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RESEARCH PAPER

## Information sources and knowledge on vaccination in a population from southern Italy: The ESCULAPIO project

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### ABSTRACT

Vaccine knowledge of the general population is shaped by different information sources and strongly influences vaccination attitudes and uptake. The CCM-Italian Ministry of Health ESCULAPIO project attempted to identify the role of such information sources, in order to address adequate strategies to improve information on vaccines and vaccine preventable diseases.

In the present study, data on 632 adults from Southern Italy regarding information sources were collected, and their perceived and actual knowledge on vaccinations were compared and analyzed in relation to socio-demographic characteristics and information sources.

The main reported reference sources were general practitioners (GPs) (42.5%) and pediatricians (33.1%), followed by mass media (24.1%) and the Internet (17.6%). A total of 45.4% reported they believed to be informed (45.4%), while those estimated to be truly informed were 43.8%. However, as showed in the multivariate logistic regression, people having the perception to be correctly informed ascribed their good knowledge to their profession in the health sector (Adj OR 2.28, CI 1.09–4.77,  $p < 0.05$ ) and to friends/relatives/colleagues (AdjOR 6.25, CI 2.38–16.44,  $p < 0.001$ ), while the non-informed population thought the responsibility had to be attributed to mass media (AdjOR 0.45, CI 0.22–0.92,  $p < 0.05$ ). Those showing the real correct information, instead, were younger (AdjOR 1.64, CI 1.04–2.59,  $p < 0.05$ ), and their main reference sources were pediatricians (AdjOR 1.63, CI 1.11–2.39,  $p < 0.05$ ) and scientific magazines (Adj OR 3.39, CI 1.51–7.59,  $p < 0.01$ ).

Only 6% knew the “VaccinarSi” portal, developed to counter the widespread antivaccine websites in Italy. The post-survey significant increase of connections to “VaccinarSi” could be ascribed to the counselling performed during questionnaire administration.

Strategies to improve information about vaccination should be addressed to fortifying healthcare workers knowledge in order to make them public health opinion leaders. General population should be provided with correct indications on trustworthy websites on vaccines to contrast false information supplied by anti-vaccinists on their own websites or social networks pages and on the mass media.

### KEYWORDS

general population; health care workers; information source; Internet; perception; vaccination; information

## Introduction

The lower vaccine uptake recently reported in the general population has been commonly associated with different factors.<sup>1–4</sup> One of the most important determinants that are able to shape vaccination attitudes are information sources, existing in a variety of types and differently influencing the general population.<sup>5–8</sup> It is commonly recognized that information source and trust are closely related each other, since trust is a critical concept for understanding why some sources of information on vaccination are consulted more than others, how information on vaccination is re-interpreted and how beliefs that are often contrary to medical science are formed.<sup>1</sup> Trust in the information source has been shown to be a relevant factor of the effect of risk communication.<sup>9</sup>

A recent meta-analysis evidenced an overall reporting the available information sources by interviewed European parents,<sup>10</sup> with information sources such as mass media, as well as the advice from general practitioners (GPs) or other health care workers (HCWs), reported as frequently lacking or insufficient by around one third of the articles and significantly associated with a lower vaccination uptake.<sup>11–16</sup>

Effectively, both the literature and market research data confirmed that advice from HCWs is the main and most influential source of vaccination information for most people.<sup>1,17</sup>

Moreover, nowadays there is an increasing use of the internet-based information sources, especially in younger generations, even though this information is generally perceived to

have a low importance for health decisions; HCWs remain the most important source, followed by conventional media.<sup>18,19</sup>

The ESCULAPIO project, funded by the Italian National Center for Disease Prevention and Control of the Ministry of Health (CCM), is aimed at developing health communication strategies and interventions on preventable diseases and vaccination to increase vaccine coverage in the general population. One of the activities envisaged in the project was to identify major determinants of lower vaccination uptake through systematic reviews and meta-analyses.<sup>10,20</sup> These searches allowed the development and testing of a questionnaire to collect data on the main factors influencing vaccine uptake in a population from Southern Italy.

The aim of the present study is to examine information sources on vaccines and vaccine preventable diseases in the interviewed population. A secondary objective is to investigate on the perceived and actual knowledge and to compare them also in relation to socio-demographic characteristics and other influencing sources. Moreover, a detailed analysis of the connections to a national portal developed to counteract anti-vaccinists' opinions ("VaccinarSi") is performed, in order to assess whether the intervention performed within the ESCULAPIO project was effective in disseminating in the interviewed population the existence of an important web source such as the VaccinarSi portal.

