



## Attitudes and beliefs of parents about routine childhood vaccination in Greece

Despoina Gkentzi, Charalampia Tsagri, Eirini Kostopoulou, Sotirios Fouzas, Apostolos Vantarakis, Gabriel Dimitriou & Anastasia Varvarigou

To cite this article: Despoina Gkentzi, Charalampia Tsagri, Eirini Kostopoulou, Sotirios Fouzas, Apostolos Vantarakis, Gabriel Dimitriou & Anastasia Varvarigou (2021) Attitudes and beliefs of parents about routine childhood vaccination in Greece, Human Vaccines & Immunotherapeutics, 17:9, 3066-3072, DOI: [10.1080/21645515.2021.1914805](https://doi.org/10.1080/21645515.2021.1914805)

To link to this article: <https://doi.org/10.1080/21645515.2021.1914805>



Published online: 10 May 2021.



Submit your article to this journal [↗](#)



Article views: 76



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)

RESEARCH PAPER



## Attitudes and beliefs of parents about routine childhood vaccination in Greece

Despoina Gkentzi<sup>a</sup>, Charalampia Tsagri<sup>a</sup>, Eirini Kostopoulou<sup>a</sup>, Sotirios Fouzas<sup>a</sup>, Apostolos Vantarakis<sup>b</sup>, Gabriel Dimitriou<sup>a</sup>, and Anastasia Varvarigou<sup>a</sup>

<sup>a</sup>Department of Paediatrics, Medical School, University of Patras, Patras, Greece; <sup>b</sup>Department of Public Health, Medical School, University of Patras, Patras, Greece

### ABSTRACT

Vaccine hesitancy remains one of the 10 major global threats as per the WHO report in 2019. The aim of the present study is to assess attitudes and perceptions of vaccine hesitant parents in Greece with a view to implementing strategies to increase vaccine uptake. A cross-sectional questionnaire-based prospective survey was conducted between September 2019 and June 2020 on parents of children attending primary education in the city of Patras in Western Greece. Data on parental attitudes and beliefs about vaccinations were collected and analyzed. Multivariable logistic regression was used to investigate factors associated with vaccine uptake. Out of 2154 distributed questionnaires, 1227 were completed and returned (response rate 56.9%). The main vaccine information source for Greek parents was their primary care pediatrician (90.8%). Doubts still exist amongst approximately one-third of them (33.5%) regarding a possible relationship between vaccines and autism. Of note, 44% of the study participants believe that unvaccinated children could attend school. 84.6% of the parents in our cohort admitted that they had fully vaccinated their children. In the multivariable analysis, marital status ( $p < .002$ ) and Greek nationality ( $p < .001$ ) were found to be the most significant determinants of vaccine uptake. Overall, we found that the percentage of parents in Greece that are vaccine hesitant is small yet not negligible. Based on our results, targeted public health interventions should particularly focus on single parents and those with non-Greek nationality. Training healthcare professionals to provide adequate information is crucial to clarify misperceptions.

### ARTICLE HISTORY

Received 26 February 2021  
Revised 19 March 2021  
Accepted 4 April 2021

### KEYWORDS

Vaccine hesitancy; Greece; parents; school-aged children; vaccine uptake

### Introduction

The implementation of vaccination schedules worldwide has led to a considerable decrease in childhood morbidity and mortality during the last decades. It is currently estimated by the World Health Organization (WHO) that vaccination prevents 2–3 million deaths annually and a further 1.5 million could be avoided if vaccine uptake increased at a global scale.<sup>1</sup> Nonetheless, vaccine hesitancy remains one of the 10 major global threats as per the WHO report in 2019.<sup>1</sup> Vaccine hesitancy is defined as the “delay in acceptance or refusal of vaccination despite availability of vaccination services”.<sup>1</sup>

Research has identified several factors associated with parental vaccine refusal such as socio-cultural, personal beliefs, and attitudes or previous vaccination experiences.<sup>2,3</sup>

Vaccine hesitancy has been a long-standing issue and has been further expanded following the publication of Wakefield in 1998 in *The Lancet*, where an association between the measles-mumps vaccine (MMR) and autism was reported. Although, the study was quickly withdrawn due to methodological flaws, the suggested link between MMR and autism had already taken global dimensions.<sup>4–6</sup> For instance, in the United Kingdom, there has been a reduction in measles vaccination coverage from 92% in 1996 to 84% in 2002.<sup>4,5</sup> Of note, the first dose measles vaccination coverage in the UK had fully recovered to 92% by 2012.<sup>7</sup> Nonetheless, recent reports show that

parents are still reluctant to offer the MMR vaccine to their children and this is related to fears, misperceptions, inadequate government focus on public health, limited vaccine availability, limited access to immunization services, conflict, migration, women's limited formal education and inconvenience in accessing vaccines.<sup>8–10</sup> All the above have apparently contributed to the recent measles outbreaks worldwide.

