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Patrizia Selleri, Felice Carugati

Author information

- * Department of Psychology, Alma Mater Studiorum University of Bologna, Italy.
Email: patrizia.selleri@unibo.it
- ** Department of Psychology, Alma Mater Studiorum University of Bologna, Italy.
Email: felice.carugati@unibo.it

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Mothers and Vaccinations: From Personal Experiences to Shared Representations. A Challenge for Healthcare Authorities

Patrizia Selleri, Felice Carugati

Abstract: The paper aims at contributing to articulate the relationships between mothers' vaccination history of their children's approach to vaccination schedules and mothers' myths, fears about vaccines, confidence in health authorities, and other sensitive issues found in academic literature (hesitancy, conspiracy, toxic chemicals, autism). While these issues are studied in terms of parents' individual characteristics (ideas, attitudes, beliefs), the paper aims at showing the socio-cognitive organization of them, in terms of representational field, according to social representations theoretical approach. A convenient sample of mothers with preschool children, hosted in nurseries and kindergartens of an Italian region, was asked to fill a questionnaire with items concerning the abovementioned issues. Descriptive statistics and MCA analysis allowed to show the socio-cognitive organization of mothers' representations about vaccination and their relationships with children's vaccination histories. The results show a well-organized representation of the vaccination issues, where clusters of positive vs negative positions are concerning the mothers' uncertainty (hesitancy) about the vaccination future of their children and the sensitivity to social media as sources of information. Moreover, mothers from low-level education tend to agree on myths, conspiracy, claims for free choice, and social media as primary sources of information, while university mothers tend to disagree. Uncertainty about completing the mandatory vaccination schedule plays the role on hesitancy. Mothers agree on the contents but disagree on the connotative quality of them: university mothers with younger vaccinated children are less afraid of vaccination procedures and less suspicious towards healthcare authorities. Confidence in these authorities, vs conspiracy of pharmaceutical industries, plays a significant role in shaping the mothers' socio-cognitive representational field of vaccinations. *Conclusion:* The interconnection among representations, mothers' vaccination history, universalistic values, and doubts about science showed that a socio-psychological approach is a useful tool for identifying the social conditions of the emergence of positive vs negative attitudes.

Keywords: Mothers, Vaccine representations, Hesitancy, Healthcare Authorities

Introduction

Vaccination programs represent one of the greatest achievements of science and medicine (Chatterjee, 2013). Nevertheless, critics and controversies have existed as long as vaccines themselves (Schwartz, 2012) and have increased since 1980 due to several reasons, included the rapid growth of social media, with the consequence of widespread dissemination of concerns and misconception - the so-called *myths* (WHO, 2015)

Among the myths, vaccines do cause autism, and Thimerosal (Aluminum) as the adjuvant to vaccine safety is accused of being dangerous (CDC, 2020).

The success of vaccination campaigns has rapidly been replaced with fears that vaccines are not safe or even cause diseases. Concerns or ideological/political rhetoric amplify rare cases of adverse reactions. Simultaneously, in Western societies, the ideology of individualization (Urbinati, 2011; Dawson, 2013), and the claim for free choice for their children urge some parents to demand the ultimate decision. Moreover, the decline of trust in social institutions does influence a mix of mistrust, conspiracy, and claim of mastering complex medical information, even when parents lack specific knowledge (King & Leask 2017).

Research on vaccination issues has a long history; it has successfully identified several notions as *myths*, *hesitancy* (Dubé et al., 2013; Facciola et al., 2020), *confidence* (Larson et al., 2015), and *conspiracy* (Lewandowsky, Gignac & Oberauer, 2013). This noticeable, and very considerable literature, taken together has been showing and discussing multiple aspects of the vaccination issues, in the framework of individual attitudes and beliefs (Brotherton, French & Pickering, 2013). In fact, what is missing is a theoretical account of how these notions are socially constructed and interrelated. Moreover, no attention is paid to mothers as candidates of specific socio-psychological dynamics, eventually organizing these pieces of information, because of mothers' direct responsibilities for decision making about children's health (Ranji, Rosenzweig Gomez, & Salganikoff, 2017). Even when the participants of surveys are fathers or mothers (Prosser & Petersen, 2016), no specific theoretical reasons are put forward, apart from the obvious one that they are parents to their children.