## Results

### Sample description

In the present study, data on 632 adults from Southern Italy regarding socio-demographic characteristics, knowledge and information sources on vaccination were collected.

The sample was composed mainly by females, people less than 55 years, with a secondary or lower education, being married or cohabitant, with numerous family components, having 2 or more smartphone/tablet and TV, and Internet connection at home; half sample was composed by parents, with minors in the household, having one PC in the family (Table 1).

A total of 43.8% of the population was evaluated as informed, while a slightly and non significant higher percentage had the perception to be informed (45.4%) (Table 2). The main information sources reported were GPs (42.5% of the population) and pediatricians (33.1%), followed by mass media (24.1%) and the Internet (17.6%); other HCWs and friends/relatives/colleagues were reported as information sources by 12.5% and 10.5% of the population, respectively (Table 2).

Most of them heard criticisms on vaccinations, and in particular from social networks (Table 2).

### Associations of knowledge with socio-demographic characteristics and information sources

Different socio-demographic characteristics, information sources and knowledge on vaccinations were found associated with both perceived and actual knowledge in the univariate analysis. Few of them were showed to be independent determinants of information. As showed in the multivariate logistic regression, people believing to be correctly informed ascribed their good knowledge to their profession in the health sector (Adj OR

**Table 1.** Socio-demographic characteristics of the interviewed population from the ESCULAPIO project (N = 632).

	N	%
<b>Gender</b>		
F	393	62.2
M	239	37.8
<b>Age</b>		
18-54	455	72.0
>=55	177	28.0
<b>Education</b>		
Secondary or lower	442	70.5
University	185	29.5
<b>Working in health sector</b>		
Yes	71	17.8
No	329	82.3
<b>Marital status</b>		
Married/cohabitant	470	75.3
Non married/single	154	24.7
<b>Being parent</b>		
Yes	320	50.6
No	312	49.4
<b>Minors in household</b>		
Yes	346	54.9
No	284	45.1
<b>No. family members</b>		
1-2	136	21.6
3-4	427	67.8
>4	67	10.6
<b>No. smartphone/tablet</b>		
0	60	9.8
1	124	20.2
2	193	31.4
>2	237	38.6
<b>No. computer</b>		
0	85	13.7
1	316	51.0
2	136	21.9
>2	83	13.4
<b>No. TV</b>		
0	22	3.5
1	191	30.7
2	235	37.7
>2	175	28.1
<b>Internet connection at home</b>		
Yes	534	87.5
No	76	12.5

2.28, CI 1.09–4.77,  $p < 0.05$ ) and to friends/relatives/colleagues (AdjOR 6.25, CI 2.38–16.44,  $p < 0.001$ ), while the non-informed population thought that the responsibility had to be attributed to mass media (AdjOR 0.45, CI 0.22–0.92,  $p < 0.05$ ) (Table 3).

Those showing the real correct information, instead, were younger (AdjOR 1.64, CI 1.04–2.59,  $p < 0.05$ ), and their main reference sources were pediatricians (AdjOR 1.63, CI 1.11–2.39,  $p < 0.05$ ) and scientific magazines (Adj OR 3.39, CI 1.51–7.59,  $p < 0.01$ .) (Table 3).

### Connections to the VaccinarSi Website

Only 6.3% of the interviewed population reported to know the Italian "VaccinarSi" portal (Table 1), developed to counter the widespread anti-vaccinist opinions.

The georeferenced analysis based on the website connections, evidenced a significant increase of 15.2%, 3% and 7% in the number of connections, the number of pages per session and the session length, respectively, in the 3 months after our intervention in the shopping centers in the Sicilian Western

**Table 2.** Information data on vaccination of the interviewed population from the ESCULAPIO project (N = 632).

	N	%
<b>Actual knowledge<sup>a</sup></b>		
Yes	277	43.8
No	355	56.2
<b>Perceived knowledge</b>		
Yes	268	45.4
No	322	54.6
<b>Main information source<sup>b</sup></b>		
General practitioner	251	42.5
Pediatrician	195	33.1
Other health care workers	74	12.5
Mass media	142	24.1
Internet	104	17.6
Friends/relatives/colleagues	62	10.5
Scientific magazines	31	5.3
<b>Ever heard criticisms on vaccines</b>		
No	95	15.1
Yes	533	84.9
<b>Heard criticisms from social networks</b>		
No	510	80.7
Yes	122	19.3

<sup>a</sup>estimated through an index derived from the answers to the following six items: knowledge of the difference between compulsory and recommended vaccinations; knowledge on vaccines (efficacy, safety, adverse effects, protection, in adequate doses); knowledge on diseases (effects, preventability, contagiousness, dangerousness); knowledge of the regional vaccine calendar; knowledge of the national VaccinarSi website; knowledge of the correct strategy to prevent mentioned diseases. More than half of right answers were index of good knowledge.

