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University Students and Vaccinations: A Challenge for Universities and Health Care Authorities

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University Students and Vaccinations: A Challenge for Universities and Health Care Authorities

Patrizia Selleri, Felice Carugati

Abstract: The controversies around vaccines have been in the spotlight over the years, particularly in the public arena. The case of the Italian vaccination fierce controversies was particularly worrying in a period (2017) when a new law introducing mandatory vaccine schedules for children was submitted to Parliament. 705 Italian university students belonging to medical curricula (paediatricians, pharmacists), midwives, psychologists, educators, were asked to fill out a questionnaire about salient issues about vaccines (myths, confidence, conspiracy, parent's free choice, individualistic and competitive positions about decision making), and their personal vaccination history (mandatory vaccination received). While these issues have been studied in terms of people's characteristics, the paper aims at showing their socio-cognitive organization, in terms of an integrated representational field, according to the socio-psychological approach. MCA analysis allowed a well-organized representational field of students' representations of vaccination and their relationships with students' vaccination histories, sensitivity to social rumors and social media, and Science as the instrument for eradicating vaccine-preventable diseases (VPD). The results show clusters of favourable vs negative positions that are modulated by the respect of mandatory vaccine schedules and the students' curricula. Medical students are closed to individualism and competition, characteristics of liberal professions; less prone to myths; no conspiracy, nor the parents' free choice. Psychology and Education students do not share these positions and are more prone to myths, conspiracy, rumors, and parents' free choice. Medical students are more distant and disinterested in vaccine-specific topics than their humanities peers. Midwives share an intermediate position. A socio-psychological approach to vaccine issues vs an individual cognitive one offers a better understanding of complex and dilemmatic vaccine issues. Implications for improving the organization of medical and humanities university curricula are discussed.

Keywords: University students, vaccine representations, Health Authorities, MCA

Introduction

Vaccines and vaccination programs represent two of the most outstanding achievements of medicine in the battle against vaccine-preventable disease (VPD) worldwide. International organizations (WHO Sage Group, 2017) have significantly promoted large-scale vaccination programs. As a result, most VPDs are at low level worldwide. Nevertheless, children's vaccinations and people's vaccinations have been losing public confidence over the years. This decline in confidence is referred to as a global crisis (*WHO confidence Project*: Larson et al. 2019; WHO, 2020a; b).

Furthermore, a paradox of the modern age is at stake: although technological progress has improved our living, working, and health conditions, the perception of living in a "risk society" has increased enormously. Consequently, the success of vaccination campaigns has been replacing fears of disease with fears that vaccines are not safe or even cause diseases, while the minimal number of adverse reactions are amplified by fears or ideological or political instrumentalization (State interference, economic interests, party clash). Hence, the spread out of so-called *fake news* (Reuters Institute, 2017). International organizations such as WHO Sage Group (Mc Donald, 2015) have been monitoring the widespread burgeoning controversies around the risky content of the vaccines (thimerosal), the consequence of vaccination (autism), the short- and long-term negative effects (adverse reactions), i.e. WHO defines as *misconceptions or myths* (WHO, 2015). Some arguments against vaccines and vaccinations are at stake: safety concerns about science accountability and the Big-Pharma propaganda favouring covered business interests. A large amount of literature about vaccine and vaccination issues includes a wealth of notions like *confidence* (Larson et al., 2019), *hesitancy* (McDonald, 2015); *free choice* about of decision-making for children's vaccinations (Alhalaseh et al. 2020; Jones et al. 2015).

Conspiracy is another topic (Blaskiewicz, 2013; Lewandowsky et al., 2013), where global pharmaceutical industries (Big Pharma) are charged with promoting large-scale vaccination campaigns as a matter of unfair business and concealing severe adverse reactions. Social media (websites and blogs held by several social agents) significantly spread conspiracy (Lantian et al. 2016).

A recent contribution to understanding the relationships between hesitancy and conspiracy is found in the echo chamber metaphor (ECH: Grimes, 2017; Crist, 2018). ECHs are virtual environments where persons or categories of people encounter information or opinions that reflect and reinforce their own. ECHs create misinformation and distort a person's perspective, so they have difficulty considering opposing viewpoints and discussing complicated topics. ECHs are fueled partly by confirmation bias, the tendency to favor information that reinforces existing beliefs. The controversies on vaccines