Some authors suggest that specific consideration needs to be given (Atwell, Meyer, & Ward, 2018) to parents, and particularly mothers' vaccination/antivaccination positions. These authors underline the necessity of a theoretical account of how the beliefs of vaccine-hesitant or rejecting parents are socially constructed, acquired and reinforced.

According to this recommendation, we consider that mothers with 0-6 children (age of vaccination schedules in most countries) are facing the

mandatory requests from health authorities and their responsibilities (Di Pietro et al., 2017) to accept, delay or refuse. On the other side, mothers face a plethora of mixed information and feelings about vaccine myths; fears for adverse effects; rumors concerning adverse reactions. This plethora is amplified and distorted by fake news from social media, claims for free choice, personal lack of scientific information, that mothers should give order and make sense. How mothers cope with this plethora?

Previous studies on mothers' social representations of intelligence (Mugny & Carugati, 1989) do offer a socio-psychological theoretical approach to these issues.

These studies show that the subjective lack of information and distrust in Science, coupled with the responsibilities for children's development and the necessity of decision-making, organize the content of mothers' ideas about intelligence in a coherent socio-psychological field, we labeled *social representations of intelligence* (Selleri & Carugati, 2014), where the notion of *representational field*, inspired by Lewin's field theory, refers both to the content of what people think of some social issues (their everyday ideas) and the socio-cognitive organization of that content (Carugati, 1990; Carugati & Selleri, 2011).

Thus, we have an example of a possible theoretical framework to study whether mothers' myths, hesitancy confidence, conspiracy (the plethora of notions) could be organized in terms of social representations, where mainstream literature is following the individualistic approach in terms of separate individual attitudes and beliefs (Yaqub, Castle-Sevdalis & Chataway, 2014).

Mothers have to cope with two major issues: personal uncertainty concerning the health authorities' requests to complete vaccination schedules in due time; decision making given their children's age (years of vaccination schedules) and doubts about the capacity of Science to prevent the risks for adverse reactions to vaccines. These three issues are expected to play the role of organizing principles of the representations of vaccine issues, where vaccination fears, myths, pharmaceutical industries conspiracy, claims for free choice, confidence in health authorities, rumors about adverse reactions, and reference to social media play the role of content. Therefore, the theoretical framework of social representations is a tool for studying the socio-cognitive dynamics of vaccines /vaccination issues.

The Italian context of the research

The choice to study the representation of vaccine /vaccination issues in an Italian sample of mothers was inspired by several reasons. First, mothers are consensually considered as primarily responsible for their children's

health (Lupton, 2011), and Italian pediatricians and healthcare authorities share this view (Angelillo et al., 1999; Di Pietro et al., 2017). Moreover, specific events occurred in Italy during the years 2015-2017. An alert of Italian medical associations and the Italian Institute of Health (ISS) was diffused about the progressive lowering of immunization rate for the four mandatory vaccines (polio, tetanus, diphtheria, and hepatitis-b) and for MMR (strongly recommended) (Signorelli et al., 2017; Siani, 2019). Measles is a case in point. Despite a specific alert from European Diseases Control agency, reporting that Romania and Italy have been experiencing large outbreaks of measles in 2017, increasing anti-vaccine activities of parents' associations, were reinforced by reference to international networks.

The Ministry of Health had promoted a two-year program (end 2017) for counteracting the lowering of children's immunization (measles included): ten vaccinations were decided as mandatory for 0-16-year-old children (polio; diphtheria, tetanus, hepatitis-B, Hemophilus influenza-B; measles, mumps, rubella, whooping cough). Fierce opposing views had arisen in the public opinion, even though the rationale of the law detailed and updated information about the immunization schedules and debunked fake news (Giambi, Fabiani, et al., 2018), and sites covered up conspiracy arguments with claims of free choice.

At the time of research (October 2016 - March 2017) the situation was as follows: four mandatory vaccines (polio; diphtheria, tetanus, hepatitis-B), and three strongly recommended (measles, mumps, rubella, MMR) for 0-6 year children.