<sup>b</sup>estimated on the basis of a question with multiple answers; the percentage frequency is calculated on the 590 persons that answered the question.

Area whose population was potentially involved in the intervention.

In particular, the analysis highlighted a significant higher increase of the single website connections in Western Sicily (15.2%), that was the residence area of the potential customers shopping centers, compare with Eastern Sicily (4.3%) (Fig. 1). Moreover, while in Western Sicily the mean number of session increase was 3%, in the same period a slight decrease in Eastern Sicily (− 8.6%) was observed. Finally, in contrast with a 7% increase in the session length in seconds in Western Sicily

(97.3 vs 90.6), a substantial reduction for the same variable in the not intervention area (96.5 vs 72.5; − 24.8%) was observed (data not shown).

A further analysis reported in Fig. 2 showed the biennial connections to VaccinarSi website in Sicily in the year pre and post intervention. The figure evidenced that, in the year before our intervention, the connections were in a decreasing phase, and a slight increase is showed just after our intervention, followed by the summer period of lower connections, and again by a subsequent increase.

## Discussion

The present study provides a framework of the perceived and the actual knowledge on vaccines and vaccine preventable diseases by the population interviewed in an area of Southern Italy, and presents them in relation to socio-demographic characteristics and information sources. Moreover, it evidences how intervening on the general population with appropriate strategies could be effective in addressing people to some correct behaviors such as searching accurate information on the right Internet sources.

Age is one of the factors mostly influencing the actual knowledge of the interviewed population (but not the perceived knowledge), with the youngest being more informed than the oldest. This could be explained as most of them have to deal with their role of parent, they have to face the vaccine experience with their child, and for this reason have to search for information about vaccines and related diseases. This is also confirmed by the fact that in this study pediatrician is the most reliable source reported by most informed people.

The most frequently reported reference persons are GPs and pediatricians. These figures are generally the most credible sources, are trusted arbitrator of knowledge and influence decision of vaccinating, as reported in other studies. For example, in a review on older adults, healthcare providers had a facilitating effect on the vaccination status of older

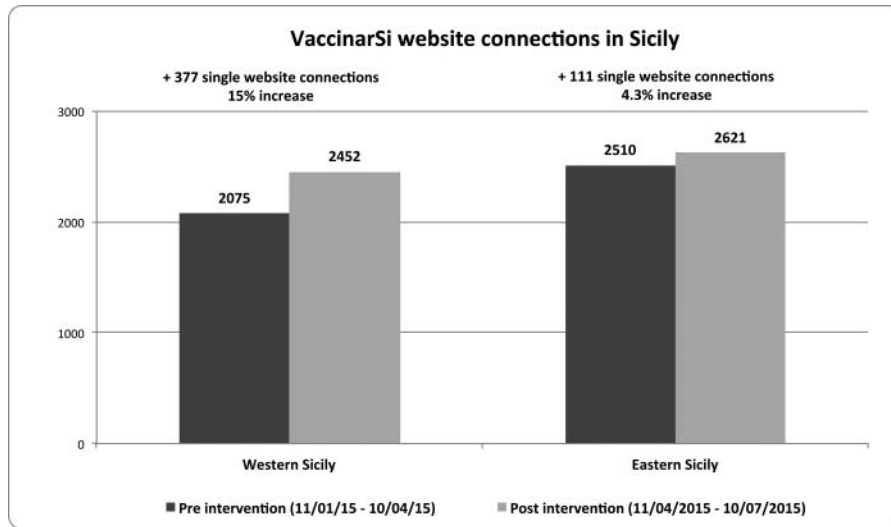
**Table 3.** Multivariate analysis of the associations between the perceived and actual knowledge and socio-demographic characteristics and information sources of the interviewed population from the ESCULAPIO project (N = 632).