and vaccinations have been extending, by including vaccination as civil liberties issues (Broniatowski et al., 2020), claiming people's rights to determine the choice of medical care, coupling with the ideology of individualism, and competition vs. universalism (Triandis & Gelfand, 1998; Dubois & Beauvois, 2004; Velan et al., 2012; Urbinati, 2019). Moreover, the decline of confidence in Health Care Authorities plays a major role in activating in the general population and parents, a mix of mistrust, gullibility, credulity, conspiracy, a pretence of understanding and mastering complex levels of highly sophisticated information (Larson, 2018; Wilson et al., 2020). A further paradox is shown among healthcare professionals (HCPs). They play a central role in vaccine confidence, and their recommendations are strong drivers of vaccine acceptance among laypeople. In many countries (Loulergues et al., 2009; Scanlon, 2011), however, a considerable fraction of these professionals is affected by vaccine hesitancy, which in turn may be fostered by a lack of trust in Health Care Authorities. The nature of HCPs concerns is similar to those of their patients and highlights a conflict between the recommendations and practices of HCPs concerning vaccines (Karafillakis et al. 2016), and doubts expressed by a portion of HCPs about the utility and benefit-risk balance of some vaccines. Many HCPs also seek information online about vaccination to find more "objective" information about concerns or to better understand their patient's fears and concerns (Le Maréchal et al., 2016). As for the midwives, a review of the global literature (Attwell et al., 2018) show that most midwives supported vaccination, although a spectrum of beliefs and concerns emerged that parallel what is documented for the general population. In contrast to practicing HCPs, very few studies have been conducted to assess medical students' perceptions (i.e. paediatricians and pharmacists) concerning vaccines and vaccinations, with few exceptions (Kernéis et al., 2017). Moreover, a well-documented critic of the inadequacy of teaching vaccine/vaccination issues is presented by reviewing the most diffused general and specialized American Medicine Handbooks, asking the question: *How much does American Medical School teach about Vaccines?*¹ In fact, out of thousands of pages devoted to all the general and specialized topics, only a few pages or even a few paragraphs are devoted to vaccines and vaccinations. Medical school curricula in different countries do not offer mandatory courses or hands-on training in vaccination topics (Rath, Mühlhans & Gaedicke, 2015). Even during graduate training programs in Pediatrics, vaccination issues are occasionally learning topics. No international data are available, on how midwifery students are taught about vaccination in their undergraduate or graduate degree programs (Attwell, Yusuf & Frawley, 2019). Nevertheless,

¹ <https://www.youtube.com/watch?v=buQvtnQ7VXA&channel=MyIncredibleOpinionwithForrestMaready>

the categories of future HCPs are significant resources for healthcare information and best practices, including their role in vaccination healthcare policies. The same figure is for Pharmacists (Welch, 2009; Koçak et al., 2022; Zahid et al., 2020). Other university students (Psychologists and Educators) will be involved in their future healthcare practices with children and their parents, as they will be responsible for children's health and specific relations to their parents in school systems. Nevertheless, no information is available on whether these students benefit from any curricula about vaccine and vaccinations: in Italy, no classes are devoted to them. What can be summarized by this review of the literature is manifold. First, international organizations are increasingly concerned by the resurgence of hesitancy and anti-vaccine movements. Researchers devote a wealth of resources to studying adults' hesitancy and negative positions about vaccination, showing a variety of characteristics of them. Even the scattered research on categories of medical professionals, future medical professionals, and HPCs lack practical and specific training on vaccination issues during university education. This noticeable and very considerable literature has been showing and discussing multiple aspects of vaccination issues in the framework of individual attitudes and beliefs (Brotherton, French & Pickering, 2013). Indeed, most studies consider participants with no theoretical attention to socio-psychological dynamics possibly organizing such pieces of information.

Attwell, Meyer & Ward (2018) argued that the ineffectiveness of information campaigns or public health interventions in changing vaccination behaviors might be rooted in deeper psychosocial dynamics that influence individual decisions, according to the moral foundations of vaccine attitudes (Amin et al., 2017). 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.

A socio-psychological approach to understanding the interplay between issues emerging from the literature on vaccines and vaccination and the dynamics that organize it, has been introduced by Selleri & Carugati (2020), studying mothers with preschool children of compulsory vaccination age. Mothers are a case in point because their opinions and beliefs about vaccines and vaccination interact with their direct responsibilities for decision-making about children's health. Therefore, their hesitancy, confidence in vaccination and Health Care Authorities, and sensitivity to conspiracy, rumors, and other related issues, cease to be scattered, individual beliefs, becoming a complex interplay of mothers' beliefs, their decision making and their children's vaccination histories. The above-mentioned study has shown a well-organized representational field of vaccination issues, where clusters of positive vs negative positions concern the mothers' uncertainty 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 of hesitancy. Mothers organize the contents disagreeing on their connotative quality: for instance, university mothers with younger vaccinated children are less afraid of vaccination procedures and less suspicious towards Health Care Authorities. Confidence in these Authorities, vs conspiracy of pharmaceutical industries, plays a significant role in shaping the mothers' socio-cognitive representational field of vaccinations, according to their social positions. The relationships connecting representations, children's vaccination histories reported by mothers, their universalistic values, and doubts about both Science and Health Care Authorities play a significant role in shaping the social conditions for producing a representational field. Mothers organize ideas, beliefs, and attitudes toward vaccinations in a coherent framework where, for instance, myths and fears about autism and doubts about the efficacy of vaccines (bottom cognitive level of concerns) are paired with more general positions: for example, a conspiracy of the Big Pharma; hence, probably, and consequently, claims for a free choice, and vaccines/vaccinations considered *contra naturam*. In this sense, mothers organize knowledge into socio-cognitive representations (a representational field) in terms of making sense and sensitivity to their decision-making responsibilities rather than as a set of separate pieces of cognition.

