REVIEW ARTICLE

Conscientious Objection and Other Grounds for Vaccination Refusals Worldwide

Yutaka KATO

Ishikawa Prefectural Nursing University
Email: yk227@aya.yale.edu

Abstract

Vaccination has contributed to a healthier world population. While it is often considered compulsory or recommended, people might refuse it for various reasons. According to the classification used in the United States, refusals can be made on medical, religious (or conscientious), philosophical and other grounds. Although non-medical refusals have been tolerated in some states, some think that refusals undermine infection control and lead to outbreaks of vaccine-preventable diseases. The objective of this research is to shed some light on the status quo of vaccination refusal worldwide and consider rationales and implications of different reasons which some individuals cite to refuse vaccination. This research examines literature on vaccination refusal published between January 1, 2010 and September 1, 2019, using the PubMed database. Several sets of key words were chosen to identify a sufficient number of relevant articles. Many studies in the search results sought to find out factors related to refusal/hesitancy. The articles were classified according to the country or area of primary focus. Vaccination refusers are ubiquitous, regardless of whether vaccination is mandatory or voluntary. Reports on the United States (US) accounted for the majority, and also the majority of first authors belonged to institutions in the US. As well, the proportion of US-based refusal literature is greater than that of publications in the medical field worldwide. Outside the US, there were only sporadic reports for each country. Some reports on the same countries contradicted each other. The majority of the reasons cited were non-conscientious (medical side-effects of vaccines, fatality from infections, access, financial problems, etc.). Reports of religious refusal were rare and anecdotal. There is a possibility more people will refuse vaccinations worldwide in the future, as risks of infections appear smaller. Therefore, though the numbers of articles on vaccine refusal published each year gradually increased and then began to decrease, from 2017 to the present, it is advisable to monitor more carefully the reason for refusals and to track the sources of information.

Key words: conscience, conscientious objection, vaccine, religion, database search, literature

1. Introduction

Vaccination, which is "a biological preparation that improves immunity to a particular disease,"[1] has contributed to a healthier world population. According to Martinez-Mateo et al., "Nowadays, vaccines are increasingly powerful, effective and safe. The list of vaccine-preventable diseases is expanding" and today contains such diseases as hepatitis B, measles, rubella, mumps, tetanus, poliomyelitis, pertussis, diphtheria, meningitis, and varicella. While vaccination is often considered compulsory or recommended for some infectious diseases, across the globe, people have hesitated, delayed, or outright refused to be vaccinated for various reasons. In the case of vaccines for children, such as measles, mumps, rubella (MMR), and human papilloma virus (HPV) vaccines, parents or guardians are potential refusers. A variety of reasons are cited for vaccination refusal. For example, even though numerous scientific researchers have repeatedly denied a link between vaccination and autism[2], this link is still cited by refusers[3]. As well, the antipathy towards vaccination resulting from this false link appears to be more prevalent than ever. Such antipathy is considered a great threat

to public health. Because of "herd immunity" or "community immunity" ("… when enough people are vaccinated against a certain disease, the germs can't travel as easily from person to person — and the entire community is less likely to get the disease."[4]); however, not every person must be vaccinated for vaccinations to be effective in suppressing infectious diseases. Thus, the coverage goal of the World Health Organization is 90% (not 100%) by 2020.[5]

Attempts to categorize reasons for vaccination refusals have been made to help identify refusals that should be accommodated and those that should not. In the United States (US), refusals are classified along medical, religious (or conscientious), philosophical, and other grounds[6]. Medical refusals are those made based on the health conditions of refusers, such as allergies, immune system problems, etc. Refusals of this type are considered acceptable in every state in the US. Further, refusals based on religious grounds are legally permissible in 45 US states, although few major religious groups explicitly refuse vaccinations today[7]. Philosophical refusals refer to those that are based on personal reasons. Divergent risk perception, which is often considered an unacceptable reason for vaccination refusal, is usually classified as a philosophical refusal in the US (as medical exemptions refer exclusively to professionally endorsed exemptions). According to one report, "children whose parents refused for reasons of religion" accounted for 4.4%.[8] Some medical professionals, public health experts, and policy-makers believe that philosophical refusals as well as religious refusals undermine infectious disease control and lead to sporadic outbreaks.[9] In recent years, restrictions on non-medical refusals or exemptions have been tightened in some areas of the US. For example, according to Delamater et al., the "California Implemented Senate Bill 277 (SB277), in 2016, made California the first state in nearly 30 years to eliminate nonmedical exemptions from immunization requirements for schoolchildren."[10] Also, New York "eliminated a religious exemption to vaccine requirements [...] in the face of the nation's worst measles outbreak in decades"[11] in 2019. A detailed list of US states accommodating religious and philosophical exemptions is provided by the National Conferences of State Legislatures.[12]. Instead of eliminating exemptions, in Ontario, Canada, administrators strengthened "school immunization requirements" and introduced "stiffer steps to qualify for a medical, conscience, or religious belief."[13]

Research on vaccination intersects multiple fields, such as biomedicine, bioethics, public health, religious studies, and other related disciplines, because the characteristics of vaccines and vaccine-preventable diseases, autonomy and integrity of people, human rights, public health goals, grounds for vaccine hesitancy, along with delay and refusal, need to be considered.

Relying on the categories of vaccination refusal in the US, the author of this article seeks to understand the status quo of vaccination refusal worldwide and consider the rationales and implications of the various reasons individuals cite in their refusals to be vaccinated.

2. Methods

This study examined existing literature on vaccination refusals published between January 1st of the year 2010 and September 1st of the year 2019. Articles were identified using the PubMed database and analyzed in light of the categories of refusal found in the US[14]. Medical Subject Headings (MeSH) terms were used, if applicable[15]. Several sets of keywords were used in PubMed searches of article titles and abstracts to identify a sufficient number of relevant articles (e.g., "vaccination AND refusal OR vaccination AND refuse" and "vaccine AND refuse OR vaccine AND refusal"). Searches for "vaccination AND refusal OR vaccination AND refuse" in article titles and abstracts yielded 34 articles. Further, searches for "vaccine AND refuse OR vaccine AND refusal" yielded 267 results. Twelve articles appeared in both searches. Nonrelevant articles, such as those dealing exclusively with medical researches, were excluded. Articles without abstracts and articles written in languages other than English were also excluded. Of the remaining articles, 11 were deemed nonrelevant and excluded because of their focus on topics such as contributions in medical science and refusals of other medical procedures, etc. Only 9 articles were labeled with the MeSH term "Religion and Medicine," which

necessitated the present study to first investigate abstracts, followed by further investigation of entire articles, as needed. The remaining articles that were ultimately reviewed for this study were then classified according to the country or region of primary focus.