Methods

Participants

A sample of 972 mothers with 0-6-year-old children (age of the preschool system in Italy), living in a Northern region of Italy, and hosted in preschool organizations (nurseries and kindergartens) agreed to participate in a survey about ideas regarding children's vaccines and vaccinations. The heads of preschools gladly accepted to collaborate, distributing the proposed questionnaire. Mothers were requested to answer referring to their youngest child, with written consent to the research.

The study instrument

The study instrument was a self-administered questionnaire with three sections.

In the *baseline section*, mothers have been asked to report their children's age and gender, parents' age, profession, educational level, and the number of children.

In the second section, children's *vaccination history* has been checked by assessing: the following topics: the four mandatory vaccines received (acronyms used VcY Vaccine executed; vs VcN no vaccine executed); mothers' educational level (University UN vs compulsory plus high school: CpH); intention to complete the immunization schedule (IntY vs IntN: hesitant mothers); knowledge of rumors about adverse reactions (RumY vs RumN).

In the third section, mothers' *representations of vaccinations*, were assessed through 21 items, presented in the format of statements (borrowed by the literature) with responses on a 5-point Likert-type scale, ranging from "strongly disagree" to "strongly agree". The items chosen for the present paper are as follows:

Myths: "Vaccines cause Autism" (AutY vs. AutN); "Vaccines contain toxic chemicals (Thimerosal), that are very dangerous" (ThY vs.ThN);

Confidence in healthcare authorities: "Professionals of the national healthcare system are prepared and updated about vaccinations"; (CfdY vs CfdN)

Pharmaceutical industries conspiracy: "The big pharmaceutical industries are disloyally financing campaigns in favor of vaccinations" (CspY vs CspN);

Freedom of choice: "Vaccinating children is a private choice of parents: healthcare authorities do not have to intervene" (FrY vs FrN);

Relations between vaccines and nature: "I think vaccinations are interventions against nature" (Nctr vs Npro);

Doubs about Science: "Research in medicine is very advanced but not yet ready to remove the doubts about the risks associated with vaccines and vaccinations" (DbY vs DbN).

Social media: use of social media (web, Facebook) as a source of information. A five-point scale was submitted ranging from "never" to very frequently". A median of the answers has been used. (SmY vs SmN).

Universalistic values: to assess them, a modified version of the Triandis & Gelfand's (1998) questionnaire with four items, was used in the present study. Examples of items are "Whoever has more in life must help more than others; helping each other is useful for achieving positive results in life; children must be taught to trust institutions" An index of Universalistic values (Universalism: UnY vs UnN) was calculated summing up the scores, and then the median.

Results

Descriptive analysis

The sample is described as follows (Tab.1):

Table 1 - Mothers' characteristics

	Characteristics	n	Weighted %
<i>Mothers' age</i>	20-30	122	12.5
	31-40	627	64.5
	41-50	223	22.0
Children's age	0-3 (Nursery)	570	58,6
	4-6 (Kindergarten)	402	41,4
N. Children	Mothers with one child	412	42,4
	Mothers with two/more children	560	57,6
Mothers' Educational levels	Junior High School or less	152	15,6
	High school	374	38,5
	College, University, PhD	446	45,9

Mothers and vaccinations: 65,1 % mothers acknowledge *their children are in line with the immunization schedule* for the four mandatory vaccinations (university mothers 73,3%; high school plus compulsory mothers 58,2%). When asked about their children's previous adverse reactions, 78,9% of mothers acknowledge no reactions, while 15,3% had consulted a pediatrician and a tiny percentage (5.8%) had requested first aid or brief hospitalization. Crossing personal experiences of adverse reactions, and rumors about adverse reactions, 52,4% of mothers report neither direct adverse reactions for their children nor rumors about other children. 12,0% report some minor reactions for their children; the remaining third doesn't remember any specific memories of difficulties.

47,9% of mothers admit that healthcare authorities of their cities are competent and well prepared and 41,7% of mothers admit that the authorities deserve trust, but healthcare authorities are charged with overestimating vaccine benefits over risks and adverse reactions.

