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Who's Skeptical of Vaccines? Prevalence and Determinants of Anti-Vaccination Attitudes in Italy

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Abstract

This paper investigates negative attitudes toward vaccines in Italy, where anti-vaccination movements have gained significant momentum in recent years. Considering the substantial health risk to herd immunity the issue poses, particularly after the sudden outbreak of the Covid-19 pandemic, it has become increasingly urgent to study the prevalence and diffusion of anti-vaccination beliefs. Using data from the 2016 European Social Survey's (ESS) country specific questions for Italy, the prevalence of anti-vaccination attitudes is examined along with how they are influenced by demographic, attitudinal and value-oriented determinants. The results show that 15 percent of the Italian public strictly hold negative views toward vaccination, and the prevalence of anti-vaccination attitudes is most commonly found among those who are less educated and aged between 25 and 34. While religiosity and political conservatism do not have an effect on anti-vaccination beliefs, our results indicate a strong positive link between anti-vaccination attitudes and distrust in the country's health-care systems and political institutions.

Keywords

Italy, anti-vaccination attitudes, European Social Survey (ESS), Item Response Theory

Introduction

Vaccination is considered one of the most prominent achievements in public health. Owing to the developments in immunization during the last two centuries, vaccinations have prevented millions of deaths, birth defects and disabilities associated with infectious diseases. Moreover, vaccinations have led to the worldwide reduction of child and infant mortality rates, and once very common and deadly diseases, such as smallpox, have been eradicated (Orenstein and Ahmed, 2017). Despite being one of the most significant public health successes, there has been a contemporary reduction in vaccination coverage and an upsurge in vaccine hesitancy and skepticism, particularly in Western countries (Douchleff, 2014; Dubé et al., 2013; Gallup, 2019; Signorelli, 2017; Skea et al., 2008).

The vast majority of people in the medical field promote the importance of vaccination of individuals, yet a growing number of parents are deliberately choosing not to vaccinate their children. Moreover, some members of the general public are questioning the safety of vaccines and oppose vaccination mandates (Dubè et al., 2013). As a result, vaccine preventable diseases (VPD), such as measles, mumps and pertussis are rising in Europe (CDC, 2003; ECDC, 2018; Yaqub et al., 2014) and in the United States for the first time in a century (Gallup, 2019; Hornsey et al., 2018; Smith, 2017).

Considering the significant individual and public health concern the vaccination issue poses, particularly after the sudden outbreak of the Covid-19 pandemic, it has become increasingly urgent to examine the profile of citizens who express skeptical opinions on vaccination as well as the underlying determinants of such opinions. Our article investigates the prevalence of negative attitudes toward vaccination and the possible determinants of increasingly prominent anti-vaccination sentiments, with a specific focus on demographic, attitudinal and value-oriented factors. Namely, we consider: education, age, general and institutional trust, religiosity and political orientation. We do so in Italy, a country where the vaccination issue has become particularly contentious in recent years, and where the impact on public health has been substantial.

Vaccination attitudes have already been predominantly investigated in the U.S. and some parts of Europe, but the orientation of contemporary public opinion in Italy regarding vaccination has since remained largely unknown. Accordingly, our paper aims at filling this regional gap in the literature. This is of particular interest as Italy has experienced – in large part because of a stark decrease in vaccination coverage – one of the worst epidemics in measles since the post vaccination period in Europe (CDC, 2003; WHO, 2018). The number of measles cases reached a record high in 2017, the second highest in Europe after Romania (Guardian, 2017; 2018; Siani, 2019). At the same time, a tenacious anti-vaccination movement was gaining momentum, taking advantage of the ambiguous position on the topic by the newly established populist government. Before coming into power with a populist coalition in the general elections of 2018, members of the anti-establishment 5-Star Movement (M5S) publicized vaccines to be unsafe, and anti-vaccination sentiments were commonly expressed by the supporters and exponents of M5S (Siani, 2019).

Italy is also among the worst hit European countries from the Covid-19 pandemic, with currently around 325,000 total cases and 36,000 deaths (Ministero della Salute, 2020). The novel coronavirus led to the loss of many lives throughout the nation and put a significant strain on the country's economic, political, social,

and health-care institutions. As the pandemic unfolded, the Italian government agreed, along with Germany, Netherlands and France, to the purchase 400 million doses of a potential Covid-19 vaccine from *AstraZeneca* (Huffpost, 2020), but an anti-vaccination sentiment surfaced among the general public.

In order to address the issue of anti-vaccination sentiments in Italy, we employed high-quality data from the European Social Survey Round 8, which allowed inference of the findings to the general Italian population aged 15 and older. The aim of the paper is to provide sound information for policy makers to shape programs that will enhance the prevention of the spread of infectious diseases, including but not limited to Covid-19. At the outset, we note that we begin from the assumption that vaccination against preventable diseases represents an element of medical rationality, and persons expressing negative attitudes toward vaccination are going against this rationality. Nevertheless, for the purposes of this study we are not concerned with arguments that people make to rationalize their negative position toward vaccines. Instead, we focus on the possible determinants of such attitudes.