Following this argumentation, the study of the representational field of vaccines and vaccinations could be usefully extended to other people, not assuming isomorphism, but approaching the issue with the same socio-cognitive perspective, borrowed by previous studies on social representations of intelligence (Mugny & Carugati, 1989; Carugati, Scappini & Selleri, 1994; Carugati & Selleri, 1998; Carugati & Selleri, 2004; Miguel, Valentim & Carugati, 2016; Selleri & Carugati, 2020).

University students (Medicine, Pharmacy, Midwifery, Psychology, Education) are cases for complementary reasons. First, research focused on vaccine issues in university students preparing for medical and health professions is very shortage, even in medical curricula (Pediatrics included), with few exceptions in Pharmacists (Zahid et al., 2020) and midwives (Attwell et al., 2018) and absent in humanities students.

Second, the socialization approach could define the graduate experience as a period of professional identity formation. Professional identity is defined as a representation of self, achieved over time, during which the professional characteristics, values, and norms are internalized, resulting in individual

thinking, acting, and feeling like a professional (Matthews, Bialocerkowski & Molineux, 2019). This general definition, applied to the categories mentioned earlier, means that these students are not yet fully socialized into their professional roles, especially if their curricula are not explicitly devoted to introducing them to vaccine and vaccination issues. Consequently, these five categories are halfway between university students and certified professionals along the socialization path towards entry into their professions. Currently, at least in Italy, medical students in Paediatrics are attending specialization curricula (6 years + 5 years of specialization); for pharmacists and psychologists the curriculum is 5 years; for educators the curriculum is of 4-5 years; for midwives the curriculum is much shorter (3 years, practically total immersion). Therefore, besides the quality of curricula, their length and being alongside them could modulate students' opinions and representations of vaccine issues. On the other hand, Pediatricians and Pharmacists belong to classical liberal professions, while Psychologists and Educators could be considered more belonging to helping professions, and Midwives in-between, because of their medical curricula, integrated with practical professional habits towards future mothers, who will be confronted to vaccines decision-making.

Hence it is plausible to expect different positions towards vaccine issues, as a consequence of their distinct academic curricula and their sensitivity towards scientific knowledge, everyday knowledge and sources of information. Given that vaccinations have unavoidable implications on people's health, and vaccinating is a way of taking care of self and other people, the relationships between vaccination issues and people's individualistic vs universalistic values and visions of living in society should be taken as important articulation of representations and moral values (Mugny & Carugati, 1989; Vaidyanathan, 2015; Fetherston, 2017; Hatem & Halpin, 2019). These issues could be proposed to university students, expecting that three categories would show a more individualistic position for medical students and a more taking-care universalistic position for humanities students, while midwives will share an intermediate position, given they have a medical-oriented curriculum integrated with practical professional habits towards future mothers.

The current study

The Italian context of the research

Data were collected in a specific social and political period in Italy (2017) when lively public discussions were at stake during the parliamentary iter of Italian national law on vaccines and vaccinations. Since 2001 the health

policies in Italy have been delegated to the regional administrations, including children's vaccination policies. Until 2016 the Italian Ministry of Health had established four mandatory vaccines (diphtheria, tetanus, poliomyelitis, hepatitis B), and three strongly recommended: measles, mumps, and rubella (IHM, 2014).

One of the delegation's results is that the immunization rate of the children's population went systematically and considerably down, with a 'leopard spot' effect among regions (Bonanni, 2015; Signorelli et al., 2017).

Despite an alert of scientific medical associations and the National Institute of Health concerning the lowering of herd immunity effect, increasing anti-vaccine activities of parents' associations against the scientific and clinical warnings characterized 2016-2017. The Italian Ministry of Health (2017) promoted a law for introduction at the national level, by which children 0-16 years must be vaccinated against polio; diphtheria, tetanus, hepatitis-B; whooping cough, Haemophilus influenzae-B; measles; rubella; mumps; chickenpox. These vaccinations are mandatory and free of charge. For these reasons, studying the knowledge and positions of a sample of medical and social curricula university students about vaccination issues (of public interest and part of their future profession) seemed interesting for grasping the lively dynamics of socio-psychological phenomena. The research was focused on Italian university students (Paediatrics, Pharmacy, Midwifery, Psychology, and Education).