Information and participation in the activities promoted by health authorities: we asked mothers about the different sources of information they use. One of them is offered by health authorities, who provide mothers with a leaflet informing about the vaccination schedules and offer occasions for meeting groups of parents for further information. If we cross mothers who acknowledge they have received the official leaflet with mothers' participation in further initiatives held by the health authorities, we notice that about two thirds (62,5%) have received the leaflet but they did not participate; 20,4% do not remember any information. Only 13,0% of mothers have both received the leaflet and participated in the initiatives, while 4,1% did not remember about the leaflet but did participate. Crossing the reception of the leaflet and the search of specific information in the leaflet, of the 725 mothers

who answered the two questions, about only 54% admit to having received the leaflet and used it for improving personal information, which is not a satisfactory result for health authorities. Furthermore, crossing the participation in the health authorities' initiatives with the qualitative evaluation of the information received, only 39,4% of mothers are openly satisfied with the information. Another illustration of the mothers' positions towards vaccines/vaccinations information offered by health authorities, is the crossing of search of information with the general evaluation of mothers' satisfaction about the knowledge they have (not exceptional); only 43,3% of mothers who search for specific information are satisfied. A slight difference appears, according to the mothers' educational level: 47,1% of university mothers vs. 39,9% of compulsory and high school mothers.

What about the future of vaccinations? Out of 65, 1% of mothers who have vaccinated their children, 84,0% are uncertain whether to complete the scheduled procedure of the four mandatory vaccines. Of 153 mothers who have postponed some vaccinations for any reason, 77,1% are uncertain also for the future. Summing up, we underline that 77,1% of the overall participant mothers are uncertain to complete in the future the scheduled procedures for their children, which is a result of major concern for the Regional health care authorities. No specific differences concerning educational levels and organizations.

Multiple correspondence analysis. From vaccination history to vaccine representations

The first analysis we present is about what we consider, according to the update academic literature, at least a sample of items allowing to grasp the mothers' representational field of vaccines issues: myths about the risk of vaccination, a conspiracy by pharmaceutical industries, confidence in health authorities, mothers' free choice of deciding about vaccination, rumors about adverse reactions, plus two general topics aiming at grasping mothers' universalistic values and doubts about Science as preventing risks about adverse reactions. Categorical variables of the topics were obtained by transforming a 5-points Likert-scale to categorical variables and accommodated into the MCA by recoding them as two levels, according to the median of their distributions.

Multiple correspondence analysis (MCA; Spss version 26.0) was the statistic tool we choose for the analysis. MCA is a powerful exploratory technique for uncovering groupings of categories in the dimensional space, providing critical insights on the relationships between categories, without needing to meet assumptions requirements such as those required in other techniques to analyze categorical data (Abdi & Valentin, 2007). Categorical data have

been transformed into crosstables, and the results are in a graphical manner (Johnson & Wichern, 2007).

To define the number of dimensions to retain, Eigenvalue and Cronbach's alpha score have been chosen. Although no defined number of dimensions is firmly established, some authors recommend a two-dimensional picture of data. Based on these criteria (Sourial et al., 2010), a solution with two dimensions has been chosen (Tab. 2): the first accounting for 29,827% of the variance, and the second for 11,684% yielding a total variance of 41,511%. The first and second dimensions are, respectively, with Eigenvalue at 2,983 and 1,168; Inertia at 0,298 and 0,117; total Inertia at 0,415; the Cronbach alpha at 0,739 and 0,160. Although the generally accepted lower limit for the Cronbach's alpha is 0,70, the small values of the second dimension are acceptable in exploratory research, where a small alpha score can be due to a reduced number of variables, poor interrelatedness between items, or heterogeneous constructs to capture a two-dimensional picture of the data. The methodological procedure has been conducted assuming this limitation. Discrimination measures and a joint plot of category points have been obtained. Category quantification plots constitute a complementary method of displaying discrimination of variables that can identify category relationships.

All discrimination measures (Table 2) are between 0,529 and 0,010, with a maximum value of 0,529 (conspiracy) for the first dimension, and 0,377 (universalistic values) for the second dimension.