Many factors play a decisive role in deciding whether or not to vaccinate. First, the importance of the historical, political, and sociocultural context, where different factors (previous experience with public health services, family history, conversations with friends) may influence the vaccination decision.<sup>11,12</sup> Moreover, many scientific studies have shown the negative impact of media and the internet on parents' decision to get vaccinated.<sup>13–16</sup> Furthermore, the role of public health and healthcare professionals is unquestionably crucial in the decision-making of parents.<sup>4,11</sup> In addition, parents' decisions regarding the administration of vaccines to their children depend to a large extent on their knowledge and relevant information, their attitudes, and values, as well as on their personal experiences.<sup>11,12</sup> Studies have also shown that parents who are reluctant to vaccinate their children usually rely on unscientific judgments, might belong to specific ethnic minorities and delay vaccinations for their children, without realizing the consequences.<sup>17,18</sup> Of note, countries with mandatory policies to prevent the spread of infectious diseases show

higher vaccination uptake despite reluctance.<sup>19</sup> Interestingly, there are countries with high vaccination coverage rates where parents do delay or even do not carry out vaccinations.<sup>20,21</sup>

Data about vaccine hesitancy amongst Greek parents are scarce. In a study conducted in 2013 refusal of vaccinations by parents was not found as frequent in Greece, concerning one every 100 vaccinations delivered by private-practice pediatricians, and involved mainly MMR and HPV vaccines.<sup>22</sup> In a more recent large-scale retrospective data-driven analysis conducted globally, Greece was reported as a country with high levels of trust toward vaccine and this has been further strengthened after 2018.<sup>23</sup>

The aim of the study is to assess attitudes and perceptions of vaccine hesitant parents of children attending primary education in a large geographical area in Western Greece with the view of implementing strategies to increase vaccine uptake.

## Methods

### Study population and questionnaire

A cross-sectional prospective survey was conducted between September 2019 to June 2020 on parents of children attending public primary compulsory education, i.e., kindergarten (4–5 years old) and elementary education (6–12 years old), in the city of Patras, the third biggest city in Greece (following Athens and Thessaloniki). We used stratified sample design in all public kindergartens and elementary school of the Municipality of Patras and the schools were equally stratified into all municipal subregions. In particular, we used the stratified sampling method to randomly select the schools that will participate so that schools from all areas of Patras would equally participate in the study. There are for instance suburbs in Patras with high socioeconomic status versus areas with lower socioeconomic status or high population of immigrants. For our analysis, one stratum was one municipal subregion of Patras. Then, we have chosen amongst them the schools that would participate using simple random sampling (25 elementary out of 86, 10 kindergartens out of 101). Prior to conducting the study, approval was obtained from the relevant Institutional Review Board (IRB) (decision number: 9/20.06.2019) and the study was conducted according to the Helsinki Declaration of 1975. All parents/guardians of children of the selected schools were informed in detail with a written information sheet about the study aims as well as data confidentiality. The questionnaire was then distributed to the parents, filled in and returned to the research team. The questionnaire was written in Greek and was composed of 34 questions (supplemental material). More specifically, the questionnaire consisted of 9 questions related to demographic characteristics, 13 questions of Likert scale (Not at all, a little, neutral, very, very much), 8 questions of dichotomous scale (Yes, No), 2 questions with simple choice scale and 2 questions with multiple response scale referring to parents' knowledge, attitudes and perceptions about vaccines, vaccine-preventable diseases as well as information sources on vaccination. The development of the

questionnaire was performed following literature review and tested within a group of 50 parents to ensure clarity, content validity, and internal consistency prior to conducting the survey.

### Statistical analysis

Categorical variables are expressed as absolute and relative frequencies, while continuous variables are presented as means  $\pm$  standard deviations. The chi-square test was used to compare the rates of responders between different study groups. Univariable logistic regression was applied to explore factors that influenced vaccine uptake. Statistically significant variables in the exploratory analysis were subsequently included in a multivariable stepwise logistic regression model. The crude (unadjusted) and the adjusted effect of each variable were expressed by its odd ratio (OR)  $\pm$  95% confidence intervals (CIs). Statistics were performed using the SPSS v.25 software (IBM Corp, Armonk, NY). The level of significance was set to 0.05 for all analyses.

