Albumin

The growth medium for varicella, in ProQuad[®], contains human albumin [8]. Human albumin is obtained via fractionation of the human plasma from blood donations [17]. In contrast, the growth medium for measles, mumps, and rubella contains recombinant human albumin [7]. Recombinant human albumin does not contain blood or human plasma; currently, rice and yeast are used for large-scale production of recombinant human plasma [17].

Bovine Serum

The growth medium for measles, mumps, and rubella is supplemented with bovine serum. M-M-R[®] II contains less than 1 parts per million (ppm) fetal bovine serum per dose [7]. ProQuad[®] contains 0.5 mcg bovine calf serum per dose [8].

Hydrolyzed Gelatin

Hydrolyzed gelatin, which is often incorporated in vaccines in order to stabilize and preserve active ingredients or act as a solvent, may be of porcine or bovine origin. The hydrolyzed gelatin is obtained from collagen of the skin, bone, or other components of pigs or cattle [6]. M-M-R[®] II contains 14.5 mg of hydrolyzed gelatin per dose [7]. ProQuad[®] contains 11 mg of hydrolyzed gelatin per dose [8].

As discussed, the animal and human components of the M-M-R[®] II and ProQuad[®] are essential to the production of the vaccines in their current formulation and directly contribute to vaccines' role in the prevention of measles. Yet these same components can present religious objections due to their derivation from human and animal sources.

Religious Views on the Use of Measles Vaccination

Judaism

There are several branches within the Jewish faith, which include Conservative Judaism, Secular Judaism, Reform

Judaism, Orthodox Judaism and Reconstructional Judaism. Each branch interprets the teachings of the Torah, the main scripture of the religion, differently. Along with the Torah there are other scriptures, texts and writings that express the history, laws, traditions, ethics and philosophy of the Jewish faith. To what extent these teachings are followed or how they are interpreted makes up the different sects within the religion [6, 18].

In Judaism there is a supreme value placed on human life and preserving it at all costs; the physician and the patient both have an obligation to provide and seek health so that one can further the practice of the religion and live the life God intended [19]. In the Torah there are several references to the duty of physicians to heal. It is said “and heal he shall heal” (Exodus 21:19) which has been interpreted as God giving physicians authorization to heal or even obligating them to heal when they are able. The phrase “[d]o not stand idly by the blood of your neighbor” (Leviticus 19:16) has been interpreted as mandating physicians to provide care to patients when they are ill. This same verse from Leviticus has been used by Jewish scholars to encourage smallpox vaccinations in past eras [6].

Several Jewish dietary laws restrict what can be consumed by followers of the faith. Food that is considered suitable for eating is termed kosher; more conservative and Orthodox Jews are more likely to follow these dietary restrictions. Certain animal products from pork, shellfish or improperly slaughtered animals are considered non-kosher and shouldn't be consumed according to Jewish law. These restrictions could be applied to vaccines that contain porcine gelatins, such as both measles vaccine formulations. However, several Jewish authorities have only limited the use of porcine components to orally administered medications, not products that are given intravenously. The use of porcine components in a vaccine therefore do not violate Jewish law [6, 20].

Among the Jewish branches, Orthodox Jews have experienced the greatest number of documented measles outbreaks due to declining vaccination rates within specific communities [6]. Orthodox Jews adhere most thoroughly to Jewish law and tend to isolate themselves into communities of Orthodox families living within a specific geographic location. They often utilize the same Jewish schools and interact socially with each other without much interaction with outsiders of the community and faith. These factors create pockets of unvaccinated Jewish communities which are susceptible to infection when the measles virus is introduced. A measles outbreak occurred in Antwerp, Belgium among an Orthodox Jewish community, infected individuals were interviewed, and reasons for non-vaccination were not found to be due to religious beliefs. Rather, due to the advice of their primary care providers, or due to fears of side effects or allergies to the vaccination itself [21].

Hinduism

Hinduism has over 900 million adherents worldwide, with the majority of Indian and Nepali people subscribing to Hinduism [22]. Hinduism considers itself to be the Eternal Tradition. Its roots can be traced to between 1,500 and 500 BC [23, 24]. Hinduism has no one individual founder, doctrine, or scripture and is thus often referred to as ‘a way of life’ or ‘a family of religions’ [22]. Hindus advocate nonviolence and respect for life [23, 24] with many Hindus practicing vegetarianism as an extension of this belief. Hindu’s believe in a circle of life, known as reincarnation, with the ultimate reincarnation occurring in the form of a cow. Thus, cows are highly regarded in Hindu culture and eating beef is banned [22]. Hindu’s medical ethics stem from a principle of nonviolence and respect for animal life forms.