The most relevant discrimination measures for the first dimension are conspiracy (0,529); autism (0,506); vaccines *contra naturam* (0,491); free choice (0,454); toxic chemicals, (Thimerosal 0,314).

For the second dimension, universalism (0,377) is on the top followed by confidence in health authorities (0,176); doubts about Science (0,173); social media (0,164), rumors (0,108).

In the first dimension, autism was correlated (transformed variables) with conspiracy ($r=0,449$); toxic chemicals (Thim: $r = 0,362$); free choice ($r=0,320$); vaccines *contra naturam* ($r=0,393$);

Free choice was correlated with conspiracy ($r=0,399$) *contra naturam* ($r=0,480$); doubts ($r=0,213$); conspiracy was correlated with vaccines *contra naturam* (0,380). This dimension is the *representational field of the vaccines*. All the correlations are significant at $p < 0,001$.

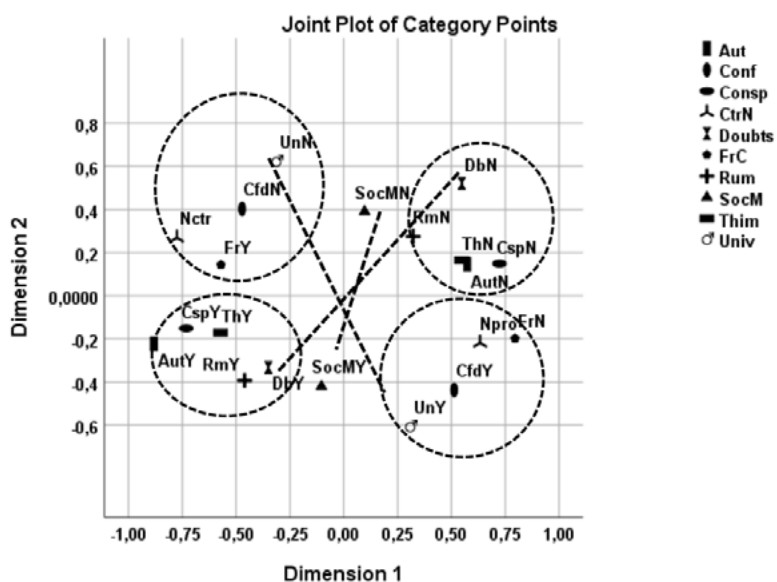
In the second dimension, universalistic values are correlated with vaccine *contra naturam* ($r=0,220$); confidence (0,206); free choice (0,189); these correlation are significant at $p < 0,01$; universalistic values are correlated with doubts about Science (0,008) at $p < 0,05$, and with social media ($r=-0,004$) at $p < 0,05$. Social media are correlated with rumors ($r=0,115$); conspiracy ($r=0,048$); free choice ($r=0,048$); autism ($r=0,045$). The correlations are sig-

nificant at $p < 0,05$). This dimension could be labeled *hesitancy nourished by universalistic values and social media*.

Table 2 - Discrimination measures of vaccines representational field

	Discrimination measures		Mean
	1	2	
Autism	,506	,033	,269
Thimerosal	,314	,028	,171
Free choice	,454	,028	,241
Conspiracy	,529	,022	,276
Social Media	,010	,164	,087
Universalistic values	,097	,377	,237
Vaccines contra naturam	,491	,059	,275
Doubts about Science	,192	,173	,183
Rumors	,148	,108	,128
Confidence in health authorities	,242	,176	,209
Total active	2,983	1,168	2,076
% of variance	29,827	11,684	20,755

Figure 1 - Joint plot of category points of the representational field of vaccine issues



Captions

Indirect information about adverse reactions (Rumors): RumY rumors; RumN: no rumors

Autism: Vaccines cause autism: Aut: AutY: mothers who agree; AutN: mothers who do not agree

Thimerosal (toxic chemicals): Thim: The vaccines contain mercury; ThY: mothers who agree; ThN: mothers who do not agree

Confidence in healthcare authorities: Conf: Healthcare authorities are prepared and updated on vaccinations; CfdY: mothers who agree; CfdN: mothers who do not agree

Conspiracy of pharmaceutical companies: Consp: The campaigns in favor of vaccinations are financed by Big Pharma; CspY: mothers who agree; CspN: mothers who do not agree