## Results

Out of 2154 distributed questionnaires, 1227 were completed and returned (response rate 56.9%). Table 1 demonstrates the socio-demographic characteristics of the population surveyed in our study. Most of our respondents were women (73.7%). In 77% of cases, the age group was 26–35 years old. The majority of the sample participants were of Greek nationality (94.1%) and married or cohabiting (85.7%). We do not have any data

**Table 1.** Socio-demographic and occupational characteristics of the surveyed population (n = 1227).

	n	%
<b>Gender</b>		
-Male	323	26.3
-Female	904	73.7
<b>Age, mean</b>		
-<18 years	1	0.1
-18–25 years	208	17
-26–35 years	945	77
-36–50 years	73	5.9
<b>Marital status</b>		
-Married/cohabitant	1052	85.7
-Non married/single	175	14.3
<b>Number of children</b>		
-1 child	276	22.5
-2 children	680	55.4
-3+ children	271	22.1
<b>Nationality</b>		
-Greek	1155	94.1
-Albanian Immigrant	7	0.6
-Syrian Immigrant	41	3.3
-Iraqi Immigrant	7	0.6
-Roma	17	1.4
<b>Education</b>		
-Primary	85	6.9
-Secondary	459	37.4
-Higher	683	55.7
<b>Employment status</b>		
-Employed	930	75.8
-Unemployed	297	24.2
<b>Annual income</b>		
-0–10,000 Euros	340	27.7
-10,001–20,000 Euros	563	45.9
->20,000 Euros	324	26.4

**Table 2.** Sources of information about vaccination of study participants, knowledge about vaccine related side effects and vaccine uptake (n = 1227).

	n	%
<b>Main information source on vaccinations</b>		
<i>-Pediatrician</i>		
Strongly disagree	47	3.8
Disagree	14	1.1
Neutral	52	4.2
Agree	133	10.8
Strongly agree	981	80
<i>-Health Visitor</i>		
Strongly disagree	839	68.4
Disagree	82	6.7
Neutral	140	11.4
Agree	89	7.3
Strongly agree	77	6.3
<i>-Alternative Medicine Practitioner</i>		
Strongly disagree	989	80.6
Disagree	126	10.3
Neutral	66	5.4
Agree	20	1.6
Strongly agree	26	2.1
<i>-Mass Media</i>		
Strongly disagree	737	60.1
Disagree	175	14.3
Neutral	164	13.4
Agree	113	9.2
Strongly agree	38	3.1
<i>-Internet search engines use</i>		
Strongly disagree	365	29.7
Disagree	250	20.4
Neutral	261	21.3
Agree	215	17.5
Strongly agree	136	11.1
<b>Reliability of online sources on vaccination issues</b>		
Strongly disagree	311	25.3
Disagree	423	34.5
Neutral	365	29.7
Agree	99	8.1
Strongly agree	29	2.4
<b>Affected by sites' negative reviews on vaccination issues</b>		
Strongly disagree	533	43.4
Disagree	363	29.6
Neutral	197	16.1
Agree	95	7.7
Strongly agree	39	3.2
<b>Doubts about the information circulating on the internet that some vaccines cause autism</b>		
Not at all	441	35.9
A little	341	27.8
Neutral	253	20.6
Much	125	10.2
Very Much	67	5.5
<b>Should unvaccinated children be able to attend school?</b>		
Yes	540	44
No	687	56
<b>Have fully vaccinated their children</b>		
Yes	1038	84.6
No	189	15.4

on the characteristics of those parents who did not fill in the questionnaires.

Table 2 summarizes the sources of information on vaccination and intention to get vaccinated of the surveyed population. The main information source for Greek parents was their primary care pediatricians (90.8%). A very small percentage (3.7%) were advised from an alternative medicine professional about vaccines. Online sources for information on vaccines were considered reliable by 10.5% of the parents in our cohort whereas one-third of them admitted uncertainty about this issue. Moreover, doubts still exist amongst approximately one-third of the surveyed parents (33.5%) with regard to a possible

relationship between vaccines and autism. In addition, 84.6% of the subjects stated they have fully vaccinated their child according to the National immunization schedule. Of note, 44% of the study participants believe that unvaccinated children could attend school whereas 56% support the opposite view. We performed a further comparative between these two parental groups (Chi-Square test) and found that Greek parents versus non-Greek ( $p = .013$ ) and those living in urban area versus semi-urban area of Patras ( $p = .04$ ) were more likely to believe that unvaccinated children should not attend school. We did not find any other statistically significant difference in the remaining socio-demographic characteristics (age, sex, education, marital status) of parents belonging to these two groups.

Figure 1 presents parental views on immunization-related problems. The vaccines that parents are more worried about are, in order of descending frequency, the Meningococcus B, MMR, HPV and Varicella.

Figure 2 illustrates parental views regarding who benefits from vaccination. Nearly two-thirds of our study participants admit the societal benefits whereas half of them also believe that pharmaceutical companies are benefited from immunization programs.