Increase in anti-vaccination attitudes and the situation in Italy

A recent survey (conducted on 140 countries with over 140,000 respondents) discovered that 21 percent of the world's population do not believe vaccines to be safe (Gallup, 2019). Moreover, compared to other countries, Italy is found to be among those having the lowest levels of vaccine confidence (Larson et al., 2016). Examining the rates of vaccination coverage in Italy, Signorelli and colleagues (2017) report that national coverage targets set by the Ministry of Health under the issue of the National Plan for Prevention through Vaccines (*Piano Nazionale di Prevenzione Vaccinale*) (PNPV) have been only partially met. In 2016, mandatory vaccinations against polio, tetanus, diphtheria, and hepatitis B were all below the coverage target of 95 percent at the national level. Specifically, the vaccine coverage rate against measles, mumps, and rubella (MMR) has never reached the 95 percent coverage target. In fact, the mandatory vaccines rate of coverage has decreased for the last four years. For instance, MMR vaccine coverage was around 87 percent in 2016 for all regions of Italy, a 3.6 percent decline from 2013 (Signorelli et al., 2017).

Before the pre-vaccination era, between 25,000 to 90,000 measles cases were typically reported in Italy annually. With the introduction of the measles vaccination, the cases have significantly dropped. In 2002, a measles outbreak increased sharply again, affecting thousands of children – predominantly in the Catania region, where there was an inadequate vaccination coverage (CDC, 2003). Cases of measles continue, particularly in regions that have low vaccination coverage (WHO, 2018). Between February 2017 and January 2018, there were around 5,000 reported measles cases in Italy, accounting for 35 percent of all cases in Europe (ECDC, 2018).

The mentioned increase, both in the prevalence of anti-vaccination and vaccine skepticism, pose significant public health concerns for all citizens. This is because vaccination coverage is vital for maintaining herd immunity in communities and reducing the risk of disease for the general population. When large number of individuals are not vaccinated, it becomes much easier for diseases to spread. Thus, unvaccinated individuals not only pose a risk to themselves, but also to others (Smith, 2017). From this perspective, it can be argued that vaccination is a social responsibility to maintain herd immunity, and that vaccination can have a positive effect on vaccination approval (Dubè et al., 2013).

Among those who are against mandatory vaccination, it is common to find a vocal skepticism toward the scientific elites. This scientific skepticism is often fueled by the mass media's presentation of the government, pharmaceutical companies and doctors in medical conspiracy theories (Jolley and Douglas, 2017). Surely, this is the case in Italy, where the plausibility of the danger of vaccines on individual health goes hand-in-hand with other beliefs by conspiracists that are spreading among a significant portion of the population (Mancosu et al., 2017). This is in line with the idea that some section of the Italian general public is losing confidence in vaccination. Both the anti-vaccination movement and government complacency to address the issue could be contributing factors to the alarming phenomenon. Some even have suggested that the two recent Italian court rulings in favor of parents of children diagnosed with autism after vaccination have further legitimized the standpoint of the anti-vaccination advocates (Paravicini, 2016).

The increasing parental vaccine hesitancy and vaccine refusal often stem from a public fear of an empirically unproven or bluntly false negative understanding of the effects of vaccination, especially on children. Possibly the most remarkable example concerns the presumed relationship between the MMR vaccine and autism (Skea, 2008). While the study that links the MMR vaccine to autism, conducted by Andrew Wakefield (1998), was found to be fraudulent, the fears about vaccination and vaccine safety remained prevalent, both in the U.S. and in Europe (Smith, 2017), and it is not rare to find vague references to the above-mentioned forged results in casual talks.

A more recent vaccine skepticism among the Italian general public was aroused when the Italian Minister of Health, Roberto Sperenza, announced that the government has agreed, in concordance with France, Germany and the Netherlands, to the purchase 400 million doses of a potential Covid-19 vaccine from the bio-pharmaceutical company *AstraZeneca*. The health minister received thousands of messages on social media in response, where individuals have continuously expressed their distrust in the vaccine initiative of the Government and the proposed efficacy of the trials (HuffPost, 2020). In the next section, we lay out potential predictors of vaccine skepticism among the Italian public.

Vaccine skepticism

Our paper explores the level of 'vaccine skepticism' among Italians along three dimensions: demographic, attitudinal and value orientation. At the demographic level, we examine the relationship between age and years of education, and attitudes concerning vaccination. At the attitudinal level, we investigate the link between general and institutional trust and anti-vaccination sentiment. Last, in terms of value orientations, we investigate how people's religious and political orientations impact their views on vaccination.

Demographic determinants

For the relationship between age and vaccination, previous research indicates that elderly individuals are more supportive of vaccination (Larson et al., 2016; Larson et al., 2018; Peretti-Watel et al., 2013). Older generations were raised in an era in which infectious diseases were still prominent in their communities. Consequently, we think that older generations will be able to better identify the benefits of vaccination than younger generations.

The level of education of an individual can also play a fundamental role in health-related outcomes in general and vaccination attitudes in particular. Based on decades long research in the developed and developing world, it has been shown that there is a strong positive association between education and health-related outcomes (Eide and Showalter, 2011; Goldman and Smith, 2011; Zimmerman and Woolf, 2014). We know that people with a higher level of education live longer, engage in less risky behaviors, have the cognitive ability to understand their health needs, communicate more effectively with their health-care providers, and have more opportunities to learn about health and health risks (Zimmerman et al., 2015) – all of which are closely linked to people's vaccination decisions. Although less common, anti-vaccinations attitudes are sometimes found among highly educated and niche communities, deviating from the general trend (Yang et al., 2015). Previous research, however, generally finds a positive correlation between low education and reduced vaccination uptake and anti-vaccination attitudes (Larson et al., 2016, 2018). Therefore, we test the following demographic hypotheses:

H1a: Older individuals are less likely to express anti-vaccination attitudes.

H1b: Less educated individuals are more likely to express anti-vaccination attitudes.