	Perceived knowledge (yes vs no)				Actual knowledge (yes vs no)			
	Adjusted OR*	Lower 95% CI	Upper 95% CI	p-value	Adjusted OR*	Lower 95% CI	Upper 95% CI	p-value
Age <55 years (vs ≥55) <sup>a</sup>					<b>1.64</b>	<b>1.04</b>	<b>2.59</b>	<b>0.034</b>
Married/cohabitant (vs non married/single)	1.61	0.83	3.12	0.156	1.35	0.84	2.16	0.216
Families with >2 components (vs 1 or 2) <sup>a</sup>					0.92	0.56	1.52	0.747
Presence of minors in household (vs no)	0.42	0.13	1.29	0.130	0.50	0.22	1.17	0.110
Parent (vs non parent)	1.61	0.52	4.98	0.412	<b>2.10</b>	<b>1.94</b>	<b>4.71</b>	<b>0.049</b>
At least one smartphone/tablet (vs none) <sup>b</sup>	3.72	0.90	15.49	0.070				
Presence of internet connection in household (vs absence) <sup>a</sup>					1.43	0.84	2.44	0.185
University education (vs secondary or lower) <sup>b</sup>	1.46	0.82	2.62	0.203				
Working in health sector (vs no) <sup>b</sup>	<b>2.28</b>	<b>1.09</b>	<b>4.77</b>	<b>0.029</b>				
GP as reference information source (vs no) <sup>b</sup>	0.73	0.41	1.29	0.278				
Paediatrician as reference information source (vs no)	1.42	0.75	2.69	0.285	<b>1.63</b>	<b>1.11</b>	<b>2.39</b>	<b>0.012</b>
Scientific magazines as reference information source (vs no)	<b>8.07</b>	<b>1.64</b>	<b>39.66</b>	<b>0.010</b>	<b>3.39</b>	<b>1.51</b>	<b>7.59</b>	<b>0.003</b>
Mass media as reference information source (vs no) <sup>b</sup>	<b>0.45</b>	<b>0.22</b>	<b>0.92</b>	<b>0.028</b>				
Friends/relatives/colleagues as reference information source (vs no) <sup>b</sup>	<b>6.25</b>	<b>2.38</b>	<b>16.44</b>	<b>0.000</b>				
Heard criticisms from social networks (vs no) <sup>b</sup>	0.59	0.29	1.16	0.127				

<sup>a</sup>not associated with perceived knowledge in the univariate analysis

<sup>b</sup>not associated with actual knowledge in the univariate analysis

\*Adjusted for gender



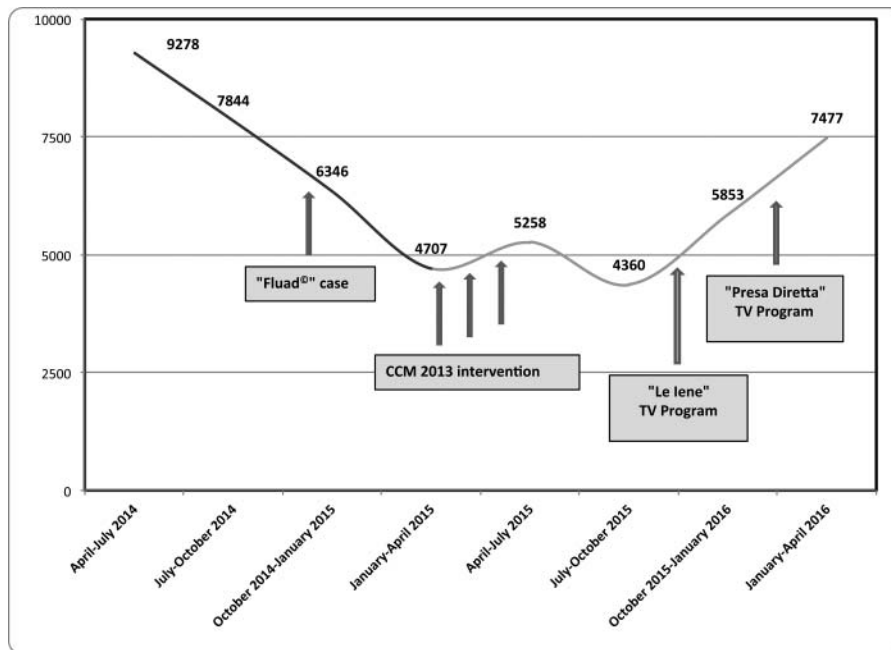
**Figure 1.** Number of single VaccinarSi website connections by Western and Eastern areas of Sicily and by pre-intervention and post-intervention period in the shopping centers located in the Western area.