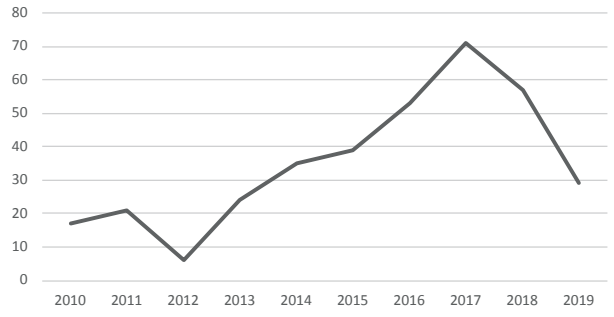
3. Results

3.1 A chronological shift

The articles were classified according to the year when those articles became available to the general public for the first time. In case more than one date of publication was recorded in the PubMed search results, the earlier date was used for this study. Table 1 and Figure 1 show the number of publications that appeared in the search results during the period. Though this study is not intended as a quantitative research, the numbers of articles on vaccine refusal published each year had been gradually increasing, but presumably started to decrease, around 2017. The reason for this decrease is unknown and hard to explain, but it is necessary to monitor publications to see whether this tendency will continue.

Table 1, Figure 1

Search resuts with "vaccine"		Search results with"vaccination"		Total	
2010	15	2010	2	2010	17
2011	19	2011	2	2011	21
2012	6	2012	0	2012	6
2013	23	2013	1	2013	24
2014	34	2014	1	2014	35
2015	36	2015	3	2015	39
2016	49	2016	4	2016	53
2017	59	2017	12	2017	71
2018	51	2018	6	2018	57
2019	23	2019	6	2019	29



3.2 Geographic Scope

Figures 2 and 3 show the geographic focus of the articles reviewed. Several studies were not geographically framed, exploring global or theoretical problems applicable to any country. For the sake of simplicity, articles focusing on more than one country are not included. In the search results, research on vaccination refusals in the US accounted for 64.2% (77) of the 120 articles published during 2010-2014 whose geographic areas of focus were specified and 52.2% (83) of the 159 articles published during 2015-2019 whose geographic areas of focus were specified. When Figure 2 and Figure 3 are compared, the ratio of the articles focusing on the US decreased, which suggests relatively greater interest in vaccine refusal and hesitancy outside the US in the last five years, and the total number of published articles is greater in that period.

As geography is insignificant for scientific articles, except for venues of clinical trials, this study compared the geographical distribution of articles according to locations of institutions of first authors. To simplify matters, if a first author belonged to more than one institution, only the institution listed at the top was used. According to the Scimago Journal & Country Rank, in the field of medicine from 1986 to 2018, the US (with 4,148,320 publications) accounts for 25.3% of all the publications (16,391,492 publications).[16] In comparison, the predominance of articles written by authors belonging to US institutions is conspicuous in this inquiry. Figure 4 and Figure 5 show the geographic distributions according to first authors in articles whose first authors' institutions were published during 2010-2014 and 2015-2019, respectively.

There were fewer research reports on vaccination refusals by populations outside of the US. Refusers appear to exist across regulatory contexts, that is, in places where vaccination is mandatory as well as those where it is not. Many articles focused on geographic regions that attracted attention, for example, because of an infectious disease outbreak, such as the case of pertussis that emerged in California in 2010 and polio outbreaks in regions where polio remains endemic, such as India, Afghanistan, Pakistan, and Nigeria. In the near future, China may be another area of focus as a vaccine scandal ("the

Changsheng vaccine crisis") occurred in 2018, when "unqualified DTP vaccines were reported to be used for child vaccination," causing more people to be suspicious about the safety of vaccines.[17] Of all articles considered, the author of this study found that no other country, with the exception of Canada, was reported to have intensively discussed methods of classifying acceptable and unacceptable refusal reasons as those of the US in abstracts in the search results.

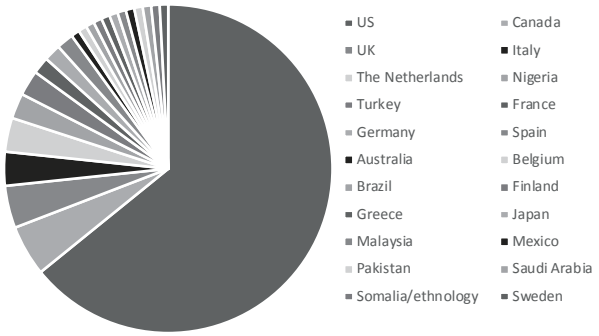


Figure 2. The geographic focus of the articles (2010-2014) in decreasing order

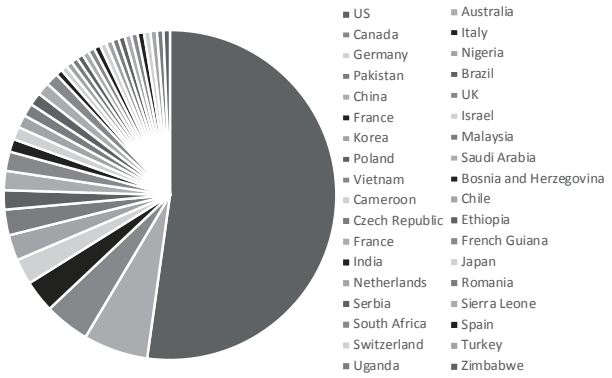


Figure 3. The geographic focus of the articles (2015-2019) in decreasing order

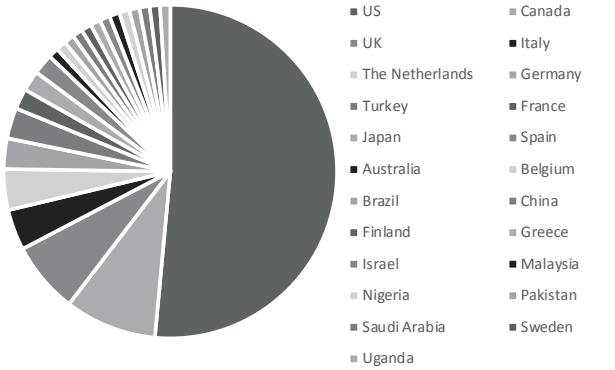


Figure 4. The geographic distribution according to first author (2010-2014) in decreasing order

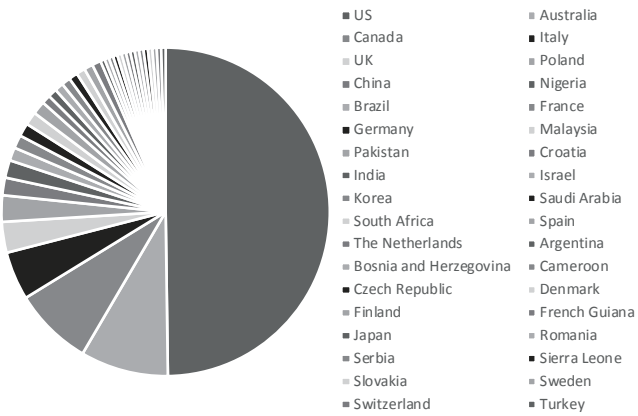


Figure 5. The geographic distribution according to first author (2015-2019) in decreasing order

3.3 Regional case studies

As qualitative research, this study did not count the numbers of articles that dealt with different grounds for hesitancy, delay, and refusal. Instead, recurring or conspicuous reasons for refusal as well as related themes in the literature were identified. Many studies sought to identify factors related to vaccination refusal or hesitancy to get vaccinated. The majority of the reasons cited by refusers were non-conscientious reasons such as side-effects of vaccines, low fatality or insignificant severity of infections that vaccinations intend to prevent, limited access to vaccine providers, and financial problems. Reports of religion-based refusals did exist, but they were rare and anecdotal. Notable cases from a geographic perspective are described extensively in the following.