Attitudinal determinants

General trust, also known as 'social trust', whether it is interpersonal or impersonal, is a crucial aspect of civic culture (Misztal, 1996; Larson et al., 2018). Thus, general trust can play an important role in the behavior and attitudes of individuals. This can be understood through the relationship between trust and social responsibility. That is, social trust ignites a type of social responsibility and a type of moral obligation within individuals to act in a way that is beneficial for the common good (Hearn, 1997). Regarding vaccination decisions, previous research identifies social responsibility and the welfare of others – in the form of ensuring herd immunity and avoiding harm to others – as significant predictors among parents who decide to vaccinate their children (Bish et al., 2011; Dubè et al., 2013; Skea et al., 2008). This is in line with the idea of Hardin (2006), who describes trust and trustworthiness as the expectation that the actor (or actors) considers the well-being and interests of another person (or persons) when making decisions. Thus, the higher one's social trust level is, the higher will be the consideration of the opportunities that can increase the general well-being, even if the benefit is diffuse, such as with vaccination.

Trust, as a relationship, not only manifests between individuals, but also between individuals and systems. In the case of vaccinations, parents are asked to place an impersonal trust in what Giddens (1990:80) calls "abstract systems," such as political and health-care institutions. This is because these institutions bring a "warrant of trust" due to their professional reputation (Brownlie and Howson, 2005).

Among governmental institutions, the health-care system undoubtedly has the most direct effect on people's values on vaccination. For the majority of people, the most trusted information on vaccination comes from health-care institutions and can have a crucial impact on determining vaccination attitudes. Since positive beliefs regarding vaccination are often cultivated by health-care institutions and providers (Gottval et al., 2011; Oscarsson et al., 2011; Yakub et al., 2014), a loss of trust in health-care institutions is directly related to anti-vaccination attitudes. Studies on this phenomenon find a positive association between anti-vaccination attitudes and lack of trust in the health-care system. The less people believe in medical institutions, the less support they demonstrate for vaccinations (Salmon et al., 2005, Dubè, 2013; Yakub et al., 2014).

Also, a more general attitude of distrust in government's political institutions can jeopardize the government's credibility on public decision-making regarding the well-being of individuals. When individuals distrust the government, they tend to believe that government agents do not have the incentive to act in the best interest of citizens (Hardin, 2006). Once the trust of individuals in abstract systems is breached, their general attitude toward public decision-making by the government on public health-care and well-being of individuals can deteriorate. When individuals lose their trust in political systems, they can often lose trust in the key messages government officials put forth, such as the benefits and necessity of vaccinations. This has been shown in previous studies that link mistrust in government to less favorable views of vaccination (Brownlie and Howson, 2005; Gefenaite et al., 2012; Hubson-West, 2007).
Accordingly, we posit the following attitudinal hypotheses:

H2a: As individuals' general trust increase, their anti-vaccination attitudes decrease.

H2b: As individuals' institutional trust decrease, their anti-vaccination attitudes increase.

Concerning the second hypothesis, more specifically:

$H2b_1$: Lower satisfaction with the health-care system is associated with stronger anti-vaccination attitudes.

$H2b_2$: Lower satisfaction with the political institutions is associated with stronger anti-vaccination attitudes.

Value-oriented determinants

Previous research elucidates that both political and religious beliefs can shape vaccination attitudes. Evidence shows that vaccination refusals are often linked to strong religious convictions (Mckee and Bohannon, 2016), and that the number of persons who are asking for vaccination exemptions due to religious reasons is rising (Domachowske and Suryadevara, 2013). Those who hold religious convictions often express anti-vaccination attitudes because of their personal beliefs regarding the origin of illness (Dubè et al., 2013). These individuals consider both health and illness as an 'act of God', in which humans are not meant to interfere (Streefland, 2001). Qualitative studies on this issue indicate that vaccine refusals for religious reasons have been found particularly high among Orthodox Calvinists in the Netherlands and the Amish in the U.S. (Dube et al., 2013). Other studies also find a link between attendance to religious services and refusal of the HPV vaccination. As the attendance to religious services increases, the acceptance of HPV vaccination decreases (Barnak et al., 2010; Constantine and Jerman, 2007).

Nevertheless, most of this evidence refers to countries with a religious landscape that is very different from Italy. Italy presents a rather homogenous religious landscape, with a strong predominance of Roman Catholics. Empirical data that demonstrate the influence of the Catholic faith on people's vaccination attitudes are scarce. As in most major religions, there are no direct prohibitions against vaccination in the Catholic faith, and within Catholic teaching there is a strong emphasis on doing what promotes the common good (Carson and Flood, 2017). Catholics tend to express more favorable views of vaccination, compared to other denominations of Christianity and other faiths (Carson and Flood, 2017; Larson et al., 2016; Larson et al., 2018). For instance, according to a global survey on vaccination confidence in Europe, Catholics are more likely to report higher confidence in vaccination safety, confidence and effectiveness (Larson et al., 2018). Accordingly, we think that religiosity and vaccination attitudes will be positively associated.

In conjunction with religious values, political values can also influence vaccination attitudes. Our motivation for this hypothesis in the case of Italy can be further supported by the prevalence and widespread diffusion of conspiracy theories, particularly the suspicious attitudes toward the scientific establishment (Mancosu et al., 2017). Mancosu et al. (2017) include an item on vaccines in the Index of Conspiracist Ideation, which shows a significant association between this Index and the voting choices of interviewees. Considering the close connection between conspiracist beliefs and voting behavior, we think that anti-vaccination and conservatism will be inversely linked.