Participants, instruments, and measures

A convenient sample of 705 students in medical curricula (Pediatricians, Pharmacists, Midwives) and Humanities (Psychology, Education Sciences) was collected at the University of Bologna and the University of Rome (Catholic University of Sacred Heart); a further sample of Pediatrics students from different Italian Universities, was enrolled during their 2017 annual meeting (ONSP)² in Bologna.

Baseline questionnaire

Participants were asked to report their age; parents' professional and educational level; university curriculum; knowledge of Italian mandatory and highly recommended vaccines; personal vaccination history (mandatory vaccinations received); personal and rumors knowledge of potential adverse reactions; level of satisfaction about curriculum experience of vaccination topics; search for information and personal sources of information; confidence in Health Care Authorities' policies about vaccinations.

² These students were members of the *National Observatory of the Italian Association of Students in Pediatrics* (ONSP) from different Italian schools of Pediatrics <http://www.onsp.it/>

Representations of vaccinations

To assess the students' representational field concerning vaccinations, items drawn from previous research on Italian and Portuguese mothers (Selleri & Carugati, 2020; Miguel, Valentim & Carugati, 2016; Miguel et al., 2022) were presented in the form of statements, with responses on a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree". Items were formulated to represent as much as possible the spectrum of views and positions found in the literature: **Confidence** (*the Health Care Authorities are experts, they are updated on vaccinations and deserve confidence*); **Myths/misconceptions** (*vaccines cause autism; vaccines contain toxic chemicals as Thimerosa*); **Conspiracy** (*Pharmaceutical companies are so powerful that they try to cover up information about vaccine adverse reactions*); parents' **Free choice** of decisions on whether to vaccinate their children (*vaccinating children is a private choice of parents: Health Care Authorities should not intervene*); **Nature** and wellbeing (*when people interfere with nature, often they produce disastrous consequences*). Three other topics were proposed for assessing general positions about society: **Individualism** (*Becoming an adult means having less and less need for others*); **Competition** (*Without competition, there is no modern society*); **Universalism** (*Helping each other helps achieve positive results in life*).

Results

Descriptive analysis. The questionnaire was distributed to all students during the academic year 2017-2018 through an online format (Roma) and the same written questionnaire (Bologna and ONSP). The students were requested to fill the questionnaire voluntarily and anonymously. The questionnaire took around 30 minutes to be filled out, with a response rate of 80%. 85% women, and 15 % men; a rate in line with the number of students enrolled in their curricula. 46,1% between 19 and 24 years; 53,9% between 25 and 29.

Academic curriculum and vaccinations training. In Italy, no specific training in Hygiene or children's health is allowed for Psychology or Education students during their academic curriculum. As for the students in medical professions, 59,6% were following some educational classes on Hygiene and elementary information about vaccines/vaccinations topics, with a difference among Pediatrics (77,6%), Midwives (68,4%); Pharmacy (50,5%).

Knowledge of mandatory vaccines. According to the Italian National Program on children's vaccinations, available at the period of research (2017-2018) (IHM 2014), four mandatory vaccines were required: Diphtheria, Tetanus, Poliomyelitis, Hepatitis B (we refer to them as 4MND), and three were strongly recommended: Measles, Mumps, Rubella (MMR).

47,5 % of students correctly specify the 4MND vaccines, with a more favourable trend for Pediatrics students (72,4%). Surprisingly enough, 59,9 % of Psychology students say *yes*, compared to 38,7% of Midwives and 34,6% of Pharmacy, students for whom this topic is non-trivial for their future professions.

Table 1 - Participants' characteristics

	Characteristics	N	Weight %
Students' age	19-24	380	53,9%
	25 -29	325	46,1%
Students' gender	Men	101	14,3%
	Women	604	85,7%
Students' education	Paediatrics	116	16,4%
	Pharmacy	81	11,5%
	Midwifery	310	43,9%
	Psychology	137	19,5%
	Education Sciences	61	8,7%
Mothers' education	Junior high school	296	42,0%
	High School	250	35,5and
	College, PhD	159	22,5%
Fathers' education	Junior high school	305	43,3%
	High school	199	28,2%
	College, PhD	201	28,5%
Mothers' level of the profession (Ilo, 2007)	CITP ISCO-88 Skill level 4 Upper class	218	30,9%
	CITP ISCO-88 Skill level 3 Technical professions	265	37,6%
	CITP ISCO-88 Skill level2 Service workers	74	10,5%
	CITP ISCO-88 Skill level 1 Elementary occupations	148	21,0%
Fathers' level of the profession (Ilo,2007)	CITP ISCO-88 Skill level 4 Upper class	263	37,3%
	CITP ISCO-88 Skill level 3 Technical professions	195	27,7%
	CITP ISCO-88 Skill level 2 Service workers	160	22,7%
	CITP ISCO-88 Skill level 1 Manual occupations	87	12,3%

As for the parents' professions, 63,0% of students have no parents practicing any medical profession (medical students 55,6%; Humanities 81,8%).