Table 3 shows the results of the univariable and multivariable regression analysis with regard to parental socio-demographic characteristics and vaccine uptake. In univariable analysis higher vaccination uptake was associated with older parental age (>26 years old versus <26 years old) ( $p < .002$ ), marital status (married/cohabiting versus single) ( $p < .001$ ), Greek nationality versus non-Greek ( $p < .001$ ) and higher parental education versus primary and secondary education ( $p = .002$ ). In the multivariable analysis, marital status (married/cohabiting versus single) ( $p < .002$ ) and nationality (Greek nationality versus non-Greek) ( $p < .001$ ) were found to be the most significant determinants of higher vaccine uptake.

## Discussion

This study reports on parental attitudes toward vaccines in a large sample of Greek parents. To our knowledge, this is the largest study in the field conducted in parents of school-aged children in the country. In our sample of Greek parents, we overall found a positive attitude toward vaccines and the majority of our parents declared compliance to the National Immunization Schedule. This is in agreement with a 2018 European report which concludes that the general attitude of the European public toward vaccination is positive.<sup>24</sup> Similarly, a large-scale study in 18 European countries (including 210 parents from Greece) conducted by the European Academy of Pediatrics on vaccine confidence showed that parents generally believe that vaccines are important and effective.<sup>25</sup>

## Demographics

Two-thirds of our reporting parents are women and most of them are employed either fulltime or part-time. This somehow reflects the modern Greek society where women are still the primary caregivers of their children yet have also established themselves in the labor market. The fact that women have filled

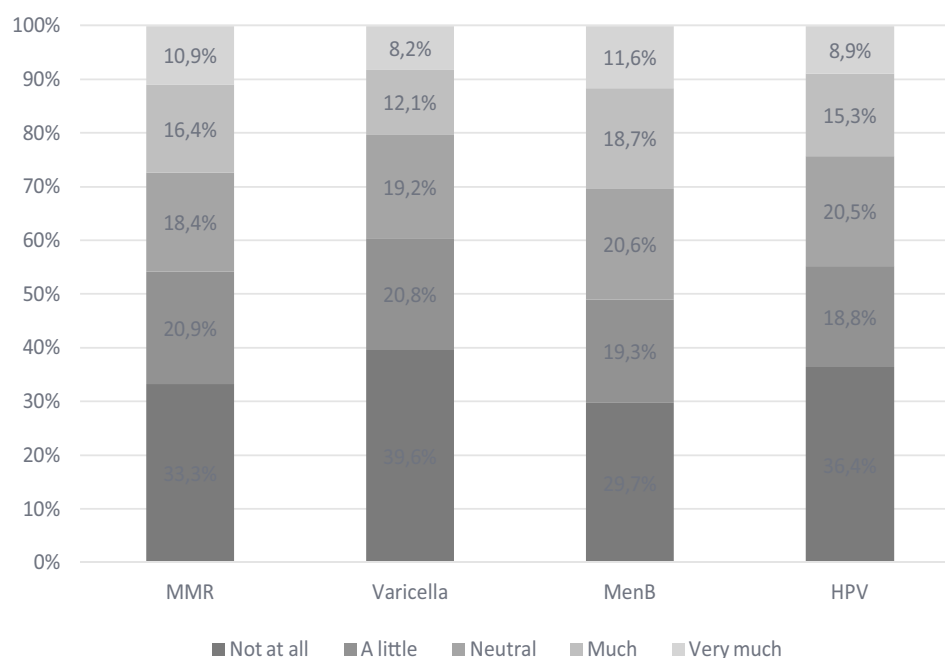


Figure 1. Parental worries for immunization related problems.