Free choice of vaccination FrC: Vaccinating children is a private choice of parents: healthcare authorities should not intervene; FrY: mothers who claim; FrN mothers who do not claim

Vaccines *contra naturam* CtrN: I think that vaccinations are a fact against nature.; Nctr: mothers who agree to; Npro Mothers who do not agree

Doubts on research: Research in medicine is very advanced but not yet ready to remove the doubts about the risks associated with vaccinations; DbY mothers who agree; DbN: mothers who do not agree

Universalistic values Univ: UnY: mothers who agree; UnN mothers who do not agree

Social media as a source of information: SmY yes; SmN: not

Figure 1 shows the joint plot of the category points. Focusing on the four circles, in the first dimension (abscissa), negative positions are against the positive ones, divided in two sub-cluster; in the first cluster (top left); no confidence in health authorities; free choice; vaccines *contra naturam*; no universalistic values; in the second cluster (bottom left) autism, toxic chemicals (Thim), conspiracy, doubts about Science; rumors.

The same cluster is for the positive positions; the figure shows a chiasm: top left with the bottom right for general issues; top right with the bottom left for specific issues. The second dimension (dashed lines) enriches the figure with universalistic values; social media, and doubts about Science that connect two by two the circles, crossing the graphic.

At this point, a further analysis was run to study (MCA) the relationships between the clusters of the representational field and the vaccination history: mandatory vaccines executed (VcY vs VcN); mothers' educational level UN vs CpH); children's organizations (Ns vs Kg); intention to complete the vaccination schedules (IntY vs IntN).

A solution with two dimensions (table 3) has been chosen: the first accounting for 22,657% of the variance and the second for 9,069%, yielding a total variance of 31,726%. The first and second dimensions are, respectively, with Eigenvalue at 3,172 and 1,270; Inertia at 0,227 and 0,091; total Inertia at 0,317; the Cronbach alpha at 0,737 and 0,229.

All discrimination measures (Table 2) are between 0,505 and 0,000, with a maximum value of 0,505 (conspiracy and autism) for the first dimension, and 0,483 (social media) for the second dimension.

The most relevant discrimination measures for the first dimension are: conspiracy (0,505); autism (0,505); vaccines *contra naturam* (0,476); free choice (0,440); Thimerosal (0,313); confidence (0,235) doubts about Science (0,190). The most relevant measures for the second dimension are: social media (0,483); mothers' educational levels (0,220) and organizations (0,219).

In the first dimension, conspiracy was correlated (transformed variables) with autism ($r = .449$); free choice (0,399); thimerosal (0,370); rumors (0,210); doubts about Science (0,292) confidence (0,257). All the correlations are significant at $p < 0.001$. This dimension does confirm the presence of the *representational field*

The second dimension is characterized by the social media (0,466); mothers' educational level (0,223); organizations (0,296). Social media are correlated with rumors ($r = - 0,115$) and organizations ($r = -0,103$). The correlations are significant at $p < 0,05$.

Table 3 - Discrimination measures of vaccines representational field and vaccination history