Reports on some countries simply dismiss religions. To name a few, for example, in the United Kingdom (UK), while childhood immunizations are voluntary, health care staff strongly encourage participation. In London, "in 2012, a pertussis outbreak prompted a national vaccination program for pregnant women."[18] In Italy, "skepticism about the vaccine (60.4%) and its cost (34.1%) were indicated" as the primary reasons for vaccination refusal.[19] Within the context of Bosnia and Herzegovina, researchers noted that "A measles outbreak with two epidemic waves involving 4,649 probable and laboratory-confirmed cases was recorded in six out of ten cantons of the Federation of Bosnia and

Herzegovina between February 2014 and April 2015."[20] The authors refer to the anti-vaccination movement as "a problem with vaccine refusal resulting from anti-vaccination activities."[21]

In Canada, morality apparently plays some roles in decision-making about vaccinations. It was reported that "91.4% of responses could be explained using the conceptual model and specifically relate to the perceived importance of vaccination (46.8%), moral convictions (19.4%), and past experiences with vaccinations services (14.5%)."[22] Personal conviction was reported to be significant in France. According to Barrière et al., "Non-vaccinated HW were influenced by their family physician's advice ($p=0.03$), personal conviction ($p<0.001$) or the media ($p<0.001$)."[23]

A report on the Netherlands refers explicitly to religious aspects of vaccination refusal. According to Spaan et al., "The Netherlands experienced several outbreaks of vaccine preventable diseases, largely confined to an orthodox Protestant minority group.... Multivariate logistic regression showed that strongest predictors for vaccinating (future) children were a low or moderate level of religious conservatism (OR 10.4 [95% CI 5.7-18.9] and 4.6 [95% CI 2.9-7.4], respectively), being vaccinated themselves (OR 6.0 [95% CI 4.3-8.5]) and high educational level (OR 2.5 [95% CI 1.6-4.0])."[24]

In Croatia, "A sizeable minority of participants was characterized by childhood vaccine refusal (10.6%) and hesitancy intentions (19.5%)."[25] According to Repalust et al., "Religiosity (AOR = 1.12, $p < .05$) and the use of alternative medicine (AOR = 2.85, $p < .001$) increased the odds of vaccine refusal."[26] Repalust et al. argue that "following the social contagion model, future research should move beyond individual-level approach and take into account social interaction and social network effects."[27] Considering this case from Croatia, use of alternative or traditional (instead of modern Western) medicine may have something to do with both religious practices and vaccine refusals. Gleason et al. reported on the relevance of "the use of 'folk' or home remedies for illness prevention and treatment" among African Americans, stating that "those who use home remedies often or almost always were less likely to get vaccinated for influenza."[28] This example may be related to the African American religious traditions.[29]

Reports on (not necessarily religious) refusal reasons in African countries were also identified in the database search. For example, in Chad, Quoc Cuong et al. found that "SID (Supplemental Immunization Days) is a special strategy intended to accelerate eradication of poliomyelitis in countries where it is still endemic (India, Afghanistan, and Pakistan, in Asia, and Nigeria, in Africa). This strategy is also applied in Nigeria's neighbours (Cameroon, Chad, Niger and Benin). Since the poliomyelitis virus was imported from Nigeria in 2001, Chad has reported cases of poliomyelitis every year. After 30 SIDs in Chad and the inaccurate or false attribution of side-effects to polio vaccines, some groups persistently refuse polio vaccination."[30]

Nigeria was of importance in terms of the morbidity landscape. According to Mangal et al., "In 2012, more than 50% of the world's cases occurred in Nigeria following an unanticipated surge in incidence."[31] Religiosity apparently plays a role in Nigeria. "In 2003, local Imams, traditional leaders and politicians declared a polio campaign boycott, due to the concerns about the safety of the polio vaccine."[32] This research suggests that the reason for polio vaccine objections in Nigeria is primarily safety-oriented, thus placing such reasons in the category of medical objections. However, it is noteworthy that Northern Nigeria is a predominantly Islamic country[33] and that the religious leadership exercised their influence in the campaign to boycott polio vaccines. Another body of research highlights the significant influence of religiosity. Michael et al. state that "the majority (59%) of participants believed that vaccination was either not necessary or would not be helpful, and 30% thought it might be harmful. Religious beliefs were an important driver in the way people understood disease. Fifty-two percent of 48 respondents reported that illnesses were due to God's will and/or destiny and that only God could protect them against illnesses."[34] Yet other researchers such as Taylor et al. doubt the gravity of religious influence, citing statistical evidence to support their argument. According to their latest report, "Wealth, female education and knowledge of vaccines were associated with a lower propensity to refuse oral polio vaccine (OPV) among rural households. But higher risk

of refusal among wealthier, more literate urban households rendered these findings ambiguous. Ethnic and religious identity did not appear to be associated with risk of OPV refusal."[35]

According to Kriss et al., in Zimbabwe, which has a predominantly Christian population,[36] "the apostolic faith in Zimbabwe has been historically associated with objection to most medical interventions, including immunization."[37] The authors argue that "disparities in childhood vaccination coverage and availability of vaccination cards persist for apostolic [believers] in Zimbabwe. Continued collaboration with apostolic leaders and additional research to better understand vaccine hesitancy and refine interventions and messaging strategies are needed."[38]

Research on vaccination refusal has also examined refusal rationales in Middle Eastern countries, where, despite a popular image of religious enthusiasm in the region, refusals are not conscientious in most cases. Regarding Israel, Yitshak-Sade et al. report that "the lowest immunization coverage was found in Bedouin schools."[39] The authors put forth "the hypothesis that difficulties related to accessibility constitute the main problem rather than noncompliance with the recommended vaccination protocol for school-age children."[40] According to a survey on Israeli health care professionals (HCPs), "reasons for vaccine refusal were fear of needles (19 %); fear of side-effects (66 %) and lack of time (16 %)."[41] In his article on vaccinations in Saudi Arabia, Ahmed states that "the most common reason for vaccine refusal was the impression that the disease was not fatal (25.4%, n = 32)."[42] This reason can be classified as a refusal based on medical grounds, as this justification depends primarily on an assessment of the disease. However, this is considered to constitute a personal reason, as this assessment is regarded as divergent by health professionals. Likewise, Alabbad et al. on research on influenza hesitancy in Riyadh, Saudi Arabia, found that the most common grounds for refusal center upon risk and benefits of vaccination.[43]