Personal immunization history. Only 36,7% have memory of all 4MND vaccines received, with major difference among students: Paediatrics (77,6%); Midwifery (39,0 %); Pharmacy (29,6%); Psychology (30,7%); Education Sciences (9,8%). In other terms, 41,6% of medical students reported personal immunization for all 4MND (41,6%) and around 1/5 of Humanities students (24,2%). Going deeper into the relationship between students' direct knowledge of children with adverse reactions and rumors during student's everyday life, about $\frac{2}{3}$ of them have answered 'No' to both questions (64,3%); about $\frac{1}{4}$ (24,1%) heard some rumors and only 6,0% answered 'Yes-Yes'. Surprisingly enough, medical students (89,7 6%) are further away from direct knowledge of other children's adverse reactions, more than Humanities students (84,8%); the same for rumors.

Personal satisfaction during curricula. The level of general satisfaction about vaccines and vaccination information is not thrilling: paediatricians (40,5%) midwives (46,1%), pharmacist (67.9%). Psychology and Education students have no vaccination teaching in their curricula.

Looking for further information. There is a mixed position towards social media: paediatricians are not interested (3,4%) and Education students as well (11,5%), while 1/3 of midwives (37,1%) and around $\frac{1}{4}$ of pharmacist (27,2%) and Psychology students (28,5%) look for information from media. A different trend is shown by the students who are asked whether they consult friends or through word of mouth: Paediatrics is on the top (43,1%); Midwifery (14,2%); Psychology (11,0%); Education (4,9%). Moderate importance is devoted to information disseminated by the Health Care Authorities (16,9%), sites of pediatric associations (13,5%), and scientific journals (13,5%).

From vaccination history to representations of vaccines and vaccination

First step. The statistics show that students largely disagree (means and medians) with the content of items.

Table 2 - Means, medians, and standard deviations

	Competition	Autism	Thimerosal	Confidence	Nature	Individualism	Universalism	Free choice	Conspiracy
Mean	1,560	1,300	1,529	1,499	1,551	1,446	1,533	1,495	1,445
Median	2,00	1,000	2,000	1,000	2,000	1,000	2,000	1,000	1,000
Std. Dev.	,496	,460	,499	,500	,497	,497	,499	,5003	,4973

The frequency of the items has been transformed into categorical variables by recoding a 5-point Likert scale, in two levels, according to the median of their distributions. These new variables were submitted to a Multiple

Correspondence Analysis (MCA; Spss version 28.0), a powerful exploratory technique for uncovering groups of categories in the dimensional space, providing critical insights on the relationships between categories, without needing to meet assumption requirements such as those required in other techniques to analyze categorical data (Abdi & Valentin, 2007). Categorical data have been transformed into cross-tables, and the results are presented in a graphical manner (Johnson & Wichern, 2007). To define the number of dimensions to retain, Eigenvalue and Cronbach's alpha scores 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), thimerosal autism, individualism, universalism, conspiracy, free choice, nature, confidence, and competition have been introduced in MCA.

Table 3 - Summary of the Model

Summary of the Model				
Dimension	Cronbach Alpha	Explained variance		
		Total autoloading	Inertia	% Variance
1	,748	2,987	,332	33,188
2	,525	1,875	,208	20,838
Total		4,862	,540	
Mean	,662 ^a	2,431	,270	27,013

Based on these criteria (Sourial et al., 2010), a solution with two dimensions has been chosen (Table 3) does account (first dimension) for 33,188% of the variance, and the second dimension for 20,838%, yielding a total variance of 54,026%. The first and second dimensions are, respectively, with Eigenvalue at 2,987 and 1,875; Inertia at 0,332 and 0,208; total Inertia at 0,540; the Cronbach Alpha at 0,748 and 0,525. 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 (Table 4) and a joint plot of category points (Figure 1) have been obtained. Category quantification plots constitute a complementary tool for displaying discrimination of variables that can identify category relationships.