At least two issues may arise for Hindu’s concerning the measles vaccine. Both measles vaccine formulations contain trace bovine components [7, 8]. Because Hindu’s believe divinity permeates all things, including plants and animals, and place special emphasize on the sanctity of the bovine species, there may be concerns with the use of cows in the creation of the vaccine [23, 24]. Additionally, Hindus, in general, are opposed to abortion [22]. The measles vaccines are formulated with the rubella vaccine, which is derived from cell lines obtained from an aborted fetus [7, 8]. The WI-38 cell line was obtained from a deliberately aborted baby in Sweden [25, 26]. With no overall faith law or doctrine, the issue of vaccine development with bovine components produced in combination with aborted fetus tissue, may be of concern to individual Hindus.

Christianity

Christians are followers of Jesus Christ, the Son of God, and use the Bible as their sacred text. Christianity traces its roots to the first century and has approximately 2.1 billion adherents worldwide, representing nearly a third of the world’s population [27].

In general, there is no prohibition of food sources or preparation for individuals practicing Christianity. However, Christians in general do believe in the sanctity of life and may have objections to the use of aborted fetus tissue in the production of the vaccine. Different Christian denominations will be further explored as to possible objections to use of the vaccine.

Roman Catholic Christians

The Roman Catholic tradition is the original form of Christianity. All other Christian denominations are decedents of the Roman Catholic faith with differences arising

due to different retained and rejected aspects of Catholicism. The Roman Catholic Church is headed by the Pope, who is given the ultimate Church authority on earth. The Pope is advised and supported by Cardinals, Archbishops, etc. and various councils and advisory boards. As relates to the measles vaccine, the Church’s stance was published in a statement on June 9th, 2005 by the Center of Bioethics [28]. Catholics believe abortion is immoral. Involvement with vaccines derived from aborted fetal tissue carries differing moral weight for consumers, marketers, and vaccine producers [28]. Looking specifically at consumers, use of the measles vaccine confers protection to individuals, their children, and the population against disease. This is good. However, use of vaccine derived from aborted fetus tissue creates a situation of “passive cooperation” in which a population consensus is reached allowing vaccine production to occur in an otherwise immoral manner [28]. As such, Catholics have an ethical obligation to promote development of an alternative live rubella vaccine and the support of the Church to make conscientious objections to vaccines with which there are moral problems [28]. Catholics are encouraged to support development of vaccines derived from non-aborted tissue sources [25, 26, 28–30]. Catholics may obtain the MMR vaccine for their children because of the protective effects of the vaccine but they are obligated to lobby for development of a morally acceptable alternative.

Protestant Christianity

Like Roman Catholics, Protestant Christians do not tend to have objections to the use of the measles vaccine except for possible concerns with components of the vaccine originating from aborted fetus tissue. Specific Protestant denominations may have additional unique concerns. For instance, Christian Scientists believe disease is not a reality and diseases can be treated with prayer [31]. As such, they may have a fundamental issue with vaccines in general, including but not specific to the measles vaccine. In addition, Dutch reformed congregations believe vaccines prevent an individual from fully relying on God for their health [32–35]. Again, this may lead to a general, but not specific, lack of measles vaccine usage due to religious reasons.

Amish

In recent years, Amish communities throughout the US have experienced outbreaks of disease due to a lack of vaccination and community immunity [36–53]. The Amish are a group of Christian fellowships which began during the Protestant Reformation in sixteenth-century Europe. Amish accept basic Christian beliefs but also have some

special interpretations and emphases that have emerged throughout their history. Their spirituality has been shaped by their interpretation of the Bible as well as several other written sources [54].

Immunizations are not prohibited by Amish religious doctrine. However, there are large communities that do not receive scheduled immunizations [6, 55–58], exemplified by measles outbreaks in 2014. Immunization rates are low within the faith primarily due to poor access to care, and concerns about vaccine safety. Only 4–6 % of respondents from a 2011 study of Amish who objected to vaccination declined having their children vaccinated for religious reasons. Rather, the primary reasons cited were concerns for safety. The same study observed that 82 % of the exempting parents stated that they would consider vaccinating their children if “they knew the shots were safe to give” [58]. The Amish therefore represent a religious population that could benefit from improved education as a driver for increased immunization rates [6, 55–58].