A review of the literature also finds research on the existing types of vaccination refusals in Asia. Researchers have identified a range of categories of vaccination refusal reasons in Malaysia, including justifications shaped by religious beliefs. Wong reports that "reasons for vaccine refusal were doubts about safety and efficacy of the new vaccine (27.4%), perceived embarrassment at receiving an STI vaccine (20.7%), and perception of not being at risk of HPV infection (20.0%)."[44] Whereas "safety and efficacy of the new vaccine" and "perception of not being at risk" can be categorized as medical reasons, refusals based on "perceived embarrassment" can be affected heavily by religious traditions, as it is not embarrassing for people from other backgrounds. Chan et al. state that, in Malaysia, "the proportion of mothers who refused vaccination because of religious belief reduced from 78% between 2013 and 2015 to 67.1% in 2016 ($p = .005$). Overall, the finding confirms the positive impact of the educational and religious interventions introduced by the State Health Department of Kedah since January 2016."[45] This is suggestive of a possibility of vaccination promotion by a religious authority, though religious beliefs are usually considered to be difficult to change and leave little room for persuasion; this possibility was reported by Dutch researchers[46]).

In Pakistan, research suggests that "parents refuse to immunize their child because of lack of immunization visit knowledge and also because of their doubts regarding vaccine potency and side- effects."[47] Nevertheless, another group saw differently the problem in a country that was established when Muslims across the Indian sub-continent separated from British-controlled India. Murakami et al. report that "local interpretations of these facts (perceptions that OPV contained birth control or pork, that OPV was a foreign/central plot against Muslims, and that the vaccination was against the Hadith and the fate determined by God) and different manifestations of OPV refusal...of other injectable vaccines [were] almost equally prevalent for reasons that were very similar."[48] The reference to "a foreign/central plot against Muslims," is, in this case, an example where the hostility or antipathy toward other religious traditions can be relevant.

Likewise, research on vaccine-hesitant and vaccine-refusing parents in Australia identifies parental rejection of Western medical epistemology as a common cause for hesitancy and refusal, a rejection that can also be influenced by hostility/antipathy toward or

disagreement with other religious traditions.[49]

As for China, religiosity does not appear as a relevant factor shaping vaccine refusal or hesitancy. In areas of China, such as Shanghai, concerns about vaccinations are reported to be predominantly medical in nature: "Among 618 caregivers, 64% were concerned about vaccine co-administration and 31% were concerned about vaccine administration to infants <6 months of age)."[50] In the communist country, where religion, likened to opium, is prohibited, there seems to be little room left for religiosity. "In December 2013, this success was threatened by widespread media reports of infant deaths following HepB administration ... [resulting in] [s]eventeen deaths and one case of anaphylactic shock."[51] Also in Hong Kong (China), according to Cheung et al., "significant predictors of vaccination … [include] age, smoking status, comorbidity, previous hospitalization, perceived susceptibility, perceived severity, and psychological flexibility."[52] In the above figures and table, Hong Kong is counted along with China. Nevertheless, considering the importance of traditional remedies in China and a recent report on a possible link between use of alternative medicine and lower vaccination (as in Australia[53]), quasi-religious aspects of Chinese traditional medicine can be worth considering in future researches.

As the above review suggests, the characteristics of the particular subgroups one belongs to can have a greater influence on reasons underlying vaccination refusals than the characteristics of one's country of domicile. For example, the US comprises groups of diverse racial and religious backgrounds. Somalis in Minnesota is a case in point. "In 2011, an outbreak of measles in Minnesota was traced back to an unvaccinated Somali child.[54]"

3.4 Thematic analysis

This review of existing literature on vaccination refusal finds that reasons for refusal involve issues with ethical implications that can be classified according to several predominant themes, including risk perception (such as side-effects of vaccines and fatality of infections,), informed consent, conflicts of interests, and free-rider problems.

3.4.1 Risk perception

With regard to risk perception and future prospects, Bégué states that "the fear of adverse effects is now stronger than the fear of infectious diseases. The benefits of vaccination for vanishing infectious diseases can be hard to perceive."[55] Oraby, Thambi, and Bacuh argue that "mathematical models that couple disease dynamics and vaccinating behavior often assume that the incentive to vaccinate disappears if disease prevalence is zero. Hence, they predict that vaccine refusal should be the rule, and elimination should be difficult or impossible."[56] A closer look at risk perception finds that refusers are also concerned about "the number of vaccines given in the first 2 years (25%, CI 22 to 29), vaccine ingredients (22%, CI 19-25), allergies (18%, CI 15-21), weakening of the immune system (17%, CI 14-20) and autism (11%, CI 8-13)."[57] Non-refusers also share similar concerns - nearly half of Australian parents have some concerns, and a quarter lack vaccine decision-making confidence regarding childhood vaccines. Vaccination can be refused because of fear of needles or lack of time.

3.4.2 Informed consent and human rights

One concept that was featured in refusal reasons was that of informed consent.[58] Martinez et al. noted that in Granada, Spain, "Non-vaccinators … ask for informed consent."[59] One of the preconditions for autonomy or self-determination is that a person is best-positioned to judge his/her own welfare, avoid harm, and protect rights and integrity of one's own body. However, vaccination's communal dimension places it beyond this precondition, as individual decisions looking to advance one's own welfare may negatively impact the welfare of an entire community.

3.4.3 Reasons for suspicions of vaccination science

In researches on vaccination, collaborations with and assistance from pharmaceutical companies may be indispensable in some cases. In the search results, most of the articles declared no conflicts of interests, which is understandable since the present study excluded purely scientific researches reporting results of clinical trials. Only three articles made it clear that they

had conflicts of interest.[60] According to the research of Martinez et al., refusers "believed that vaccination programs are moved by biased studies and interests other than prevention."[61] This suspicion is only natural because clinical trials are usually led by those who wish to promote the drug, which constitutes a conflict of interest.