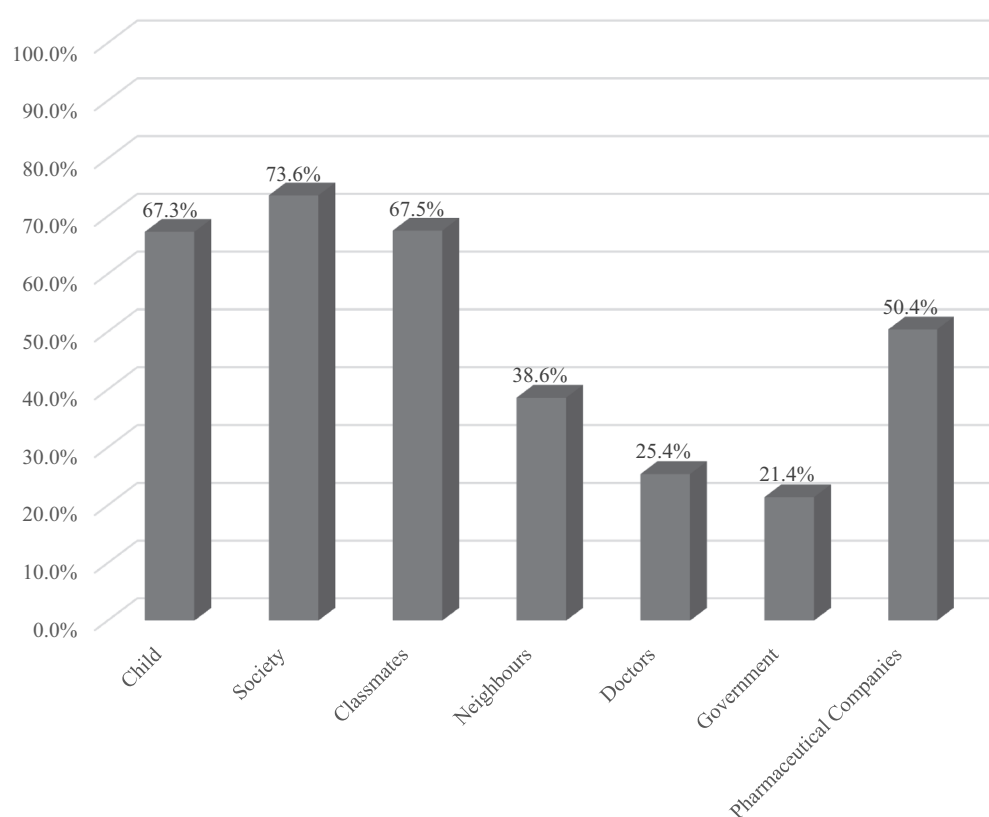


Figure 2. Parental beliefs with regards to whom benefits from vaccination.

in the majority of questionnaires in our study could be related to the overall positive attitudes toward vaccination as women tend to be more confident about vaccines compared to men as shown in studies conducted at a global level.<sup>23</sup> In our univariate analysis though we did not prove such a relationship. Nonetheless, in the multivariate analysis we have shown that parents that are married or cohabiting were more likely to vaccinate their child.

Given the fact that immunizations are delivered for free in Greece, barriers to vaccine uptake encountered by single or divorced parents are less likely to be financial in nature but more likely practical. These parents face indeed may challenge with childcare and consequently they may be more concerned with other everyday stressors and may delay well-child care visits where routine vaccination takes place.



**Table 3.** Socio-demographic determinants of vaccine uptake.

Variables	Univariable Analysis		Multivariable Analysis <sup>a</sup>	
	Crude OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Parental gender (female)	0.945 (0.662–1.348)	.753		
Parental age (>26 yrs old)	1.513 (1.095–2.091)	<b>.012</b>	1.455 (1.046–2.024)	<b>.026</b>
Marital status (married/cohabiting)	1.944 (1.319–2.866)	<b>.001</b>	1.859 (1.252–2.761)	<b>.002</b>
Number of children	0.948 (0.752–1.196)	.655		
Nationality (Greek)	1.269 (1.116–1.443)	<b>&lt;.001</b>	1.251 (1.097–1.426)	<b>.001</b>
Education (Higher)	1.466 (1.157–1.858)	<b>.002</b>	1.265 (0.988–1.621)	.062
Employed (yes)	1.350 (0.956–1.907)	.088		
Annual income (higher)	0.983 (0.796–1.214)	.875		

OR, odds ratio; CI, confidence interval. <sup>a</sup>Only variables significantly associated with vaccine uptake in univariable analysis ( $p < .05$ ) were included in the multivariable models.

With regard to education, more than half of the study participants report higher levels and interestingly in univariable analysis this is associated with higher vaccine uptake. This is contrary to the findings of a study conducted in Greece in 2010 in 731 children attending public nurseries in Athens, the capital city of Greece, whereas higher maternal education was negatively associated with the receipt of all and newly licensed vaccines.<sup>26</sup> The latter could be possibly explained by the fact that those parents who are highly educated might feel falsely confident in making decisions for their own children based on individual information processing from non-reliable sources. On the other hand, in a systematic review assessing vaccine hesitancy from a global perspective published in 2014, Greece was found to be a country where higher education leads to higher vaccine confidence.<sup>3</sup> Interestingly, in a recently published large-scale retrospective data-driven analysis, where global trends in vaccine confidence were examined from 2015 to 2019 (data from 290 surveys, 149 countries, including 284,381 individuals), parents with more years of education were more likely to vaccinate their children.<sup>23</sup> Although the majority of recent studies suggest that higher education tends to increase vaccine uptake one should bear in mind that this factor cannot always be considered as a sole determinant of future positive attitudes as many other parameters may interplay.