Jehovah’s Witnesses

Jehovah’s Witnesses is a Christian denomination started in the late 1870s that is currently led by the The Watch Tower Bible and Tract Society. Since 1945, the Watch Tower Society has instructed its followers to refuse transfusions of whole blood and certain blood components considered violations of God’s law - derived from the interpretation of several scriptural passages. Their blood doctrine has undergone multiple changes since 1945, principally in 1978, 2000, and 2004. By abstaining from blood, Witnesses express their faith that only the shed blood of Jesus can redeem them and save their life. In this view, those who respect life as a gift from God do not try to sustain life by taking in blood, even in an emergency [6, 59, 60].

The Watch Tower Society denounced vaccination from the 1920s through the 1940s, due to similar scriptural passages cited for the avoidance of blood transfusions. An early leader of the Jehovah’s Witnesses, C. J. Woodworth, believed vaccination caused animal blood cells to be injected into humans, thus members were banned from having vaccinations around this time, under penalty of excommunication [61]. The Society revised this doctrine in the December 15, 1952, issue of *The Watchtower*, saying that those passages did not apply to vaccination.

“After consideration of the matter, it does not appear to us to be in violation of the everlasting covenant made with Noah, as set down in Genesis 9:4, nor contrary to God’s related commandment at Leviticus 17:10-14. Most certainly it cannot reasonably or Scripturally be argued and proved that, by being vaccinated, the inoculated person is either eating or

drinking blood and consuming it as food or receiving a blood transfusion. Vaccination does not bear any relationship to or any likeness to the intermarriage of angelic “sons of God” with the daughters of men, as described in Genesis 6:1-4. Neither can it be put in the same class as described at Leviticus 18:23-24, which forbids the mingling of humans with animals. It has nothing to do with sex relations.” *The Watchtower*, 1952-DEC-15.

In 1960s, the Society moved into a stance of neutrality, neither endorsing nor prohibiting vaccination. Moving towards the new millennium, *Awake!* magazine published statements supporting the clinical value of vaccination.

“In the world’s developed countries, new vaccines dramatically decreased the toll of measles, mumps, and German measles. A mass polio vaccination campaign, launched in 1955, was so successful that cases of the disease in Western Europe and North America plummeted from 76,000 in that year to fewer than 1,000 in 1967. Smallpox, a major killer disease, was eradicated worldwide.” *Awake!* 1997-FEB-22.

The decision of whether to vaccinate themselves or their family is currently a decision made by the individual Witness.

Islam

The foundation of Islam belief includes Muhammad, a prophet, who received revelations from a monotheistic God which were recorded in the book of *Qur’an*. The *Qur’an* serves as the written form of God’s word and is considered to be sacred, reverent, and the ultimate revelation of God. In addition to the *Qur’an*, Muslims use the supplementary *Hadith* collections to serve as a model for daily life. The *Hadith qudsi* includes the direct words of God; whereas, the *Hadith sharif* are the words and deeds of the prophet Muhammad [62]. Islamic scholars, known as muhtahids, may also issue opinions or ruling in regards to the interpretations of the *Qur’an* (fatwas) [6]. Although fatwas are not considered so be authoritative, they offer valuable principles which may be applied to daily living, including modern medicine.

Both theological and social issues may be present for Muslims regarding the M-M-R[®] II and ProQuad[®] vaccines. Theological issues may include use of porcine components, while social issues may include concerns for safety.

Both vaccines contain hydrolyzed gelatin of porcine origin. The *Qur’an* and tradition indicate certain animal products are absolutely forbidden, while others are