The connection between reluctance to vaccination and political ideology is controversial. In the U.S., despite some vocal vaccination skepticism among well-known liberals, such as John F. Kennedy and Bill Mayor, evidence suggests that conservatives are more likely to hold anti-vaccination attitudes (Baumgaertner et al., 2018; Rabinowitz et al., 2016). Closely linked to religious values, previous enquiries show that conservatives are also more likely to express a lack of trust for the scientific and the medical community, particularly on issues regarding climate change, evolution, stem cell research and AIDS prevention (Blank and Shaw, 2015; Mooney, 2012). These studies are, however, limited in scope, referring only to the U.S. context. Thus, we extend this hypothesis to the Italian case.

In order to investigate the relationship between the value orientation of individuals and their attitudes toward vaccination, we test the following hypotheses:

H3a: Higher levels of religiosity is associated with lower levels of anti-vaccination attitudes.
H3b: An increase in political conservatism is associated with greater levels of anti-vaccination attitudes.

In the next section, we present data and statistical methods used to test our hypotheses and explicate on our operationalization of vaccination attitudes and their determinants.

Data, operationalization and methods

In order to measure vaccination attitudes in Italy, we use data from the European Social Survey (ESS) Round 8. The ESS collects information on many European countries, using a common questionnaire that measures attitudes of people on a variety of topics, such as the media, religion, immigration, health, politics and institutions. In every wave, the ESS allows each participating country to implement some country-specific questions. The vaccination questions for our analysis are from the country-specific question section of the ESS that is unique to Italy.

The ESS Round 8 Italian data were collected in 2017 (September – November), face-to-face, by using Computer Assisted Personal Interviewing (CAPI) from individuals aged 15 years or older, officially living in the country regardless of their nationality or citizenship status. The sample was selected by using a multi-stage probability sampling technique, in which the first stage involved selecting Italian municipalities, and the second stage included individuals selected from the municipality population registers (ESS, 2016). The total sample size included 2,626 individuals, and all interviews were done in Italian. The response rate was 49.7 percent, and no quota sampling or substitutions were allowed. ESS protocols assured the production of a representative sample of Italians living in households, which allowed for inference to the population.

Operationalization of variables

Dependent variable: Two country specific questions in the ESS Round 8 Italian dataset measure attitudes toward vaccination. The questions ask respondents to report their level of agreement with the following statements:

> *Vaccines wear the immune system and expose it to several diseases.*
> *When it comes to vaccines, you can trust the recommendations of the scientific community.*

The response choices for both questions range from strongly agree, agree, neither agree or disagree, disagree, to strongly disagree. The reading of the first item is straightforward, as agreeing with the statement means to be skeptical toward vaccines. The reading of the second item needs a qualification. A disagreement with the statement signals a lack of confidence in what the scientific community holds on vaccines. As the scientific community generally supports the use and diffusion of vaccination, a skeptical answer thus likely implies a negative attitude toward vaccines. The polarity of the two items is thus clearly opposite; agreeing on the first means to be skeptical about vaccines while the opposite holds for the second item. In line with our conceptualization, we chose to recode the items in a way to measure anti-vaccination attitudes. For the recoded items, thus, the higher values of the answer categories indicate greater anti-vaccination attitudes. We computed a cumulative scale, which is discussed in detail in the findings section.

Independent variables: To predict respondents' vaccination attitudes, we use the following demographic, attitudinal, and value-orientated variables: education, age, general trust, institutional trust, religiosity and political orientation.

We operationalize age as age groups, namely six groups (15-24, 25-34, 35-44, 45-54, 55-64, 65 and older), and education in three levels: primary, secondary (up to secondary school) and tertiary (university degrees and above). Regarding education, 41 percent of the individuals have a primary education, 46 percent have a secondary education, and 13 percent have a tertiary education.

In order to measure general trust, we adopt the instrument proposed by van der Veld and colleagues (2011), building a scale composed of the following indicators: trust in other people, perceived fairness of other people, and perceived helpfulness of other people. Answer categories are on an 11-point scale (0-10). PCA (Principal Component Analysis) confirmed a high internal consistency of the set of items considered, with the first extracted component accounting for 73 percent of the total variance and high reliability (std alpha = 0.81). We combined these three variables into a single *general trust* index, by computing the mean of the three indicators. The mean level of general trust was 4.57 (s.d.=1.97).

In addition to general trust, we examine two indicators of institutional trust: trust in health-care institutions and trust in political institutions. The first dimension concerning health institutions (satisfaction with the health institutions in the country) is measured with a single item on an 11-point scale. The mean level trust in health institution is 5.36 (s.d.=2.40). To measure political trust, we use four variables: satisfaction with the national government, satisfaction with how democracy works in the country, trust in the country's parliament and trust in the country's politicians. These questions are also measured on 11-point scales. PCA shows a high level of internal consistency, with the first component accounting for 73 percent of total variance (std alpha = .88). We combine these four indicators into a single political trust index, by averaging

their scores. Italian individuals generally express low levels of political trust; the mean level of political trust is 3.20 (s.d. = 2.05).

As far as religiosity is concerned, we use three indicators of individual religiosity. The first religiosity question asks survey respondents to report how religious they consider themselves to be on an 11-point scale. In addition, two questions are asked on how often respondent attend religious services and pray. The response categories for both questions range from every day, more than once a week, once a week, at least once a month, only in special holidays, less often, to never. We transform these frequencies into implied probabilities, weekly for attendance and daily for praying, with 0 indicating certainty of not attending/praying and 1 indicating certainty of attending/praying. Also, this set of items shows high internal consistency (first PCA component accounts for 71 percent of total variance, std alpha = .79). We combine the three indicators into a single religiosity index by averaging their scores, after harmonizing their scales on a range from 0 to 10.