adults and also influenced their vaccination intentions and uptake.<sup>21-24</sup>

Our results, however, show that, among the people believing to be informed, GPs and pediatricians are not independent factors of good information, while the truly informed people are those whose reference person is the pediatrician, but not the GP. An important discrepancy, thus, is produced in the wide population segment attending GPs, which does not receive correct and reliable information on vaccination. This underlines the important role of the pediatrician in the vaccination thematic, and suggests the need of shaping a more robust reference person on this matter among the GPs. One of the possible solutions is to reinforce training in health sector particularly addressed to GPs, so that greater and better information can be spread. As reported in the study from Yaqub et al,<sup>1</sup> physicians on

their turn feel there is not enough support from governments and health authorities, thus they need to be helped by them with more vaccination campaigns and other governmental strategies.

Relatives, friends and colleagues represent a source consulted by those perceiving to be informed, but not by the real informed people. It is important to consider these sources as they often can be stronger than other influences and could have some negative effect on the decision to get vaccinated<sup>25-29</sup> or even a positive effect on encouraging the decision to comply.<sup>7,21-22,30</sup> It has to be noted that interviewed population having the perception to be informed is convinced that their good information is mostly due to friends, relatives and colleagues, but unfortunately this does not correspond to the real knowledge assessed. It is likely that information shared between these sources is not correct.



**Figure 2.** Two-year trend of the number of connections to the VaccinarSi website in all Sicilian Region.



Those believing to be informed work mainly within the health sector. Even though this association was not found out in the actually informed people, scientific magazines remains one independent determinant of good knowledge. Since around 90% of those reporting to read literature work in the health sector, it could be suggested that the real informed are those working in the health sector but specifically reading correct information from the scientific magazines.

Another information source frequently reported by the interviewed population is mass media. Messages from these sources directly influence vaccination attitudes in the general population.<sup>21,24</sup> However, those people believing to be non-informed ascribed to mass media their information lack, but this was not confirmed in the multivariate regression of the actual informed persons. This is partly in line with one study on influenza,<sup>7</sup> where population characterized what they heard about vaccine in the media as mostly positive or neutral. These results suggest that vaccination messages coming from TV news or newspapers are often transmitted in the wrong manner, and thus it is necessary to improve the quality of the broadcasted vaccine information.<sup>31-32</sup>

The Internet is also reported as a used information source from the examined population. The information obtained in the Internet searches can influence their decisions to get vaccinated.<sup>6,33</sup> Psychological research underlines that informational influence on perceptions and behavior is not always conscious.<sup>34</sup> The (anti-)vaccination information on the Internet has an influence on risk perceptions and on vaccination intentions and behavior in relation to the encoded information.<sup>18</sup> Accessing vaccine-critical websites for 5 to 10 minutes increases the perception of risk of vaccinating and decreases the perception of risk of omitting vaccinations as well as the intentions to get vaccinated.<sup>33</sup>

Our results show that the post-survey significant increase of connections to “VaccinarSi” in the Western part of Sicily could be ascribed to the counselling performed during questionnaire administration. This suggests that intervening on the general population with appropriate strategies could be effective in addressing people to some correct behaviors such as searching accurate information on the right Internet sources. Such efforts need to be allied with other online and offline platforms that draw in healthcare professionals and medical societies to support sustained dialog with hesitant patients.

In particular, data regarding “VaccinarSi” website connection are very interesting, demonstrating a decreasing trend in the 12 months preceding the intervention. This decrease could be associated with the incorrect and unbalanced mass media resonance of the “Fluad®” case in Italy.<sup>35</sup> Moreover, one of the youngest suspected death before vaccination was recently reported in Eastern Sicily.<sup>36</sup>

The observed little increase in the 3 months after the intervention was due, as reported in Fig. 1, mainly to the connection raise (+377 single connections) in the Western Sicily Area.

Finally, the concurrent and subsequent enhancement of VaccinarSi website connections, after the 2015 summer period, could be probably related with the broadcasting of 2 Italian TV programs (“Le Iene” the 26th of October 2015 and “Presi Diretta” the 10th of January 2016), that touched in the correct way the theme of vaccines and vaccinations (Fig. 2).<sup>31-37</sup>

Strategies to improve information about vaccination should be addressed first to fortifying healthcare workers knowledge and modifying their attitudes in order to make them public health opinion leaders; this could improve general population-physician communication. Moreover, the importance of population-based health communication has to be emphasized, with the need of providing population with correct indications on the most reliable information sources to be consulted, e.g. trustworthy websites on vaccines that contrast false information supplied by anti-vaccinists on their own websites or social networks pages and on the mass media.