permitted (halal) or forbidden (haram) depending on how they perished. Food containing porcine gelatin derived from skin or bone is forbidden (haram); while, gelatin from beef or fish is permitted [6]. In 1995, a seminar was held by the Islamic Organization for Medical Sciences in order to address specific concerns of food and drugs. It was noted that gelatin derived from pigs has undergone extensive alterations through chemical reactions and follows the accepted constructs of ‘transformation’ [63]. The transformation from impermissible to permissible is known as *istihala* [64]. Therefore, the following recommendation was made: “The Gelatin formed as a result of the transformation of the bones, skin and tendons of a judicially impure animal is pure, and it is judicially permissible to eat it” [63]. It is important to note that Shafis, Hanbalis, and some Malikis do not accept *istihala* for porcine derivatives in vaccines, as they believe *istihala* applies only to natural transformations [64]. The *Qur’an* also states that “whoever is forced [by necessity], neither desiring [it] or transgressing [its limit], there is no sin upon him” (*Qur’an surah 2*, verse 173). Islamic law considers situations of exceptional circumstances through the “law of necessity” [6]. However, controversy still remains among Islamic juriconsults about defining what constitutes a dire necessity, especially when it comes to modern medicine and vaccines [64]. The multiple ethical and legal beliefs associated with vaccines, including the measles vaccination, leads to varying beliefs among Islamic individuals.

Discussion

This article is intended to provide discussion regarding religious and philosophical beliefs related to the acceptability of the measles vaccine. Recent measles outbreaks in the US have been linked to religious communities that have chosen not to vaccinate. This paper examines the faith belief basis contributing specifically to refusal of the M-M-R[®] II and ProQuad[®] vaccines which contain the measles vaccine. Interestingly, refusals based upon religion most often center on the use of aborted human fetus tissue used in the *rubella* component of the combined vaccine products, and animal derived gelatins used in vaccine production.

Of the major religions practiced in the world, this paper focuses on Judaism, Hinduism, Christianity, Roman Catholicism, Protestant Christianity, Amish, Jehovah’s Witnesses and Islam. In review of the Jewish and Amish faiths, there are no restrictions on the use of the M-M-R[®] II and ProQuad[®] vaccines; however, some communities within these faiths have chosen not to vaccinate due to safety and efficacy concerns. The Hindu faith does not explicitly prohibit the use of vaccines, but followers of the faith may object to vaccination due to its derivation from fetal cells or

containing bovine components. In general there are no laws or writings prohibiting the use of vaccines in Christianity, but objections to the M-M-R[®] II and ProQuad[®] vaccines arise due to the rubella virus component originating from aborted human fetus tissue. Similarly, Roman Catholicism professes the act of abortion to be immoral and thus supports the development of a vaccine product derived from non-aborted tissue. The Jehovah’s Witness faith has had a number of revisions on the topic of vaccine use in general; originally vaccines were considered blood products and were not to be administered. Recently the faith has retracted this viewpoint and now leaves it up to the individual to vaccinate or not. In Islam the primary concern is the use of a porcine based gelatin in vaccine production. There is not a uniform statement in regards to this issue yielding varying beliefs among Islamic individuals.

Limitations of this paper include its focused nature, not every of the over 4,000 estimated world religions could be covered, thus religions with known, current or historical, objections or measles outbreaks were emphasized. Furthermore, the authors do not provide detailed theological descriptions for the faith based objections, but rather describe for the healthcare professional more generally the beliefs that impact vaccine acceptance. In reviewing faith objections it became clear that in some instances the religious ideology were not actually what contributed to vaccination objection. For instance in Judaism and Amish faiths vaccine refusal is often a result of concerns related to lack of safety and efficacy of the vaccination. Additionally, in a number of faiths the final discretion is left upon the individual to make a judgment—Hinduism, Islam, Protestant Christianity.

Because vaccines are not 100 % effective, an estimated 85–95 % (dependent on the vaccine-preventable disease) of the population must be immunized in order to exert community immunity. Therefore, suboptimal rates of immunization lead to gaps in the protection from community immunity, opening the potential for outbreaks amongst the general population [65]. The Advisory Committee on Immunization Practices (ACIP) recommends,

2 doses of MMR vaccine routinely for children with the first dose administered at age 12 through 15 months and the second dose administered at age 4 through 6 years before school entry. Two doses are recommended for adults at high risk for exposure and transmission (e.g., students attending colleges or other post-high school educational institutions, health-care personnel, and international travelers) and 1 dose for other adults aged ≥ 18 years [66].

This review should serve as a resource for healthcare professionals when encountering religious objections to MMR vaccination. Objections based upon religion most

often center on the use of aborted human fetus tissue used in the *rubella* component of the combined vaccine products, and animal derived gelatins used in vaccine production. Objections among religious communities may also not be faith based, rather in some cases concerns related to lack of safety and efficacy of the vaccination result in refusal. These groups represent opportunities for education to enhance vaccination rates and reduce risk for outbreaks within unvaccinated communities.

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