We derive respondents' political conservatism using the question on self-placement on the left-right scale. In the Italian political landscape, it is reasonable to assume that moving right-ward on the scale implies a higher level of conservatism. The left-right scale is recoded to include the following categories: left, center-left, center, center-right, right, refusal to use the scale, and do not know.

Finally, we also control for other variables that may have an influence on individuals' vaccination attitudes. These include respondents' gender (male or female), working status (employed, actively unemployed, or inactively unemployed), and the area they resided in (the Northwest, the Northeast, the Red Zone, the Center, or the South). The Northwest includes municipalities of Piemonte, Valle D'Aosta, Liguria, and Lombardia. The Northeast is composed of Veneto, Trentino-alto Adige, and Friuli-Venezia Giulia. The Red Zone includes Emilia-Romagna, Marche, Toscana, and Umbria. The Center is composed of Lazio, Abruzzo, and Sardegna. Last, the South includes municipalities of Campania, Puglia, Basilicata, Calabria, and Sicilia.

Descriptive results of all variables are supplied in the Appendix (see Table A2) to the present document.

Methods

Given that our dependent variable is an ordinal scale, with increasing values indicating more negative attitudes toward vaccines, we estimate an ordinal logistic regression equation to ascertain the degree of association between anti-vaccination attitudes and demographic, attitudinal, and value-oriented determinants, while controlling for gender, employment status and region. We estimate three models. Model 1 examines the relationship between demographic determinants (age and education) and anti-vaccination attitudes, along with control variables. In Model 2, we add the attitudinal determinants (general and institutional trust) to the regression equation. Last, we add value-oriented predictors (religiosity and left-right scale dummies) to the equation in Model 3. We also use probability sampling weights (pweights) to correct for possible selection biases in the data.

Findings

To measure anti-vaccination attitudes of individuals, we develop an instrument using *Non-Parametric Item Response Theory* (IRT), namely the Mokken model for polytomous items (Mokken, 1971; Sijtsma and Molenaar, 2002; van Schuur, 2011). Unlike factor analysis, the Mokken model does not work on correlations and does not assume items included in the analysis to be parallel, meaning their marginal distribution can vary. An easy understanding of the differences in margins of the items included in a scale refers to their different levels of difficulty, where difficulty is measured by how many people will give positive answers to a question. This extends also to polytomous items (van Schuur, 2012). This is precisely the situation of our items, whose marginal distributions differ, as shown in Table 1.

The idea that vaccines can be harmful to the health of a person is reflected in a smaller proportion of respondents, making it the most difficult item among the two. More people are ready to trust scientists when it comes to vaccines.

Table 1. Distribution of the two questions on vaccines (n = 2292)

	Vaccines are harmful			Trust scientists on vaccines	
	%	cum %		%	cum %
Anti-vaccination strongly	5	5		4	4
Anti-vaccination	16	21		7	11
Nor pro nor against	23	44		24	35
Pro-vaccination	34	78		46	81
Pro-vaccination strongly	22	100		19	100

Source: ESS 2016

The adherence of the empirical data to the Mokken model is measured in terms of Loevinger's Homogeneity (H) coefficient for scalability. Mokken (1971) suggests that Homogeneity (H) coefficients greater than 0.30 are homogenous enough to form a cumulative scale. We find that the H-coefficient for the two anti-vaccination items is 0.49, which allows us to construct a cumulative anti-vaccination scale using these two items. Beside the good result in terms of homogeneity, the analysis shows that the joint distribution of our items does not produce any significant violation of monotonicity, confirming the scalability of the two items. The complete cross tabulation of the two items and the relative correct response pattern for the two items under the Mokken model, as well as the detailed analysis, are available in the Appendix (see Table A1) to the present document.

Based on this analysis, an anti-vaccination scale with eight item steps, ranging from 0 to 8, has been built summing up the answers on the two original items. After summing up the original values of the two anti-vaccination items ranging from 1 to 5, we rescaled the cumulative scale in order to have it starting from 0. This is obtained by subtracting 2 from the original values. To reduce the number of missing, when a respondent had only one valid answer, we imputed the same answer to both items.

We find that anti-vaccination attitudes are prominent among Italian citizens. As shown in Table 1, 21 percent of the respondents either agreed or strongly agreed with the statement that vaccines wear the immune system and expose it to several diseases. In addition, 11 percent of the respondents mentioned that

they do not trust the scientific community when it comes to vaccines. When considering the two items together in the anti-vaccination scale, ranging from 0 to 8, 15 percent of the respondents are placed on the high-end of the scale, manifesting negative attitudes toward vaccination, as shown in Table 2.

Table 2: The distribution of the anti-vaccination scale (n=2,446)

Anti-vaccination scale	Polarity of the scale	%	cum %
8	High (extreme) anti-vaccination	2	2
7		2	4
6		4	8
5		7	15
4		23	38
3		13	51
2		26	77
1		12	89
0	Low (none) anti-vaccination	11	100

Source: ESS, 2016

Next, we test how demographic, attitudinal, and value-oriented factors influence individuals' anti-vaccination attitudes. The first aspect we consider is the impact of age on anti-vaccination attitudes. We hypothesized that the younger generation has less favorable attitudes toward vaccination.

As shown in Table A3 (see Table A3 in the Appendix to the present document), although not significant for other age groups, anti-vaccination attitudes are most prominent among those who aged 25 through 34 (the age group in which individuals are more likely to make vaccination decisions for their children). When compared to those who are 65 and older, the odds of having an anti-vaccination score above either of the eight fixed levels are 39 percent higher for those who are aged between 25-34.