3.4.4 The free-rider problem

An individual's utility is maximized when everyone else has been vaccinated and the individual has not: that is, when an individual engages in free-riding. Such free-riders can be protected by herd vaccination, with no possibility of adverse effect. Buttenheim and Asch refer to "participation mandates, exclusion, incentives, and social norms" as "four conventional responses to the free-rider problem.[62] They find that "some health care providers have adopted the policy of refusing to accept into their practices families who refuse to vaccinate their children according to the standard vaccine schedule."[63] Whereas some may expect such a penalty to urge the general public to receive vaccinations, this exclusion policy can have negative consequences for the welfare of the broader population, as "many pediatric practices have adopted vaccine policies that require parents who refuse to vaccinate according to the ACIP [Advisory Committee on Immunization Practices] schedule to find another health care provider. Such policies may inadvertently cluster unvaccinated patients into practices that tolerate non-vaccination or alternative schedules, turning them into risky pockets of low herd immunity."[64]

4. Discussion

The majority of the articles in the search results did not include religious refusals and the majority of the reasons cited were non-conscientious (i.e., risk perception, access to vaccines, financial problems, etc.). Reports of religious refusal were rare and anecdotal. Religious refusal can be based on Christian, Islamic, or other religions, and religiosity-influenced vaccination behavior in various ways, as shown in the Results section. The first authors of the articles whose first authors' institutions were specified in the PubMed search results were based predominantly in the US; this predominance may be due to fewer cases of vaccine refusals, but may otherwise reflect lower attention to the issue.

4.1 Religious refusals

According to the literature identified by the database search process, religious refusals were not necessarily religious in a strict sense. For example, religions may provide networks for exchanging and disseminating secular information that can result in refusal/hesitancy, with religious leaders maintaining an influence on secular issues such as public health. The Islamic religion serves as a prime example. Reportedly, Muslims have refused vaccination in Nigeria and other countries. Compared to other religious traditions, the Islamic religion apparently leaves little to the secular dimension (considering the roles of Sharia and the authority of the imam). Other quasi-religious refusal reasons include preference to traditional or folk remedies and antipathy toward other (especially Western) traditions. The aforementioned report by Gleason et al. suggests a possibility that religions are disguised in other practices because, in some areas, folk remedies may be closely related to religious practices and beliefs.

In cases where vaccination refusal is not religious in a strict meaning, religions may still function as a catalyst for non-religious refusals, but religious participation also may influence the problem surrounding vaccinations. As clerics can mobilize and motivate people, suggest more virtuous paths, religions may actually function for the betterment of public health.

If refusers cite medical reasons, it is more likely that health care professionals (HCPs) with their greater expertise on the subject, could possibly persuade potential refusers to be vaccinated. On the other hand, if refusals are made on religious grounds, it may be more difficult for HCPs to understand their motivation and consequently persuade refusers effectively. This suggests that the possibility of persuasion (i.e., decision reversal) varies based on different grounds of refusal. This seems consistent with the report that "Different reasons for refusal are associated with different patterns of vaccination behavior."[65] For HCPs, understanding refusers' attitudes towards vaccination and health can be made more difficult when refusals are based on

values foreign to HCPs. If the refusal makes little sense to HCPs, it might be simply dismissed or not be recorded or reported properly.

A lack of reports on religiously based refusals may be interpreted in a variety of ways. In developing countries, this gap may be attributed to less attention paid to non-medical factors such as human rights, including the principle of informed consent. Some countries may not be well-prepared to evaluate religiosity in public policy. They need to consider how to deal with potential religious refusal, for few studies on reasons for refusal in countries outside of the US discussed criteria as sophisticated as those used to categorize such reasons than those used by researchers in the US. Moreover, some authors in the search results were not based in areas targeted in their research. Unless they come from the targeted area, there remains a possibility that some authors are not knowledgeable about the religio-cultural practices and beliefs in the area. Also, partly because PubMed was used for the present study and articles listed in the database were written mostly by those trained in scientific fields related to health care and also because much attention to religions may undermine chances of being published in medical journals, due attention may not be paid to religio-cultural aspects of people's behaviors.

4.2 Contradictory research reports

A number of case studies reporting on vaccination refusals within the same country produced results that were incoherent and contradicted each other. Such examples include contradiction in the reports on religious refusals in Nigeria and Pakistan. These contradictions and incoherence may have arisen for a number of reasons. One explanation is that conflicting reports on the same country may reflect differences in the region or sample populations studied or differences in the time in which vaccination refusal in a given country was examined. Another possible explanation for contradictory results is a lack of attention, by some researchers, on the religious aspects of vaccination refusal. Again, HCPs are usually not knowledgeable about religious teachings or traditions and they are not cultural anthropologists. One conspicuous and relevant trend found in the literature, relating to contradictions and incoherence, is that reasons for refusal are used and measured by scholars in very different manners. For example, survey and interview questions that ask about a refuser's "lack of confidence" rely on a rather superficial and vague construct in need of further clarity, as perceptions of "confidence" may concern the safety and effectiveness of vaccines, their readiness (i.e. they feel they have enough knowledge to move forward to take vaccinations), and so forth. To prevent such inconsistencies of wording in asking about the reasons for refusal considered by researchers, well-designed qualitative surveys should precede quantitative surveys that typically feature questionnaire surveys, so that the latter form of research, in building on the factors identified by qualitative surveys, can develop survey questions and possible answers in a way that is more relevant to a given context. In this way, quantitative survey results will be more meaningful. Given the broad spectrum of reported grounds for refusal, without prior insight into specific grounds for refusal, sound quantitative analysis is hardly feasible. Further inquiry into the cause of contradictory results will be necessary to reach any conclusion about the independent or combined role of the above factors in producing contradictory results across case studies on the same countries.

4.3 Informed consent, integrity of body, and harm to others

As a conceptual instrument, informed consent has been developed and applied to avoid harm to persons through integrating autonomy and self-determination in health care. Vaccination involves minimal but actual invasiveness to the human body. Thus, it may appear to the eyes of each person receiving the vaccination as a form of medical intervention involving potential harm analogous to other health care procedures. In healthcare, avoiding harm to the body or protecting the integrity of the body is of paramount concern. However, vaccination as a collective intervention has derived from a distinct context which is foreign to the notion of informed consent. To achieve public health goals, we need to reconcile the concepts of informed consent and public health goals. Moreover, within the context of vaccination, there are nuanced

relations between individual choice and the harm principle.[66] In another wording, John Stuart Mill's Harm Principle stipulates that "... people should be free to act however they wish unless their actions cause harm to somebody else." One problem is that a vaccination refusal of one person does not necessarily constitute direct harm to others because of "herd immunity" or "community immunity." When generalized, however, a vaccination refusal can pose a threat to the public health and thus constitute harm to others. From this viewpoint, sporadic refusal by individuals seems more justifiable than consistent refusal by groups of individuals. When vaccination refusal is exercised by people belonging to the same group, tolerance is less likely, contrary to regulations in some American states that require affiliation to religious groups[67].