As for nationality, Greeks represent the majority of the study participants with only a minority being immigrants or belonging to the Roma ethnic group. This generally reflects the distribution of the population that lives in our area yet might also indicate the willingness to participate in the study. We know for instance that people belonging to the Roma ethnic group and live in our area have significant gaps in childhood vaccination, mainly due to cultural beliefs. The latter might have perhaps led to a decreased response rate. In univariable analysis, having Greek nationality was significantly associated with vaccine uptake. A similar association was reported in a nationwide study conducted in Italy where Italian nationality was associated with less vaccine hesitancy, as well as in a smaller study conducted in Greece in 2010.<sup>26,27</sup> Another possible explanation that could account for this finding is that children of immigrants or belonging to the Roma communities are less likely to attend regular child health care follow-up visits due to financial or other logistical constraints. The latter represents an area for future targeted interventions to increase vaccine uptake in our area. It is also worth mentioning here that parents of Greek nationality in our cohort are more likely to believe that unvaccinated children should not

attend school which reflects their overall positive attitudes toward vaccination and better understanding of the societal benefits of the vaccines. However, nearly half of all our study participants irrespective of socio-demographic characteristics would agree that unvaccinated children can attend school. This is a worrying finding given the fact that enrollment in public school in Greece, thus far, presupposes full immunization coverage as proven by the personal child's healthcare records. For children of immigrants or other ethnic minorities there are governmental arrangements in place so that they get fully vaccinated before school entry. Therefore, parents of all nationalities throughout the country ought to comply with the national guidance in this field.

### Sources information and beliefs about vaccine

With regard to the main information source on vaccination, the primary care pediatrician is the main source for our study participants. This is somewhat expected as it reflects the primary care delivery setting in our country where all children are followed up and get vaccinated by a pediatrician, either belonging to the public sector or to the private, and not by general practitioners. Pediatricians are generally well trained in vaccine preventable diseases and in issues surrounding vaccinations as this represents one of their main duties and responsibilities of their daily practice in Greece. Hence, they are well informed in the field and can provide reliable information to parents. It is worth mentioning that at a European level it has been demonstrated that parents who consult general practitioners appear to be more likely to exhibit vaccine hesitancy than those who consult pediatricians.<sup>25</sup> Of note, the percentage of parents who consult an alternative medicine practitioner is very small (3.7%) in our surveyed population. This is not an unexpected finding as it reflects the overall low level of acceptance of homeopathic medicine in Greece especially for issues related to child health.

As for the reliability of the online sources (social media included) on vaccination issues, 1 in 10 of our study respondents believes that these can be a useful source whereas one-third declares uncertainty in the field. Similar percentages have also been reported from Italian parents and are considerably worrying given the misleading information that can occasionally be distributed on the web.<sup>27</sup> Even more worrying is the belief held by 15% of our parents that vaccines may cause autism. Moreover, one in five of our study participants admit being unsure about such a link. Twenty-three years following

the Lancet publication by Wakefield and despite huge public health efforts as well as high quality published work confirming the absence of any link between the two, parents worldwide are still concerned about MMR causing autism.<sup>4,8,9,27</sup> Based on our findings and other studies, efforts should continue in order to clarify misperceptions on this particular issue. It is also worth mentioning at this point that MMR is the second most common vaccine in our cohort that parents admit that they are worried about following the new *Meningococcus B* vaccine. The fear of side effects of the latter could be explained by the fact that *Meningococcus B* vaccine is a fairly new vaccine and not at present incorporated to the recommended vaccines of the National Immunization Schedule. Hence, worries although not scientifically based are somewhat understandable from a parental perspective. However, uncertainty still exists about MMR despite decades of proven safety and effectiveness. Following MMR, HPV vaccine still causes concerns amongst Greek parents and this has been previously reported in the country.<sup>28</sup> Although there is now considerable body of evidence supporting the safety profile of this vaccine, increased fear of side effects still remains one of the main barriers for vaccine uptake.<sup>29</sup> Further health education is obviously required in the field from a public health perspective.

### Limitations

We acknowledge that our study, as a pragmatic one, has several limitations. The main one is that it is geographically restricted to Western Greece which may not allow for generalization of the findings in the whole country. It is however the largest one conducted so far in Greece and in the third biggest city in the country. Our results could be representative of the whole country given that no major differences exist concerning the sociodemographic characteristics of the urban Greek population (nearly 80% of total population)<sup>30</sup> as well as the main sources of vaccine information. We also acknowledge that the response rate in our survey appears low compared to the usual one reported in questionnaire-based studies but one should bear in mind that the last 4 months of the study coincide with the SARS-CoV2 2019 pandemic. The latter has disrupted the questionnaires turnover due to school closures and lockdown measures. In addition, the questionnaires were filled in on a voluntary basis and therefore vaccine hesitant parents may have decided not to participate, which may have led to under-reporting. Moreover, in this survey, we have collected data regarding parental attitudes toward vaccine uptake of their offspring which does not necessarily imply true vaccine uptake as we did not directly check the healthcare records of their children to prove such positive attitudes. Finally, we acknowledge the inability of the cross-sectional nature of our study to make a causal inference.