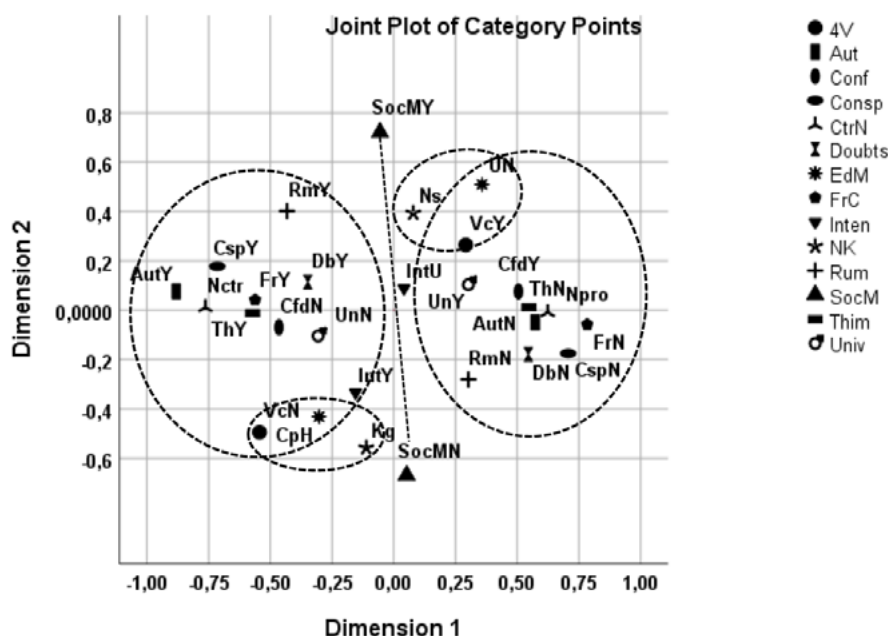
Discrimination measures	Dimension		Mean
	1	2	
Autism	,505	,004	,254
Thimerosal	,313	,000	,156
Free Choice	,440	,002	,221
Conspiracy	,505	,031	,268
Social Media	,003	,483	,243
Universalistic values	,093	,011	,052
Vaccines contra naturam	,476	,000	,238
Doubts about Science	,190	,020	,105
Rumors	,131	,113	,122
Confidence in health authorities	,235	,005	,120
Preschools	,009	,219	,114
Mothers' educational levels	,108	,220	,164
4 mandatory vaccines executed	,159	,131	,145
Intention to complete mandatory vaccines	,006	,030	,018
Total active	3,172	1,270	2,221
% of variance	22,657	9,069	15,863

Figure 2 shows the joint plot of the representational field and vaccination history. The overall results of the previous analysis are confirmed, with interesting integration of the representation: hesitant mothers (IntU) are plot in the center of the configuration; university mothers with children in Nurseries are less prone to consider vaccines as the causes of autism and do not refer to Thimerosal as a chemical damaging children’s health. These mothers are more confident in Science and health authorities and they less consider vaccines *contra naturam*.

Mothers with lower educational levels with children in kindergarten share the other side of the same moon. Specific attention is devoted to the vertical axis joining social media and uncertainty (IntU) to complete mandatory schedules; this result could be interpreted as the trace of search to cope with hesitancy by referring to social media as a source of information.

A complementary result is offered by the placement (in the graphic) of the mothers who report mandatory vaccinations (VcY) vs. who do not report (VcN). The former (mainly with lower educational level and children in Nurseries) are associated with the negative positions, the latter mothers (mainly with higher educational level and children in kindergartens) are more prone to the positive representational field. The second dimension shows *the presence of social media in the mothers’ vaccination history* and on the background the *file rouge of uncertainty*.

Figure 2 - Joint plot of category points of the representational field of vaccine issues and vaccination history



Captions

4mandatory vaccines executed: VcY four vaccines received; VcN four vaccines not received

Preschools: NK; Kg: children in kindergartens; Ns: children in nurseries

Mothers' educational level EdM: UN: university mothers; CpH: high school plus compulsory school mothers

Intention to complete immunization schedule: Int: IntY: intention yes; IntU uncertain, hesitancy

Discussion and conclusions

Immunization is a cornerstone of preventive medicine, but vaccination rates are on the decline in many areas of the world. When mothers' responsibilities are questioned, it is crucial to investigate both the vaccination history concerning the mothers' approach to schedules requested by health authorities and the socio-cognitive organization of the contents and determinants of mothers' representations of vaccines and vaccinations.

The vaccination history shows a complex figure. The reported immunization rate is largely below the herd recommended rate. Mothers could not have a detailed memory as a matter of compliance with health authorities, but the uncertainty to complete future scheduled vaccination should prevent us from such an optimistic interpretation. Another *caveat* refers to the reported relationships between mothers and the policy of health authorities: little use of written information offered, occasional participation in the initiatives promoted *ad hoc* by the authorities, The large number of mothers uncertain to complete the vaccination schedule and their little interest in healthcare policies, are two complementary results. A mixed position does inspire the relationships between mothers and healthcare authorities. On the one hand, mothers admit that healthcare authorities are well prepared, and simultaneously, mothers challenge authorities because they stress vaccine benefits over risks of adverse reactions. Summing up, the vaccination history of these mothers, shows a dilemmatic socio-cognitive position, between the Scylla of inconsistent information at disposal and the Charybdis of fears and decision making.

