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RESEARCH PAPER

Meningococcal serogroup B vaccine: Knowledge and acceptability among parents in Italy

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ABSTRACT

This study aimed to evaluate the knowledge and attitudes about Meningococcal meningitis B and the relative vaccine for children among a sample of parents in Italy. A cross-sectional investigation was conducted from October to December 2015 among a sample of 910 parents in the geographic area of Naples and Salerno (Italy). In total, 543 of 910 parents returned a completed questionnaire for a response rate of 59.7%. Almost all parents had heard about meningitis (95.8%), 79.8% of these knew the mode of transmission (through respiratory droplets) and 62.5% knew the susceptible population (infants, children and adolescents). Moreover, a large percentage (86%) knew that the vaccine is a preventive measure. Parents who were married, those who had one child, those who did not have information about the MenB vaccine by physicians and those who needed additional information about the MenB vaccine were more likely to know the vaccine as a preventive measure of meningitis. Regarding attitudes toward the MenB vaccine, approximately two thirds of parents considered the vaccine useful (67.2%) and said that they would vaccinate their children (64.1%). Parents who had administered at least one recommended vaccination to their children, those who considered the vaccine useful, those with need for additional information about the vaccine and those who knew that the vaccine was a preventive measure of meningitis were more likely to have a positive attitude to vaccinating their children. Considering the results of our study, it looks appropriate that the knowledge of the population about meningitis and its related vaccinations is improved through correct health education and effective vaccine strategies that are implemented by policy makers.

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Introduction

Meningococcal meningitis is a bacterial infection of the meninges which occurs mainly in children under 1 y and adolescents. It frequently causes serious physical disability or can be fatal if untreated.[1-3] In Europe and in the United States, the majority of cases of meningitis are caused by meningococcus B and C and the introduction of a vaccination against the meningococcus C has significantly reduced the number of cases reported due to this serogroup.[4-8] However, in Italy a progressive and alarming reduction of the vaccination coverage rates for the children up to 2 y of age involving both mandatory and recommended vaccines has been observed in the last years.[9]

The European Medicines Agency has authorized from January 2013 the placing of a new vaccine against meningococcus B and in Italy it is provided free only in a few geographic regions.[10] In particular, it is recommended for infants aged 3 to 5 months to whom 3 doses of vaccine with a booster dose should be administered and for children not previously vaccinated between 2 and 10 y and in adolescents with age >11 y to whom 2 doses should be administered.[10,11] Recently the Italian Immunization Prevention Plan 2017–2019 introduced the vaccine against meningococcus B in the vaccination schedule for infants, recommending the administration of the first 3 doses in the first year of life with a fourth booster dose in the thirteenth month of age.[9]

Also for the meningococcal serogroup B (MenB) vaccine, a determining factor for the effectiveness of vaccination programs is constituted by the knowledge of the disease and the attitude of parents to vaccinate their children. Indeed, numerous studies in different countries have investigated the knowledge of Meningococcal meningitis and the acceptability of the MenB vaccine among parents and adolescents,[12-16] but specifically in Italy, the studies conducted on this issue are very limited.[17] Understanding the behaviors of parents is essential and a priority to implement and improve the immunization programs and to effectively prevent infectious diseases and mortality in children.

Therefore, this survey had 2 main objectives. The first was to evaluate the level of knowledge and the attitudes regarding meningococcal meningitis B and the relative vaccine for children among a sample of parents in Italy and the second objective was to investigate the different factors associated to these outcomes of interest.

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Table 1. Main socio-demographic characteristics of the parents.

	Total n = 543	
	n	%
Respondents		
Mothers	444	82
Fathers	99	18
Age (years)	40.8 ± 5.9(23–60)*	
≤ 35	107	20
36–46	347	64
≥ 47	89	16
Marital status		
Married	477	87.8
Others	66	12.2
Nationality		
Italy	527	97
Others	16	3
Employment status		
Unemployed /Housewife	232	42.7
Employed	311	57.3
At least one parent who is a health care professional		
No	526	96.8
Yes	17	3.2
Educational level		
Middle school or lower	181	33.5
High school	209	38.5
Baccalaureate degree/Graduate degree	153	28
Number of children		
1	127	23.4
≥ 2	416	76.6

*Mean ± standard deviaton(range)

Results

Parents' characteristics

In total, 543 of 910 parents returned a completed questionnaire for a response rate of 59.7%. Internal consistency reliability assessed using Cronbach's α was 0.83. The characteristics of the participants are shown in Table 1. Approximately two-thirds of the respondents were mothers (82%), 87.8% of the sample were married, almost all were of Italian nationality and the average age was 40.8 y. Furthermore, one third had completed high school education (38.5%), more than half of parents were employed (57.3%), and only 3.2% were a health care professional.