Table 4 - Discrimination Measures of the vaccine representational field

Discrimination Measures			
	Dimension		Mean
	1	2	
Free Choice	,568	,006	,287
Confidence	,413	,093	,253
Autism	,313	,201	,257
Thimerosal	,439	,019	,229
Individualism	,104	,530	,317
Universalism	,198	,163	,180
Conspiracy	,330	,272	,301
Nature	,584	,006	,295
Competition	,037	,587	,312
Total active	2,987	1,875	2,431
% of variance	33,188	20,838	27,013

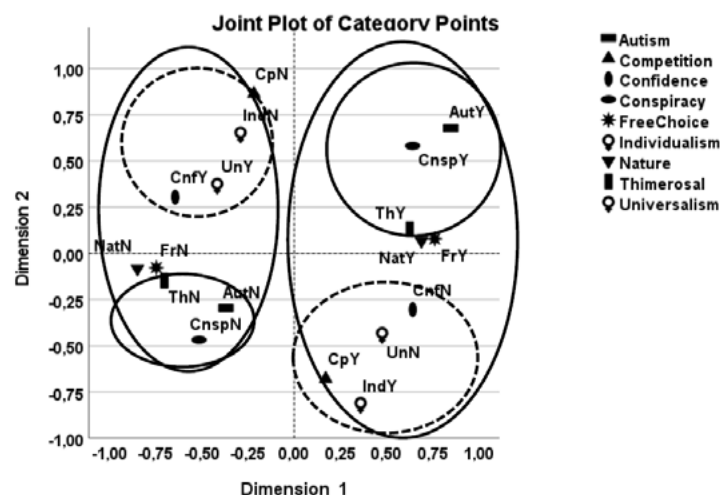
The discrimination measures (Table 4) are between 0,587 and 0,019 with a maximum value of 0,584 (nature) for the first dimension, The most relevant discrimination measures for the first dimension are nature (0,584) and free choice (0,568), issues that characterize the socio-cognitive field, with interesting contribution of thimerosal (0,439), confidence (0,413), conspiracy (0,330) autism (0,313), confidence (0,413). Consistently, nature is correlated with free choice (0,499); confidence (0,429); conspiracy (0,406); thimerosal (0,390); autism (0,372). This dimension is interpreted as the *representational field of vaccines*.

The second dimension is characterized by competition (0,587); individualism (0,530); conspiracy (0,272).

Competition is correlated with individualism (0,572); conspiracy (0,161); confidence (0,190). This dimension is interpreted as the *individualistic contribution of the competition to the representational field*.

All correlations of $\geq 0,300$ are significant at $p < ,001$; otherwise, $p < ,05$ of the two dimensions.

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



Captions

Autism: AutY: students who agree; AutN: students who do not agree
 Thimerosal (toxic chemicals): ThY: students who agree; ThN: students who do not agree
 Confidence in Health Care Authorities: CnfY: students who agree; CnfN: students who do not agree
 Conspiracy of pharmaceutical companies: CnspY: students who agree; CnspN: students who do not agree
 Free choice of vaccination: FrY: students who claim free choice; FrN: students who do not claim
 Vaccines *contra naturam*: NatY: students who agree to; NatN: students who do not agree
 Competition: CpY: students who agree on competition; CpN: students who do not agree
 Universalistic values: UnY: students who agree; UnN: students who do not agree
 Individualistic values: IndY: students who agree; IndN: students who do not agree
Sociological items
 Mandatory vaccines received: 4all: all mandatory received; 4MS: some mandatory received
 Postgraduation: Med: Medical students; Midw: Midwives; Hum: Humanities students
 Age: 24: 20-24 years >24; 25 years and beyond

Figure 1 shows the plot of the two dimensions of the representational field with its components.

Favorable positions concerning nature and free choice are clearly opposed, showing their significant contribution to the first dimension. The two more prominent (larger) solid ovals lines surround the opposite positions of each of the components (issues). On the left side (dimension 1), we find no free choice, no nature, confidence, no Autism, no thimerosal, universalism, no competition, no individualism.

On the right side, the opposite part of this representation.

The smaller solid circles (clusters) circles surround the favourables and negative positions. At the bottom left: refusal of specific myths connected with no conspiracy and no free choice; at the upper left: the favorable counterpart is apparent.

The smaller dashed circles (clusters) surround competition, conspiracy, individualism, and universalism.

Summing up, the four clusters are positioned as a chiasma, opposing upper left with bottom right; bottom left with upper right, showing an elegant view of socio-cognitive organization of the representational field.

Second step. Three sociological variables have been added to the representational field as supplementary variables in MCA: student's post-graduation (Paediatrics plus Pharmacy (**Med**), Midwifery (**MidW**), Psychology plus Education students: **Hum**); two levels of the following topics: Students knowledge of the mandatory vaccines in Italy; post-graduation students' age: (≤ 24 vs >24). According to the MCA statistics, supplementary variables are not used to determine the principal dimensions. Their coordinates are predicted using only the information provided by the performed multiple correspondence analysis on active variables. The results are shown in Table 4 and Figure 2.