We also find higher education and anti-vaccination attitudes to be inversely related, meaning that anti-vaccination values are widespread among the less educated. As shown in Table A3, having tertiary education significantly reduces the odds of having an anti-vaccination score above either of the eight fixed levels by 45 percent. This is predominantly in line with the previous literature on the relationship between education and anti-vaccination attitudes. Overall, while our demographic H1a (age) is only partially supported, the H1b (education) coincides with our expectation.

Regarding our attitudinal hypotheses, a lack of trust in institutions (for both health-care institutions and political institutions) are both significant predictors of higher anti-vaccination attitudes. As an individual's satisfaction with the health-care institutions increases, their odds of having an anti-vaccination score above either of the eight fixed levels diminishes by 14 percent (see Table A3 in the Appendix). Similarly, as trust in the political institutions decreases, the odds of having an anti-vaccination score above either of the eight fixed levels reduces by 12 percent. Therefore, our hypotheses $2b_1$ (health-care institutions) and $2b_2$ (political institutions) are both confirmed, and trust in health-care institutions is the strongest predictor of anti-vaccination attitudes. These findings are also in line with previous literature on the relationship between institutional trust and anti-vaccination opinions.

Paradoxically, while general trust significantly predicts anti-vaccination attitudes, it is in the opposite direction that what we have originally hypothesized. A higher trust in others in fact leads to greater anti-vaccination sentiment. This is a surprising finding that emerges from our analysis and is against our expectations. We posit potential explanations that may improve our understanding of the paradox of horizontal trust in the discussion section in more detail.

We mentioned that Italian religious landscape is very homogenous, and unlike in some other Christian denominations, Catholicism does not actively promote anti-vaccination. We did not, however, find religiosity to be a significant predictor of anti-vaccination attitudes. Similar to religiosity, we also did not find a significant association between political conservatism and anti-vaccination attitudes. The direction of the relation is in line with our expectations: those who lean toward the right have higher anti-vaccination attitudes. Nonetheless, the effects are small. This is partly unexpected given the fact that vaccination attitudes have been largely politicized in the recent years. It is, however, interesting to note that people refusing to use the left-right scale to describe their self are significantly more negative toward vaccination. Those who report no political position have 48 percent higher odds of reporting an anti-vaccination score that is above either of the eight fixed levels.

A last point to mention is that the spread of anti-vaccination attitudes is not homogenous throughout the Italian landscape. The findings do not follow the traditional north and south divide; rather, they show a contrast between the center of the country, holding a more positive view of vaccination, compared to the north and south regions.

Discussion

The first significant outcome of the analysis concerns an estimate of the prominence of anti-vaccination attitudes in Italy. This is the first time this estimate is produced starting from a quality sample (ESS Round 8, 2016), with a large sample representative of the Italian population living in households, aged 15 or older.

Our results indicate that 15 percent of the public strictly hold negative views toward vaccination, while another 25 percent is placed in the neutral intermediate position. The number of people expressing anti-vaccination attitudes is substantial if we consider that herd immunization is reached only when the vaccination rate exceeds 90 to 95 percent of the population. If vaccination decisions are consistent with attitudes, then in the medium term this could represent significant concerns about the achievement of the WHO targets on vaccination in Italy.

To better understand how serious such a concern could be, it is necessary to examine the profile of those citizens who express skeptical opinions on vaccination, and what are the underlying determinants of such opinions.

Answering the question of who is skeptical of vaccines in Italy, we find that prevalence of anti-vaccination attitudes is most commonly found among those who are aged between 25 and 34 – the age category in which individuals are most likely to make vaccination decisions about their young children. Assuming that attitudes can predict behavior, this is also an alarming finding for keeping herd immunity in Italian society. In addition, we also find that those who are least educated tend to hold more anti-vaccination opinions. Against the common wisdom regarding the existence of a niche of highly educated people that holds anti-

vaccination values, we found that education is still one of the most relevant elements to steer opinions in favor of vaccination in the case of Italy.

A prominent aspect of our investigation is the exploration of the attitudinal determinants of anti-vaccination opinions. In line with the previous literature, our findings illustrate a strong link between distrust in institutions and anti-vaccination attitudes. Both dissatisfaction with the system of health care and the country's political institutions increase anti-vaccination attitudes, and the trust in health-care institutions is the strongest predictor of anti-vaccination sentiment. *Response Covid-19* (a recent survey conducted in Italy during the period of April and June 2020) finds that confidence among the general public in the country's health-care system and in regional governments in the North (specifically, Lombardia and Piemente) is decreasing over time (see SPS Trend, 2020). While these were the hardest hit Covid-19 regions in Italy, the declining trust toward local governments raises substantial concerns for immunization coverage, particularly given the close relationship between distrust in institutions of government and anti-vaccination sentiment as we have found in our analysis.

Previous research indicates a positive association between religiosity and anti-vaccination attitudes. These studies, however, refer to Anglo-American countries, which have very different religious landscapes than Italy. Italy is a religiously homogeneous country, with 68 percent of Italians declaring to belong to the Catholic Church (ESS, 2016). And for our specific interest, it must be noted that the most recent pronouncements by the Pontifical Academy for Life on vaccines has removed any possible ethical and moral concern related to the characteristics of vaccines most commonly used in childhood. Nonetheless, we did not find religion to be a significant factor determining anti-vaccination values in Italy. This result could partly reflect the fact that, despite the official position of the Catholic Church noted above, there has not been an extensive public engagement on the topic in the Church hierarchy. In the future, an alternative measurement that operationalizes individuals' supernatural beliefs may better explain the relationship between religiosity and anti-vaccination beliefs.