Parents' knowledge and attitudes

Regarding levels of knowledge, almost all of the parents had heard about meningitis (95.8%), 79.8% of these knew the mode of transmission (through respiratory droplets) and 62.5% knew the susceptible population (infants, children and adolescents). In addition, a large percentage (86%) knew that the vaccine is a preventive measure, but only 10.9% and 14.6% of respondents knew respectively that antibiotics and avoidance of crowded places may be effective preventive measures. 71.4% of parents knew that the MenB vaccine is available in Italy (Table 2).

The results of the multiple logistic regression analysis, shown in Table 3, reveal that 5 variables were significantly associated with the knowledge that the vaccine is a preventive measure of meningitis (Model 1). Parents who were married (OR = 2.45; CI 95% = 1.11–5.44), those who had one child (OR = 2.82; CI 95% = 1.32–6.01), and those who felt the need for additional information about the MenB vaccine (OR = 2.41; CI 95% = 1.31–4.44) were more likely to know that the vaccine is preventive measure of meningitis. Moreover, the odds of this knowledge were lower among those with a middle school or lower education level (OR = 0.31; 95% CI = 0.18–0.52) compared with the parents with a baccalaureate degree/graduate degree and among parents who had received information about the MenB vaccine by physicians (OR = 0.99; CI 95% = 0.98–0.99).

The results concerning the respondents' attitudes toward meningitis showed that almost all parents (96.5%) agreed that meningitis is a serious disease, and 93.3% of respondents agreed that meningitis is a preventable disease. More than half of the respondents (59.5%) perceived their child/children as having a risk of contracting the meningitis with an overall mean value of 6.5 out of a maximum score of 10 and a perceived risk value of 10 for 23% of parents. The logistic regression analysis revealed that 4 independent variables have an influence on the respondents' perceived risk for their child/children in contracting meningitis. In particular, parents who had more than one child (OR = 0.4; 95% CI = 0.26–0.61), those who were married (OR = 2.17; 95% CI = 1.25–3.76), those with a high school (OR = 2.36; 95% CI = 1.5–3.71) and middle school or lower educational level (OR = 1.77; 95% CI = 1.09–2.88) compared with those who had a baccalaureate degree/graduate degree were more likely to perceive the risk for their child/children in contracting meningitis (Model 2 in Table 3).

With reference to the attitudes toward the MenB vaccine, approximately two thirds of parents considered the vaccine useful (67.2%) and would vaccinate their children (64.1%). The results of multivariate logistic regression analysis has shown that parents who had administered at least one recommended vaccination to their child/children (OR = 31.5; CI 95% = 11.3–87.9), those who considered the vaccine useful (OR = 33.5; CI 95% = 13.6–82.9), those who felt a need for additional information about the vaccine (OR = 3.75; CI 95% = 2.01–6.99) and those who knew that the vaccine was a preventive measures of meningitis (OR = 1.96; CI 95% = 1.03–3.73) were more

Table 2. Respondents' knowledge about meningococcal disease and the relative vaccination.

	N	%
Have heard about meningococcal meningitis[a]	520	95.8
	Correct response	
Knowledge of modes of transmission of meningitis[b]		
Through droplets of respiratory (true)	415	79.8
Through insects (false)	413	79.5
Through foods (false)	406	78.1
Knowledge of preventive measures of meningitis[b]		
Vaccine	447	86
Avoid crowed place	76	14.6
Antibiotics	57	10.9
Knowledge about the availability of MenB vaccine in Italy[b]	371	71.4

[a]All sample (n = 543)
[b]Only for those who reported that they have heard about meningococcal meningitis

Table 3. Multivariate logistic regression analyses indicating associations between several variables and the outcomes regarding Meningococcal meningitis and MenB vaccine.