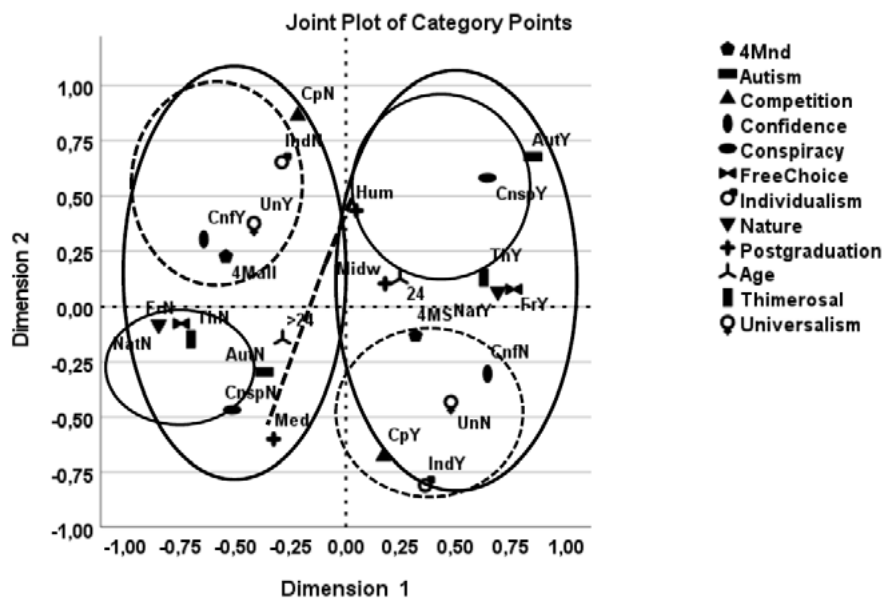
Table 5 - Discriminant measures of representational field and sociological variables (as supplementary variables)

Discrimination Measures			
	Dimension		Mean
	1	2	
Free Choice	,568	,006	,287
Confidence	,413	,093	,253
Autism	,313	,201	,257
Thimerosal	,439	,019	,229
Individualism	,104	,530	,317
Universalism	,198	,163	,180
Conspiracy	,330	,272	,301
Competition	,037	,587	,312
Nature	,584	,006	,295
Age ^a	,070	,019	,044
4Mnd ^a	,172	,030	,101
Postgraduation ^a	,044	,158	,101
Total active	2,987	1,875	2,431
% of variance	33,188	20,838	27,013
a. Supplementary variable			

The coordinates of the two dimensions are the same of the Table 3. Therefore, the attention should be devoted to the coordinates of the three supplementary variables. Taken together and considering their position on the plot (Figure 2), age is not particularly associated with any component, while 4MND is slightly more positioned to the first dimension, post-graduation to the second.

The significant result is the position of the three categories of students (Figure 2), where Psychologists and Education students (**Hum** in the Figure 2) are more sensitive to vaccine myths (autism, thimerosal), conspiracy, free choice but less sensitive to competition and individualism. The reverse is for medical students (**Med**) while midwives (**Midw**) occupy an intermediate position. A complementary result does concern universalism, which, even with its moderate discriminant measure, is systematically negatively related to individualism.

Figure 2 - Joint plot of category points of the representational field of vaccine issues and sociological variables



Hum: Education and Psychology students; **Midw:** Midwives;
Med: Paediatrics and Pharmacy Students

Discussion

The student's knowledge of the Italian vaccination mandatory programs for children is less than optimal; the same figure is for students' memories

about their personal vaccination history. These results are of major importance, for checking the reliability of self-reported vaccination history, given that these students are future professionals either as part of Health Care Services or of organizations devoted, in various ways, to children's health. Moreover, given that medical students are exposed to infectious diseases during their career, immunity against (VPD) is vital for both medical students and the patients they meet. The same argument is pertinent for psychologists and educators, particularly when they work in organizations where possible outbreaks of VPD are lurking. Students' personal history alone is not a reliable screening tool for immunity against VPD. A conservative interpretation is their vaccination histories are treated as a given, and that offers an image of these students living in a socio-cognitive environment where their health consciousness or experiences has a marginal room. Moreover, medical students' knowledge of vaccine and vaccination issues is less than optimal during their university curriculum, and they are mildly unsatisfied with their general knowledge but, by and large, are not particularly interested in getting further information, at least at the time of research, when the debates did concern the categories of parents and their decision-making. Students are also far from direct and indirect experiences of possible adverse reactions in children, which are, on the contrary, part of the nightmare of parents.

Going deeper into the vaccination issues, the student's representational field is far from a collection of scattered opinions, but a well-organized socio-psychological field that hosts specific myths (autism, thimerosal) with general positions about free choice, confidence, conspiracy, and more general ideological issues like competition in society, taking care of other people, the 'intrusion' of science into the still supposed unspoiled nature.