4.4 Risk perception and the free-rider problem

As perceived risks of infections become smaller, other rationales for refusing vaccinations such as religious beliefs may become more prevalent. There is a possibility that more people worldwide will refuse vaccinations in the future, as risks of infections appear smaller and informed consent or other rights are perceived as more important. This suggests that it is advisable to monitor more carefully grounds of refusals and to track the sources of information.

With regard to risk perception in particular, while low risks (probabilities) of harm may appear insignificant to policymakers, the general public may interpret such risks in a very different – and not necessarily illogical – manner. For example, in Japan, approximately 20 persons die annually because of being hit by lightning strikes. Despite this small number of deaths, this risk is well-known among golfers and anglers, with such groups taking precautions. They avoid standing in a field or near a very tall tree. There is nothing illogical about being concerned with risks, even if they are unlikely and rare. Refusing vaccination may be rational in terms of risk perception as long as they can believe that they will be protected by "herd immunity" or "community immunity" (or they may simply believe that the targeted infection will remain insignificant as in the cases of some influenza vaccine cases), but such refusal may be perceived as free riding.

As far as the free-rider problem is concerned, free-riders take advantage of herd immunity. To put it another way, free riding is made possible by herd vaccination. Thus, when free riding occurs because of religious beliefs shared by groups of people who gather in one place, religious beliefs may negate the protection afforded by herd vaccination by increasing the number of unvaccinated individuals in a given religious community. On the other hand, clerics can mobilize and motivate people and make followers behave in a new way. One possibility is that organizations of health professionals attempt to persuade religious leadership, as those leaders, possibly being older and having no young children, may not be usual targets of persuasion by health professionals. And successful cases (exemplified in reports by Chan et al. and Ruijs et al.) do exist. Religious beliefs may influence free riding by promoting virtuous behaviors that promote vaccination.

4.5 Implications for Japanese society

As the number of immigrants and foreign residents has been growing rapidly, with some of them possibly retaining their religious and cultural beliefs,[68] due attention to the potential factors that can affect health behaviors of those from other countries must help predict refusal or hesitancy behaviors and consider measures. Nevertheless, as discussed in this study, without sensitivity and attention, factors underlying people's vaccine hesitancy and refusal, including religiosity, can elude the attention of health care professionals.

5. Conclusion

Despite the great contribution of vaccination to humanity, people worldwide refuse vaccination for various reasons. Antipathy against vaccination today can pose a great threat to public health in the area. Relying on the classification used in the US, this research examined articles using PubMed. The numbers of articles on vaccine refusal published each year has been gradually increasing, but presumably has started to decrease around 2017. From a geographic perspective, the present study found that refusers are ubiquitous and are found in

countries where vaccination is both mandatory and voluntary. However, with regard to the geographic focus of research, there were lower ratios or reports on vaccination refusers in places outside of the US, compared to publications in the medical field in general. One possible explanation for the scarcity of reports outside the US may be that the international community does not share enough information on the vaccination status quo elsewhere. This absence of geographically consistent conscientious objection arguments apparently has contributed to public health goals.

As a qualitative research study, the numbers and ratios of articles associated with each reason for refusal were not counted. Instead, the nature of refusals and related themes that recurred in the literature were identified and categorized. The majority of the reasons cited were not religious or philosophical, with reports of religiously based refusals rare and anecdotal. The dearth of reporting on religious refusals can be interpreted in multiple ways, including an inability to evaluate religiosity in public policy. Future research needs to consider how the international community should deal with religious refusals. It is recommended that researchers monitor more carefully the grounds for refusals and track the sources of such rationales. There is a possibility that more people will refuse vaccinations in the future, as risks of infectious diseases appear smaller and informed consent and other human rights rise in importance. Religions can function as a catalyst for non-religious refusals. On the other hand, religious affiliation and clerics may help mitigate the free-riding problem, for example. Although the number of publications on vaccination shows a sign of decrease in recent years, consistent and close attention to the reasons for vaccination hesitancy and refusal can help improve the public health situation, while paying due attention to the religio-cultural aspects of people's behaviors.

The limitation of the study

The low availability of relevant articles significantly limited feasible research designs.

Endnotes

1 World Health Organization. "Vaccines" http://www.who.int/topics/vaccines/en/ (Accessed on September 2, 2019)

2 Eggertson, L. "Lancet retracts 12-year-old article linking autism to MMR vaccines" CMAJ. 2010 Mar 9; 182(4): E199–E200.

3 Costa-Pinto, J.C., Willaby, H.W., Leask, J., Hoq, M., Schuster, T., Ghazarian, A., O'Keefe, J., Danchin, M.H. Parental Immunisation Needs and Attitudes Survey in paediatric hospital clinics and community maternal and child health centres in Melbourne, Australia. *J Paediatr Child Health*. 2018 May; 54(5):522-529.

4 U.S. Department of Health & Human Services, "Vaccines Protect Your Community" https://www.vaccines.gov/basics/work/protection (Accessed on September 2, 2019)

5 World Health Organization. Global Vaccine Action Plan 2011-2020. Page 25. https://www.who.int/immunization/global_vaccine_action_plan/GVAP_doc_2011_2020/en/ (Accessed on September 2, 2019)

6 National Conferences of State Legislatures. States with Religious and Philosophical Exemptions from School Immunization Requirements. Retrieved from http://www.ncsl.org/research/health/school-immunization-exemption-state-laws.aspx (Accessed on October 29, 2019)

7 Grabenstein, J.D. What the World's Religions Teach: Applied to Vaccine and Immune Globulins. *Vaccine* 31, 2013, 2011-2023.

8 Navin, M.C., Wasserman, J.A., Ahmad, M., and Bies, S. Vaccine Education, Reasons for Refusal, and Vaccination Behavior. *Am J Prev Med*. 2019 Mar; 56(3):359-367.

9 Offit, P.A. *Deadly Choices: How the Anti-Vaccine Movement Threatens Us All*. Basic Books, 2012.

10 Delamater, P.L., Pingali, S.C., Buttenheim, A.M., Salmon, D.A., Klein, N.P., Omer S.B. Elimination of Nonmedical Immunization Exemptions in California and School-Entry Vaccine Status. *Pediatrics*. 2019 Jun; 143(6).

11 Allyn, B. "New York Ends Religious Exemptions for Required Vaccines" June 13, 2019. National Public Radio. https://www.npr.org/2019/06/13/732501865/new-york-advances-bill-ending-religious-exemptions-for-vaccines-amid-health-cris (Accessed on September 2, 2019)

12 National Conferences of State Legislatures. States

with Religious and Philosophical Exemptions from School Immunization Requirements. Retrieved from http://www.ncsl.org/research/health/school-immunization-exemption-state-laws.aspx (Accessed on October 29, 2019)

13 MacDonald, N.E., Desai, S., Gerstein, B. Working with vaccine-hesitant parents: An update. *Paediatr Child Health*. 2018 Dec; 23(8):561-562.