In addition to religiosity, results on political orientation differ from our expectations. Against our hypothesis, we did not find a relation between higher level of political conservatism and anti-vaccination attitudes. This is particularly surprising given the high level of politicization of the issue in the Italian public opinion arena. This dimension thus deserves a closer look. Political orientation was measured in terms of the left-right self-placement, assuming that right-wing leaning is an indication of more conservatism. In this way, we also located a residual category of people who refuse to place themselves in the left-right scale (approximately the 17 percent of the sample). The remarkable finding is that this group of people hold significantly more negative attitudes toward vaccines than the rest of the population.

In the past, the group of people who did not associate themselves with either left or right was infrequent, and it comprised those who were uninterested in politics. More recently, the meaning of non-placement has gained substantial political relevance in Italy, particularly in the last decade (Segatti and Baldassari, 2018). In fact, in recent national political history, an extremely successful populist movement, the 5-Star Movement (M5S), made one of its main tenants as being neither left nor right. The achievements of the M5S were astonishing, as it became the collector of a long-standing political discontent and apathy that had not found a channel of expression before (Barisione et al., 2018). The M5S received roughly 25 percent of the votes on its first appearance on the national ballot box in 2013, and a surprising 33 percent on the

following national elections in 2018 (Ceccarini, 2018). The Movement includes the most outspoken representative of skeptical views on vaccines. Considering the wide success of the populist M5S among the Italian public, our finding of neither left nor right supporters showing more anti-vaccination attitudes no longer appears anomalous. It seems that some form of spreading of populist rhetoric is associated with a significant prevalence of anti-vaccination opinions.

Another significant result, namely the relation between anti-vaccination positions and general trust, is the most surprising and challenging result to understand, and it is undoubtedly against our expectations. The result has been checked and controlled in several ways, and it seems to be robust. Thus, we are left wondering why people with higher levels of general trust tend to be more negative toward vaccines. We do not have conclusive answers to this apparent paradox, but we did follow a trail of possible explanations that might suggest different meanings of general trust, depending on education or on the way a person perceives their institutional surroundings. To address this, we ran two separate models of interaction effects, one with education and the other with political trust. If the terms were to be significant, the effect of general trust on anti-vaccination attitudes would differ for the values of education and political trust. However, we did not find either of the interaction term to be significant. Thus, the positive association between general trust on anti-vaccination attitudes remains genuine.

Finally, we find that the spread of anti-vaccination attitudes is not homogenous throughout the Italian landscape. People in the northern and southern part of the country hold more negative attitudes toward vaccination compared to those in the center of the country, demonstrating that the findings do not follow the traditional north-south divide. This also signals that the detected regional differences are not easily explained by the indicators related to economic and human development, which usually underline the differences between the northern and southern areas of the country (Cartocci, 2007; Ballarino and Schadee, 2005).

Conclusion

Immunization is one of the most conspicuous public health achievements in human history. The contemporary upsurge in anti-vaccination sentiment is, however, a major health concern, particularly for Western societies where once eradicated diseases are re-emerging again. Data from previous research indicate that anti-vaccination attitudes are associated with a stark reduction in vaccination coverage, leading to contemporary outbreaks of preventable diseases, such as measles, mumps and pertussis (Gallup, 2019).

In this article, we investigated vaccination attitudes in Italy, a country where anti-vaccination propaganda has been gaining momentum in recent years. The growing controversy around the vaccination debate has been negatively influencing people's vaccination decisions and leading some Italian regions to experience one of the worse measles epidemics in Europe (ECDC, 2018). Moreover, the recent outbreak and spread of Covid-19 has (as of October 2020) affected the health of 35 million individuals worldwide (325,000 in Italy). And it will continue to impact many more for a foreseeable future. There has been a worldwide research effort and mobilization for a vaccine as a long-term solution for prevention and cure. Among these research efforts, the Lazzaro Spallanzani National Institute for Infectious Diseases in Rome began the first human trials of the locally developed potential vaccine for Covid-19 in late August of 2020 (The Local, 2020). Even more promising effort is the potential vaccine that is being developed by Oxford University

for the Italian government, which has agreed to pay the bio-pharmaceutical company AstraZeneca 185 million Euros for 75 million doses. These efforts have fueled an anti-vaccination response by the Italian general public (Huffpost, 2020).

Given the serious health concern the anti-vaccination issue poses, there is an urgency to investigate both the prevalence and the profile of citizens who hold anti-vaccination beliefs. In our paper, we explored three major determinants of anti-vaccination attitudes: demographic, attitudinal, and value-oriented. More specifically, we inquired about the influence of age, education, general and institutional trust, religiosity and political orientation on vaccination attitudes.

Regarding who is skeptical of vaccines, we find that anti-vaccination beliefs are most common among those who are less educated and aged between 25 and 34. Both the age group and the prominence of anti-vaccination sentiment leaves us with significant concerns for achieving herd immunity in Italian society. Our findings suggest that, in order to reverse anti-vaccination attitudes, advocacy programs should target those who are younger, less educated and living in regions where vaccination coverage is lowest.