Notions borrowed from the mainstream literature that have been studying as separate, are intertwined when presented to the students (as it has been found in mothers: Selleri & Carugati, 2020; Miguel et al., 2022). That result is a non-occasional configuration but a result of a socio-psychological activity to make sense of different societal issues. Moreover, the negative and positive positions are organized in a mindful sense: no conspiracy with confidence; individualism *yes* with no universalism; competition with individualism.

It is worth noting that medical students are close to individualism and competition, two main characteristics of the image of liberal professions; less prone to myths (autism, thimerosal); no conspiracy, no free choice. Psychology and Education students do not share these positions but are more prone to myths (autism, thimerosal), conspiracy, rumors, nature. In general terms, medical students seem less interested in specific issues than their Humanities peers. Midwives share an intermediate position. It is conservative to interpret their position as the echo of the representations they share

between medical culture and the everyday culture. This social position has been shown in mothers' social representations of intelligence (Carugati & Selleri, 1994), where specific dynamics towards intelligence and education is shown in mothers who are at the same time teachers. It is a matter of a social identity conflicting with a salient issue that implies both personal responsibility and dilemmatic decision-making. An interesting result is the position of universalism with its low discriminant measure in both dimensions. It could be assumed that it is a leading value in helping professions, and social desirability could play a role. Nevertheless, (Figure 2) no universalism is associated with medical students, while universalism is associated with midwives and Education and Psychology students.

These results illustrate the interest in showing the socio-psychological micro-dynamics of specific categories of people (students during professional socialization). The same trend has been documented in mothers with children of vaccination age, in previous research, when confronted with salient and pertinent issues in their life.

Vaccine issues are not novel phenomena nor extemporaneous opinions but intertwined components of significant representations that have circulated in society since the introduction of the vaccination itself (Chatterjee, 2013). The salience of an issue over another depends on broader cultural and historical dynamics. Sometime, they are latent, sometimes burgeoning, like the recent experience of Covid-19, when its dramatic spread-out has provoked a spillage of the vaccine issues from the Pandora's box, i.e., the *Infodemia* of contents and justifications, conspiracy theories included (Rothkopf, 2003; Eysenbach, 2009). At the time of the research, our students were somewhat sheltered from the current Infodemia, but the ingredients were still like the ashes of the fire, and they took the stand according to the students' social positions.

Specific attention should be devoted to the inadequacy of teaching vaccine and vaccination issues during university curricula, a situation acknowledged by the students. The inadequacy refers to the universities responsibility of organizing adequate syllabuses (Epidemiology, Social Hygiene, Preventive Medicine).

Monitoring the representational field of vaccine and vaccination issues and its change over the socialization towards medical and helping professions could be a useful socio-psychological tool for improving the quality of these professions. A call for a re-imagination of the culture of public health and the meaning of vaccine safety regulations should be a shared goal of Universities and Health Care Authorities in the era when it is impossible to ignore predictable epidemiological events. This condition of burgeoning concerns about viral epidemics or pandemics is characteristic not only of individuals making choices but of several other social agents as well, receiving

recommendations from international organizations about preventive strategies. For example, although some seek refuge in the claim that the current COVID-19 pandemic could not have been predicted, the historical record shows that national and international agencies, in both academic and State institutions, did expect and advise preparedness for an epidemic much like the one underway. According to their specializations, new generations of medical and helping professionals should be well equipped to support the new generations of lay people in emergency and long-lasting situations of chronic stress.

Limitations

A major limitation of this research is the choice of a convenient sample of university students from two Italian universities over one year but in a period of fierce controversies about mandatory vaccinations throughout Italy. Any generalization of the results and any causal relationships should be avoided.

Moreover, we collected students with different curricula lengths without detailing possible different positions according to age. Future research should approach the interaction of age and socio-cognitive dynamics related to socialization, i.e. how students become professionals.

Nevertheless, our study addresses students during the socialization process towards their professions, pointing to the ongoing appropriation of relevant technical and cultural tools. Vaccination issues, even not yet the core portion of their socialization, peek into their experience enough to activate specific socio-cognitive dynamics. Further research may offer an opportunity to verify the theoretical claims, supporting content and dynamics of the representational field of vaccine issues. At a concrete level, it should be underlined the lack of systematic education on scientific, technological, and cultural aspects of vaccine and vaccination issues in university curricula in Italy. This situation clearly acknowledged by the students should be of major concern to Universities and Health Care Authorities. Our results underlining the role of representations in organizing the vaccine culture of specific social categories could offer the Authorities and policymakers conceptual tools for intervention strategies that could monitor and improve vaccination acceptance.

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