14 National Center for Biotechnology Information, U.S. National Library of Medicine. PubMed: https://www.ncbi.nlm.nih.gov/pubmed/ (Accessed on September 2, 2019)

15 U.S. National Library of Medicine. "Medical Subject Headings" https://www.nlm.nih.gov/mesh/introduction.html (Accessed on September 2, 2019)

16 Scimago Lab. Scimago Journal & Country Rank: https://www.scimagojr.com/countryrank.php?area=2700 (Accessed on September 2, 2019)

17 Zhou, M., Qu, S., Zhao, L., Kong, N., Campy, K.S., Wang, S. Trust collapse caused by the Changsheng vaccine crisis in China. Vaccine. 2019 Jun 6; 37(26):3419-3425.

18 Winslade, C. G., Heffernan, C. M., & Atchison, C. J. (2017). Experiences and perspectives of mothers of the pertussis vaccination programme in London. *Public health*, 146, 10-14.

19 Mita, V., Arigliani, M., Zaratti, L., Arigliani, R., & Franco, E. (2017). Italian physicians' opinions on Rotavirus vaccine implementation. *Pathogens*. *6*(4), 56.

20 Salimović-Bešić, I., Šeremet, M., Hübschen, J. M., Hukić, M., Tihić, N., Ahmetagić, S., Delibegović, Z., Pilav, A., Mulaomerović, M., Ravlija, J., &Muller, C. P. (2016). Epidemiologic and laboratory surveillance of the measles outbreak in the Federation of Bosnia and Herzegovina, February 2014–April 2015. *Clinical Microbiology and Infection*, *22*(6), 563.e1-7.

21 Ibid.

22 Meyer, S. B., & Lum, R. (2017). Explanations for not receiving the seasonal influenza vaccine: An Ontario Canada based survey. *Journal of Health Communication*, *22*(6), 506-514.

23 Barriere, J., Vanjak, D., Kriegel, I., Otto, J., Peyrade, F., Esteve, M., & Chamorey, E. (2010). Acceptance of the 2009 A (H1N1) influenza vaccine among hospital workers in two French cancer centers. *Vaccine*, *28*(43), 7030-7034.

24 Spaan, D. H., Ruijs, W. L., Hautvast, J. L., & Tostmann, A. (2017). Increase in vaccination coverage between subsequent generations of orthodox Protestants in The Netherlands. *The European Journal of Public Health*, *27*(3), 524-530.

25 Repalust, A., Šević, S., Rihtar , S., & Štulhofer, A. (2017). Childhood vaccine refusal and hesitancy intentions in Croatia: Insights from a population-based study. *Psychol Health Med*. *22*(9), 1045-1055.

26 Ibid.

27 Ibid.

28 Gleason, J.L., Jamison, A., Freimuth, V.S., and Quinn, S.C. Home remedy use and influenza vaccination among African American and white adults: An exploratory study. *Prev Med*. 2019 Aug; 125:19-23.

29 Dessio, W., Wade, C., Chao, M., Kronenberg, F., Cushman, L.E., & Kalmuss, D. (2004). Religion, spirituality, and healthcare choices of African-American women: Results of a national survey. *Ethnicity & Disease*. 14(2):189-97.

30 Quoc Cuong H., Schlumberger, M., Garba Tchang, S., Ould Cheikh, D., Savès, M., Mallah B., Demtilo Attilo, J., Ngangro Mosurel, N., & Gamatié, Y. (2010). Evaluation of the lifetime of nail markings during polio vaccinations in Chad. *Sante*. *20*(3), 143-8.

31 Mangal, T. D., Aylward, R. B., Mwanza, M., Gasasira, A., Abanida, E., Pate, M. A., & Grassly, N. C. (2014). Key issues in the persistence of poliomyelitis in Nigeria: A case-control study. *The Lancet Global Health*, *2*(2), e90-e97: 185.

32 Meyer, S. B., & Lum, R. (2017). Explanations for not receiving the seasonal influenza vaccine: An Ontario Canada based survey. *Journal of Health Communication*, *22*(6), 506-514.

33 Religious Beliefs in Nigeria. https://www.worldatlas.com/articles/religious-beliefs-in-nigeria.html (Accessed on September 2, 2019)

34 Michael, C.A., Ogbuanu I.U., Storms A.D., Ohuabunwo C.J., Corkum, M., Ashenafi, S.Achari, P., Biya, O., Nguku, P., Mahoney, F.; & NSTOP OPV Refusal Study Team. An assessment of the reasons for oral poliovirus vaccine refusals in northern Nigeria. *The Journal of Infectious Diseases*, *210* (suppl_1), S125-S130.

35 Taylor, S., Khan, M., Muhammad, A., Akpala, O., van Strien, M., Morry, C., Feek, W. & Ogden, E. (2017). Understanding vaccine hesitancy in polio eradication in northern Nigeria. *Vaccine*, *35*(47), 6438-6443.

36 The Herald. (2002, July 23). Zimbabwe: Apostolic sect members take children for immunization. Retrieved from https://allafrica.

com/stories/200207230546.html (Accessed on September 2, 2019)

37 Kriss et al. Vaccine receipt and vaccine card availability among children of the apostolic faith: Analysis from the 2010-2011 Zimbabwe demographic and health survey. Pan Afr Med J. 2016 May 11; 24:47.

38 Ibid. Also, UNICEF. (December 2016). Factors Influencing Vaccine Hesitancy and Immunization Coverage in Zimbabwe: A Rapid Assessment. Retrieved from https://www.unicef.org/zimbabwe/media/356/file. (Accessed on September 2, 2019)

39 Yitshak-Sade, M., Davidovitch, N., Novack, L., and Grotto, I. Ethnicity and immunization coverage among schools in Israel. Ethn Health. 2016 Oct; 21(5):439-51.

40 Ibid.

41 Nutman, A., and Yoeli, N. (2016). Influenza vaccination motivators among healthcare personnel in a large acute care hospital in Israel. *Israel Journal of Health Policy Research*, *5*(1), 52.

42 Ahmed, G.Y., Balkhy, H.H., Bafaqeer, S., Al-Jasir, B., and Althaqafi A. Acceptance and Adverse Effects of H1N1 Vaccinations Among a Cohort of National Guard Health Care Workers during the 2009 Hajj Season. BMC Res Notes. 2011 Mar 13; 4:61

43 Alabbad, A. A., Alsaad, A. K., Al Shaalan, M. A., Alola, S., & Albanyan, E. A. (2018). Prevalence of influenza vaccine hesitancy at a tertiary care hospital in Riyadh, Saudi Arabia. *Journal of Infection and Public Health*, *11*(4), 491-499.

44 Wong, L. P. (2011). Knowledge and attitudes about HPV infection, HPV vaccination, and cervical cancer among rural Southeast Asian women. *International Journal of Behavioral Medicine*, *18*(2), 105-111.