If this is what a researcher could infer from the mothers' reported information, the mothers' socio-cognitive activity do transform the different topics well-known in the academic literature (i.e. myths, toxic chemicals, autism, conspiracy, rumors) into well-organized clusters, articulated in two main dimensions: *the representational field* and *hesitancy nourished by universalistic values and social media*.

Scholars interested in socio-cognitive dynamics should consider the laypersons' point of view as a way they use for trying to make sense of the

information available from several conflicting sources allowed to mothers who are sensitive to the burgeoning activities of no-vax associations. When mothers position themselves against the topics, the entire cluster of contents comes to the fore, and simultaneously the cluster splits in favor vs against the contents. Mothers share the everyday experience of talking together in the backyards of nurseries and kindergartens about their fears, hopes, hesitancy. Therefore, the cluster of representations has its counterpart in the echo chambers (Grimes (2016; 2017, Crist, 2018) mothers live in: the cluster as content and the echo chambers as the container.

The interconnection of representations and mothering experience, alongside the relationships with universalistic values and doubts about Science, is a valuable window on more significant issues between rational medical science, healthcare policies, and mothers' myths and fears. Mothers' representations seem to be an exciting mixture of naïve and apprentice-like people, borrowing meaning both from official Science (challenging to approach) and the more familiar stories told or rumors (rare adverse events) as emotionally charged narrative accounts. The mothers are by no way mere fence-sitters: they are hesitant towards their children's future, and they are not a mere 'black sheeps' of the 'human herd'.

Significant practical consequences can follow from these results, for healthcare authorities and stakeholders of public health. It's time for vaccination programs to recognize that in this modern era when increasingly facts alone do not drive decisions, an important goal is understanding the complex perceptions held by mothers during their everyday experiences. To propose possible effective interventions, equal attention must be given to, and investment in, understanding of what shapes the representations and decisions of those who accept vaccination and those segments of the population who are hesitant.

A major limitation of this research is the choice of a convenient sample of mothers of an Italian region, that prevents us from any generalization of the results and any causal relationships. As for all studies relying on voluntary participation, selection bias cannot be excluded, due to the possible oversampling of mothers who have strong opinions and the under-sampling of mothers with less strong beliefs about vaccines and vaccination. Due to social desirability pressures, some mothers may not accurately report their children's immunization schedules. Moreover extending the research to fathers (and parent couples) could be a further improvement of this approach.

These methodological limitations are partially mitigated by the ecological approach of this study, carried out at a regional, very local level, studying mothers with children, at the age where they are requested to enter the vaccination schedules. In this sense, the research meets the strong recommendations diffused by the *Vaccine Confidence Project* (www.vaccineconfidence.org).

The choice of research of the relationships between mother-child vaccination history and mothers' vaccine representations may be further empirically and theoretically refined through more systematic and quantitative research: the social representations approach allows to integrate both the content of vaccine issues and the choice of specific categories of people (mothers) who are personally questioned by these issues, during the vaccination histories with their children.

On the other hand, parental concerns and information gaps following a vaccine safety scare need to be actively addressed. Healthcare authorities and providers need to approach this difficult situation considering parents' desire to do what they feel right for the child; at the same time, they are targeted by a flux of contradictory information and doubts, frequently framed as *fake news* (Carrieri, Madio & Principe, 2019). These fake news lock up mothers in echo chambers, a metaphorical description of a situation in which sensitive issues amplified and reinforced or distorted by communication and repetition inside a closed system (for instance supported by social media) and insulate mothers from rebuttal.

In a period of resurgence of debates referring to the implementation of the Italian law on children's vaccination and upcoming seasonal vaccination for Influenza, our results may offer a useful tool for a deeper understanding of mothers' way of facing sensitive issues; for entering the echo chambers that face many mothers, and offering healthcare authorities and policymakers conceptual tools for intervention strategies that could monitor and improve vaccination acceptance.

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