Moreover, our research reveals that disapproval of vaccinations is strongly linked to distrust in institutions of government in the country. Considering the strong evidence on the interlink between distrust in governmental institutions and anti-vaccination attitudes, we argue that top-down pro-vaccination advocacy at the governmental level will be ineffective in Italy. A pro-active campaign lead by the government could even jeopardize attempts to increase the vaccination rate in the country, particularly given the widespread bad reputation enjoyed by the government. In the short term, we suggest local advocacy could have a higher level of success, through grassroot activism and citizen outreaches, targeting people who are expressing the least trust in institutions. This strategy might improve vaccination coverage and enhance pro-vaccination attitudes. Advocacy at the local level could be prioritized in Italian regions where vaccination coverage is lowest.

Finally, our findings confirm that education plays a role in fostering positive attitudes toward vaccines. Logically, an increase in tertiary education among Italian people will reduce anti-vaccination attitudes. This is, however, a very long-term solution. A more timely and practical solution is to promote a diffuse knowledge of the history and positive effects of vaccines in schools at all levels.

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Appendix

Table A1: Cross tabulation of the 2 items with 5 response categories and each item step

Item 1: *Vaccines wear the immune system and expose it to several diseases.*	Item 2: *When it comes to vaccines, you can trust the recommendations of the scientific community*					
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree	Total
Strongly Agree	45	20	11	18	29	123
Agree	15	66	128	161	6	376
Neither Agree or Disagree	1	33	269	187	29	519
Disagree	3	36	117	503	109	768
Strongly Disagree	21	8	30	183	264	506
Total	85	163	555	1052	437	2292

Evaluating homogeneity and monotonicity: Table A1 gives the cross tabulation of the two items and relative correct response pattern under the Mokken model. As shown in the table, there are 9 valid scale responses (highlighted in gray in Table A1) to form a perfect scale, and the rest are model violations (observed errors). In order to determine whether we can form a cumulative scale from using these two items, we evaluate the severity of the model violations (or their lack of homogeneity) by calculating the Loevinger's Homogeneity (H) coefficient for scalability. After comparing the sum of weighted number of errors observed and expected, we find a H coefficient of .49. Considering H coefficients greater than 0.30 are satisfactory to form a cumulative scale (Mokken, 1971; Sijtsma and Molenaar, 2002), we were able to build the cumulative anti-vaccination scale using these two items. In addition to the satisfactory results regarding homogeneity, we also check the monotonicity assumption of the joint distribution of the two items and find no significant violations of monotonicity, also confirming the scalability of the two items.

Table A2. Descriptive Statistics

	Mean	SD	Min	Max
Dependent Variable				
Anti-vaccination Scale	2.789	1.818	0	8
Independent Variables				
Age				
15-24	0.127	0.333	0	1
25-34	0.135	0.342	0	1
35-44	0.160	0.367	0	1
45-54	0.195	0.396	0	1
55-64	0.158	0.365	0	1
65 or older	0.225	0.418	0	1
Education				
Primary	0.414	0.493	0	1
Secondary	0.459	0.498	0	1
Tertiary	0.127	0.333	0	1
General trust	4.571	1.969	0	10
Political trust	3.200	2.047	0	10
Health trust	5.362	2.398	0	10
Religiosity	3.898	2.836	0	10
Political Orientation				
Left	0.054	0.227	0	1
Center-left	0.184	0.387	0	1
Center	0.165	0.371	0	1
Center-right	0.220	0.414	0	1
Right	0.062	0.241	0	1
No position	0.172	0.378	0	1
Don’t know	0.143	0.350	0	1
Control Variables				
Female	0.514	0.500	0	1
Employment Status				
Employed	0.474	0.499	0	1
Unemployed (active)	0.099	0.298	0	1
Unemployed (inactive)	0.427	0.495	0	1
Regions				
Northwest	0.253	0.435	0	1
Northeast	0.133	0.340	0	1
Red zone	0.207	0.405	0	1
Center	0.106	0.308	0	1
South	0.301	0.459	0	1

Source: European Values Survey, 2017. N= 2,368

Table A3: Odds Ratio Results: Determinants of Anti-vaccination Attitudes, Italy 2017

Anti-vaccination scale	Model 1	Model 2	Model 3
Control Variables			
Female	0.91	0.91	0.90
Work Status (ref. Employed)			
Unemployed (active)	1.22	1.12	1.13
Unemployed (inactive)	1.04	1.04	1.05
Regions (ref. Centre)			
Northwest	1.65***	2.21***	2.18***
Northeast	2.11***	2.67***	2.64***
Redzone	0.89	1.14	1.12
South	1.56***	1.48**	1.46**
Independent Variables			
Age (ref. 65 or older)			
15-24	0.87	0.98	1.00
25-34	1.36+	1.37*	1.39*
35-44	1.28	1.23	1.23
46-54	1.31+	1.23	1.21
55-64	1.03	1.04	1.06
Education (ref. Primary)			
Secondary	0.85+	0.91	0.93
Tertiary	0.46***	0.53***	0.55***
General Trust		1.11***	1.11***
Health Trust		0.86***	0.86***
Political Trust		0.86***	0.88***
Religiosity			1.00
Political Orientation (ref. Centre)			
Left			0.84
Center-left			0.80+
Center-right			1.03
Right			1.25
No position			1.48**
Don’t Know			0.99
Constant cut1	0.16***	0.08***	0.08***
Constant cut2	0.38***	0.20***	0.21***
Constant cut3	1.29	0.71+	0.77
Constant cut4	2.24***	1.26	1.37
Constant cut5	8.18***	4.84***	5.32***
Constant cut6	18.82***	11.40***	12.58***
Constant cut7	44.08***	27.17***	30.07***

Constant cut8	88.23***	55.03***	61.00***
df_m	14.00	17.00	24.00

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Source: ESS, 2016. N=2,368

Note: The standardized coefficients are not reported on the table. However, they are available upon request.