Future research may help to determine how the general population knowledge and information can be applied in the vaccination decision-making process.

## Material & methods

A questionnaire was developed by the ESCULAPIO working group to collect data on the main factors influencing vaccine uptake. It includes 47 items that are structured in 6 sections, the first about socio-demographic information, the second on lifestyle, behaviors and attitudes, the third investigating vaccine anamnesis, the fourth about knowledge, beliefs and perceptions, and the last 2 asking specifically about information sources and influence or trust in institutions and people.

Questionnaires were administered between April and July 2015 within 4 shopping centers around the city of Palermo, located in the Western area of Sicily. Shopping centers were chosen as ideal environment where collecting people of different socio-economic level.

Data collected from questionnaires were transferred into an excel file and analyzed through the use of the software STATA/MP 12.1 (StataCorp LP, College Station, TX, USA).

A general description of socio-demographic characteristics and of information data was performed and is shown as percentage frequencies. Some variables were dichotomized for the sake of the study. Interviewed population was defined “actually informed” when providing more than half of correct answers to the following 6 questions regarding: knowledge of the difference between compulsory and recommended vaccinations; knowledge on vaccines (efficacy, safety, adverse effects, protection, in adequate doses); knowledge on diseases (effects, preventability, contagiousness, dangerousness); knowledge of the regional vaccine calendar; knowledge of the national VaccinarSi website; knowledge of the correct strategy to prevent mentioned diseases.

The perceived information was evaluated through the question “Do you believe to be informed about vaccines and vaccine preventable diseases?”

The main information sources investigated for the present study were both from the health sector, such as GPs, vaccination center operators, pediatricians, gynaecologists and other HCWs, scientific literature, and from non-health sector, such as mass media, the Internet, social networks, relatives, friends or colleagues.

People were also asked whether they heard criticisms on vaccines and from what sources.

Univariate and multivariate logistic regression analyses were then performed to explore the associations of the perception to be informed and the actual knowledge with socio-demographic

characteristics, information sources and knowledge. ORs and AdjORs, adjusted for age and gender, with their CIs were then showed with 95% significance level set at  $p < 0.05$ .

In order to investigate the efficacy of the intervention to disseminate the knowledge of the national website VaccinarSi, a geo-referenced analysis was performed using

Google analytics, a tool provided by Google, which tracks and reports website traffic.

Data from April 2014 to April 2016, including number of connections, number of pages per session and the session length of the website VaccinarSi in both the Western and Eastern part of Sicily, and in the whole Sicilian territory, were collected. The comparison between these parameters 3 month before and 3 month after the intervention was performed through a chi-square test with 95% significance level set at  $p < 0.05$ .

VaccinarSi is a project created by Italian Society of Hygiene, Preventive Medicine and Public Health (S.It.I.) in order to communicate and educate the general population and the healthcare community about vaccines.

It consists mainly on a web portal ([www.vaccinarsi.org](http://www.vaccinarsi.org)) and associated social network accounts (Facebook and Twitter). The web portal and the twitter page were launched on May 2013 while the Facebook account was created a year later.

The web portal is organized into 6 main sections (preventable disease, registered vaccines, benefits and risk of vaccination, fight against vaccines' misinformation, pros and cons and travel immunization) and other headings that relate to scientific events, comics and vaccination coverages. All scientific contents are validated by a committee, which includes 20 experts on immunization from the academia and the national health service. The organizational structure includes also a steering committee, an operational board and a communication task force; all of them work on a voluntary basis. The project is financed through unconditional support by Farindustria, the Italian association of 174 Farmaceutical companies, and CCM projects with any lucrative purpose.<sup>38,39</sup>

## Abbreviations

CCM	Italian National Center for Disease Prevention and Control
ESCULAPIO	Elaborazione di Strategie e di interventi di Comunicazione sanitaria mULTi-obiettivo sulle mAlattie infettive Prevenibili e sulle vaccinazioni come mezzo per aumentare le cOperture vaccinali nella popolazione
GP	general practitioner
HCW	health care worker
S.It.I.	Italian Society of Hygiene; Preventive Medicine and Public Health

## Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

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