### Conclusion

In conclusion, the percentage of Greek parents that have vaccinated their children as per national recommendations is high in our survey and the majority of Greek parents trust their primary care pediatrician as the main information provider in the field. Nonetheless, misperceptions with regard to vaccine

safety still exist despite well-designed efforts conducted during the last decades at both global and national level to increase vaccine confidence. Given the dynamic and changing nature of vaccine hesitancy, public health interventions should be constantly implemented and mainly focus on non-Greek and single parents as depicted in our study. The outcomes of such interventions should be monitored to assess the achievement of the desirable outcomes. In addition, training healthcare professionals to provide adequate information about vaccinations is crucial to clarify any concerns at individual parental level in plain language so as to encourage a better and more conscious understanding of societal and personal vaccine benefits.

### Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

### References

1. WHO report on the Ten Threats to Global Health. <https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019>.
2. MacDonald NE, The SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: definition, scope and determinants. *Vaccine*. 2015;33:4161–64. doi:10.1016/j.vaccine.2015.04.036.
3. Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. *Vaccine*. 2014;32(19):2150–59. doi:10.1016/j.vaccine.2014.01.081.
4. Brown KF, Kroll JS, Hudson MJ, Ramsay M, Green J, Long SJ, Vincent CA, Fraser G, Sevdalis N. Factors underlying parental decisions about combination childhood vaccinations including MMR: a systematic review. *Vaccine*. 2010;28(26):4235–48. doi:10.1016/j.vaccine.2010.04.052.
5. Rao TSS, Andrade C. The MMR vaccine and autism: sensation, refutation, retraction, and fraud. *Indian J Psychiatry*. 2011;53(2):95–96. doi:10.4103/0019-5545.82529.
6. Hussain A, Ali S, Ahmed M, Hussain S. The anti-vaccination movement: a regression in modern medicine. *Cureus*. 2018;10(7):e2919. doi:10.7759/cureus.2919.
7. WHO Vaccine. WHO vaccine-preventable diseases: monitoring system. [https://apps.who.int/immunization\\_monitoring/global\\_summary](https://apps.who.int/immunization_monitoring/global_summary).
8. Ashkenazi S, Livni G, Klein A, Kremer N, Havlin A, Berkowitz O. The relationship between parental source of information and knowledge about measles / measles vaccine and vaccine hesitancy. *Vaccine*. 2020;38(46):7292–98. doi:10.1016/j.vaccine.2020.09.044.
9. Tabacchi G, Costantino C, Napoli G, Marchese V, Cracchiolo M, Casuccio A, Vitale F, The Esculapio Working Group. Determinants of European parents' decision on the vaccination of their children against measles, mumps and rubella: a systematic review and meta-analysis. *Hum Vaccines Immunother*. 2016;12(7):1909–23. doi:10.1080/21645515.2016.1151990.
10. Krishnamoorthy Y, Kannusamy S, Sarveswaran G, Majella M, Sarkar S, Narayanan V. Factors related to vaccine hesitancy during the implementation of Measles-Rubella campaign 2017 in rural Puducherry – a mixed-method study. *J Family Med Prim Care*. 2019;8(12):3962. doi:10.4103/jfmpc.jfmpc\_790\_19.
11. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger J. Vaccine hesitancy: an overview. *Hum Vaccines Immunother*. 2013;9(8):1763–73. doi:10.4161/hv.24657.
12. Geoghegan S, O'Callaghan KP, Offit PA. Vaccine safety: myths and misinformation. *Front Microbiol*. 2020;11:372. doi:10.3389/fmicb.2020.00372.