45 Chan, H. K., Soelar, S. A., Md Ali, S. M., Ahmad, F., & Abu Hassan, M. R. (2018). Trends in Vaccination Refusal in Children Under 2 Years of Age in Kedah, Malaysia: A 4-Year Review from 2013 to 2016. *Asia Pacific Journal of Public Health*, *30*(2), 137-146.

46 Ruijs WL, Hautvast JL, Kerrar S, van der Velden K, Hulscher ME. The role of religious leaders in promoting acceptance of vaccination within a minority group: a qualitative study. *BMC Public Health*. 2013 May 28; 13:511.

47 Khaliq, A., Sayed, S.A., Hussaini, S.A., Azam, K., & Qamar, M. (2017). Missed immunization opportunities among children under 5 years of age dwelling in Karachi City. J Ayub Med Coll Abbottabad. *29*(4):645-649.

48 Murakami, H., Kobayashi, M., Hachiya, M., Khan, Z. S., Hassan, S. Q., & Sakurada, S. (2014). Refusal of oral polio vaccine in northwestern Pakistan: A qualitative and quantitative study. *Vaccine*, *32*(12), 1382-1387.

49 Ward, P. R., Attwell, K., Meyer, S. B., Rokkas, P., & Leask, J. (2017). Understanding the perceived logic of care by vaccine-hesitant and vaccine-refusing parents: A qualitative study in Australia. *PLoS One*, *12*(10), e0185955.

50 Wagner, A. L., Boulton, M. L., Sun, X., Huang, Z., Harmsen, I. A., Ren, J., & Zikmund-Fisher, B. J. (2017). Parents' concerns about vaccine scheduling in Shanghai, China. *Vaccine*, *35*(34), 4362-4367.

51 Yu, W., Liu, D., Zheng, J., Liu, Y., An, Z., Rodewald, L., Zhang, G., Su, Q., Li, K., Xu, D., Wang, F., Yuan, P., Xia, W., Ning, G., Zheng, H., Chu, Y., Cui, J., Duan, M., Hao, L., Zhou, Y., Wu, Z., Zhang, X., Cui, F., Li, L., Wang, H., & Wang, F. (2016). Loss of confidence in vaccines following media reports of infant deaths after hepatitis B vaccination in China. *International journal of epidemiology*, *45*(2), 441-449.

52 Cheung, K., & Mak, Y. (2016). Association between psychological flexibility and health beliefs in the uptake of influenza vaccination among people with chronic respiratory diseases in Hong Kong. *International Journal of Environmental Research and Public Health*, *13*(2), 155.

53 Frawley, JE, McIntyre E, Wardle J, Jackson D. Is there an association between the use of complementary medicine and vaccine uptake: Results of a pilot study. *BMC Res Notes*. 2018; 11: 217.

54 Wolff, E.R. & Madlon-Kay, D.J. (2014). Childhood vaccine beliefs reported by Somali and non-Somali parents. *J Am Board Fam Med*. *27*(4), 458-64.

55 Bégué, P. (2012). Vaccine refusal and implications for public health in 2012. *Bulletin de l'Academie Nationale de Medecine*, *196*(3), 603-17.

56 Oraby, T., Thampi, V., & Bauch, C. T. (2014). The influence of social norms on the dynamics of vaccinating behaviour for paediatric infectious diseases. *Proceedings of the Royal Society B: Biological Sciences*, *281*(1780), 20133172.

57 Costa-Pinto, J. C., Willaby, H. W., Leask, J., Hoq, M., Schuster, T., Ghazarian, A., O'Keefe, J., & Danchin, M. H. (2018). Parental Immunisation Needs and Attitudes Survey in paediatric hospital

clinics and community maternal and child health centres in Melbourne, Australia. *Journal of Paediatrics and Child Health*, *54*(5), 522-529.

58 Helps. C., Leask, J., Barclay, L., Carter S. Understanding non-vaccinating parents' views to inform and improve clinical encounters: a qualitative study in an Australian community. *BMJ Open*. 2019 May 28;9(5)

Gianfredi V, D'Ancona F, Maraglino F, Cenci C, Iannazzo S. Polio and measles: Reasons of missed vaccination in Italy, 2015-2017. *Ann Ig.* 2019 May-Jun; 31(3):191-201.

59 Martinez-Diz, S., Romero, M. M., Fernandez-Prada, M., Piqueras, M. C., Ruano, R. M., and Sierra, M. F. (2014). Demands and expectations of parents who refuse vaccinations and perspective of health professional on the refusal to vaccinate. *Anales de Pediatría (English Edition)*, *80*(6), 370-378.

60 Norton, S.P., Scheifele, D.W., Bettinger, J.A., and West, R.M. Influenza vaccination in paediatric nurses: Cross-sectional study of coverage, refusal, and factors in acceptance. *Vaccine*. 2008 Jun 2; 26(23):2942-8.

Delamater, P.L., Pingali, S.C., Buttenheim, A.M., Salmon, D.A., Klein, N.P., Omer, S.B.

Elimination of Nonmedical Immunization Exemptions in California and School-Entry Vaccine Status. *Pediatrics*. 2019 Jun; 143(6).

Mendes Lobão W, Duarte FG, Burns JD, de Souza Teles Santos CA, Chagas de Almeida MC, Reingold A, Duarte Moreira E Junior. Low coverage of HPV vaccination in the national immunization programme in Brazil: Parental vaccine refusal or barriers in health-service based vaccine delivery? *PLoS One*. 2018 Nov 12; 13(11):e0206726.

61 Ibid.

62 Buttenheim, A. M., & Asch, D. A. (2013). Making vaccine refusal less of a free ride. *Human Vaccines & Immunotherapeutics*, *9*(12), 2674-2675.

63 Diekema, D.S. Provider dismissal of vaccine-hesitant families: Misguided policy that fails to benefit children. *Hum Vaccin Immunother*. 2013 Dec; 9(12):2661-2.

64 Buttenheim, A. M., et al., *op. cit.* note 57.

65 Navin, M.C. et al.

66 Mill, J.S. (1859). *On liberty*. London: John W. Parker and Son.

67 The History of Vaccines: An Educational Resource by the College of Physicians of Philadelphia. Vaccination Exemptions. Retrieved from https://www.historyofvaccines.org/index.php/content/articles/vaccination-exemptions (Accessed on October 29, 2019)

68 Osumi, M. Number of foreign residents in Japan rose 6.6% in 2018, while number of overstayers grew almost twice as much, government data shows. The Japan Times. Mar. 22, 2019. https://www.japantimes.co.jp/news/2019/03/22/national/number-foreign-residents-japan-rose-6-6-2018-number-overstayers-grew-almost-twice-much-government-data-shows/#.XXZTkij7TIU (Accessed on September 2, 2019)