13. Moran MB, Lucas M, Everhart K, Morgan A, Prickett E. What makes anti-vaccine websites persuasive? A content analysis of techniques used by anti-vaccine websites to engender anti-vaccine sentiment. *J Commun Healthc*. 2016;9(3):151–63. doi:10.1080/17538068.2016.1235531.
14. Eberth JM, Kline KN, Moskowitz DA, Montealegre JR, Scheurer ME. The role of media and the internet on vaccine adverse event reporting: a case study of human papillomavirus vaccination. *J Adolesc Health*. 2014;54(3):289–95. doi:10.1016/j.jadohealth.2013.09.005.
15. Wilson SL, Wiysonge C. Social media and vaccine hesitancy. *BMJ Glob Heal*. 2020;5(10):e004206. doi:10.1136/bmjgh-2020-004206.
16. Broadbent JJ. Vaccine hesitancy: misinformation on social media. *BMJ*. 2019;366:l4457. doi:10.1136/bmj.l4457.
17. Wang E, Baras Y, Buttenheim AM. “Everybody just wants to do what’s best for their child”: understanding how pro-vaccine parents can support a culture of vaccine hesitancy. *Vaccine*. 2015;33(48):6703–09. doi:10.1016/j.vaccine.2015.10.090.
18. Tasika E, Farmaki E, Roilides E, Antachopoulos C. Implementation of the Greek national immunization program among nursery attendees in the urban area of Thessaloniki. *Hippokratia*. 2019;23:147–53.
19. Bozzola E, Spina G, Russo R, Bozzola M, Corsello G, Villani A. Mandatory vaccinations in European countries, undocumented information, false news and the impact on vaccination uptake: the position of the Italian pediatric society. *Ital J Pediatr*. 2018;44(1):67. doi:10.1186/s13052-018-0504-y.
20. Bedford HE, Elliman DAC. Fifteen-minute consultation: vaccine-hesitant parents. *Arch Dis Child Educ Pract Ed*. 2020;105(4):194–99. doi:10.1136/archdischild-2019-316927.
21. Cella P, Voglino G, Barberis I, Alagna E, Alessandrini C, Cuda A, D’Aloisio F, Dallagiacoma G, De Nitto S, Di Gaspare F, et al. Resources for assessing parents’ vaccine hesitancy: a systematic review of the literature. *J Prev Med Hyg*. 2020;61(3):E340–73. doi:10.15167/2421-4248/jpmh2020.61.3.1448.
22. Maltezou HC, Gkentzi D, Grivea I, Chaliasos N, Galanakis E, Pavli A, Katerelos P, Syrogiannopoulos G, Roilides E, Theodoridou M. Experience with parental vaccination refusal and attitudes about vaccinations of pediatricians in Greece. *Br J Med Med Res*. 2015;5(8):971–77. doi:10.9734/BJMMR/2015/13493.
23. de Figueiredo A, Simas C, Karafillakis E, Paterson P, Larson HJ. Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study. *Lancet*. 2020;396(10255):898–908. Epub 2020 Sep 10. doi:10.1016/S0140-6736(20)31558-0.
24. State of vaccine confidence in the EU 2018. [https://ec.europa.eu/health/sites/health/files/vaccination/docs/2018\\_vaccine\\_confidence\\_en.pdf](https://ec.europa.eu/health/sites/health/files/vaccination/docs/2018_vaccine_confidence_en.pdf).
25. Hadjipanayis A, van Ezzo D, Del Torso S, Dornbusch HJ, Michailidou K, Minicuci N, Pancheva R, Mujkic A, Geitmann K, Syridou G, et al. Vaccine confidence among parents: large scale study in eighteen European countries. *Vaccine*. 2020;38(6):1505–12. Epub 2019 Dec 14. PMID: 31848051. doi:10.1016/j.vaccine.2019.11.068.
26. Pavlopoulou ID, Michail KA, Samoli E, Tsiftis G, Tsoumakas K. Immunization coverage and predictive factors for complete and age-appropriate vaccination among preschoolers in Athens, Greece: a cross-sectional study. *BMC Public Health*. 2013;13:908. PMID: 24083352; PMCID: PMC3850659. doi:10.1186/1471-2458-13-908.
27. Giambi C, Fabiani M, D’Ancona F, Ferrara L, Fiacchini D, Gallo T, Martinelli D, Pascucci MG, Prato R, Filia A, et al. Parental vaccine hesitancy in Italy – results from a national survey. *Vaccine*. 2018;36(6):779–87. Epub 2018 Jan 8. PMID: 29325822. doi:10.1016/j.vaccine.2017.12.074.
28. Mammas IN, Theodoridou M, Koutsaftiki C, Bertsiass G, Sourvinos G, Spandidos DA. Vaccination against human papillomavirus in relation to financial crisis: the “evaluation and education of Greek female adolescents on human papillomaviruses’ prevention strategies” ELEFThERIA study. *J Pediatr Adolesc Gynecol*. 2016;29(4):362–66. Epub 2015 Dec 24. PMID: 26724746. doi:10.1016/j.jpap.2015.12.007.
29. Markowitz LE, Gee J, Chesson H, Stokley S. Ten years of human papillomavirus vaccination in the United States. *Acad Pediatr*. 2018;18(2):S3–S10. PMID: 29502635. doi:10.1016/j.acap.2017.09.014.
30. The World Bank Data. Urban population (% of total population) – Greece. <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=GR>.