Variable	OR	SE	95% CI	p value
Model 1. Knowledge that the vaccine is a preventive measure of meningitis (sample size = 520)				
Log likelihood = -180.27, $\chi 2 = 61.34$ (6df), p<0.0001				
Number of children				
One children	2.82	1.09	1.32–6.01	0.007
Educational level				
College degree or higher*	1*			
Middle school or lower	0.37	0.13	0.18–0.74	0.005
High school	1.49	0.58	0.69–3.22	0.305
Physicians as source of information about MenB vaccine	0.99	0.001	0.98–0.99	<0.001
Need for additional information about MenB vaccine	2.41	0.75	1.31–4.44	0.005
Marital status	2.45	0.99	1.11–5.44	0.028
Variable	OR	SE	95% CI	p value
Model 2. Parents' perceived risk for their children in contracting meningitis (sample size = 543)				
Log likelihood = -345.59, $\chi 2 = 41.91$ (6df), p<0.0001				
Number of children				
One children	0.4	0.09	0.26–0.61	<0.001
Educational level				
College degree or higher*	1*			
High school	2.36	0.54	1.5–3.71	<0.001
Middle school or lower	1.77	0.44	1.09–2.88	0.02
Marital status	2.17	0.61	1.25–3.76	0.006
Knowledge that the vaccine is a preventive measure of meningitis	1.33	0.26	0.91–1.96	0.145
Physician as source of information about MenB vaccine	0.99	0.01	0.99–1.01	0.328
Variable	OR	SE	95% CI	p value
Model 3. Positive attitude of parents to vaccinating their children with the MenB vaccine (sample size = 543)				
Log likelihood = -215.92, $\chi 2 = 277.22$ (9df), p<0.0001				
Having immunized their child/children with at least one recommended vaccination	31.5	16.5	11.3–87.9	<0.001
Parent's attitude toward the utility of MenB vaccine	33.5	15.5	13.6–82.9	<0.001
Need for additional information about MenB vaccine	3.75	1.19	2.01–6.99	<0.001
Educational level				
College degree or higher*	1*			
Middle school or lower	0.47	0.15	0.25–0.89	0.021
High school	0.63	0.2	0.35–1.14	0.126
Knowledge that the vaccine is a preventive measure of meningitis	1.96	0.64	1.03–3.73	0.039
At least one parent who is a health care professional	0.33	0.22	0.88 -1.22	0.096
Physician as source of information about MenB vaccine	0.10	0.00	0.99–1.00	0.170
Number of children				
One children	0.69	0.21	0.39–1.24	0.221
Variable	OR	SE	95% CI	p value
Model 4. Having immunized their children with all recommended vaccination (sample size = 543)				
Log likelihood = -358.64, $\chi 2 = 32.38$ (4df), p<0.0001				
Number of children				
One children	0.4	0.89	0.26–0.62	<0.001
Educational level				
College degree or higher*	1*			
Middle school or lower	0.5	0.11	0.32–0.79	0.003
High school	0.67	0.15	0.43–1.03	0.067
Marital status	0.58	0.16	0.34–1.01	0.053

*Reference category

likely to have a positive attitude to vaccinate their children (Model 3 in Table 3). Lastly, when the parents' level at baccalaureate degree/graduate degree was chosen as a reference category, middle school or lower level of education was negatively associated with the parents' willingness to vaccinate their child/children (OR = 0.47 CI 95% = 0.25–0.89).

The reasons more frequently reported regarding the positive attitude toward vaccinating their child/children were that the vaccine was useful to reduce the number of cases of meningitis (63.2%), trust in the administration of vaccinations (52.3%). However, the counsel of physicians was reported as a reason only by 25.3% of the respondents. Instead, the reasons more frequently reported by parents about not being willing to vaccinate their child/children were that the vaccine was not considered safe (45.3%), it was not recommended by their physician (27.2%), the vaccine was not considered effective (17.4%), they did not believe in the usefulness of vaccinations (12.8%) and that the vaccine was available only recently (11.8%).

Parents' behaviors

With regard to the behaviors, almost half of parents (46.2%) had immunized their child/children with all recommended vaccinations listed in the questionnaire. The results of multivariate logistic regression analysis has shown that the odds of this behavior were lower among those have only one children (OR = 0.4; 95% CI = 0.26–0.62) and among those have a middle school or lower education level (OR = 0.5; 95% CI = 0.32–0.79) compared with

the parents with a baccalaureate degree/graduate degree (Model 4 in Table 3).

In particular 83.5% of respondents had immunized their child/children against measles, mumps and rubella, and 53.8% and 47.3% of parents had respectively immunized their children with pneumococcal and MenC vaccines.

Sources of knowledge

34.8% of parents reported receiving information about the MenB vaccine. Among these respondents, 71.7% received information from physicians. Other sources were in order TV/papers/magazine (36.4%), the internet (35.9%) and family or friends (22.6%). More than two-thirds of the parents (78%) reported that they felt the need to receive additional information about the vaccine, and among these 85% and 45.9% of parents would like more information by pediatricians and general practitioners respectively.

Discussion

The present survey aimed to evaluate the level of knowledge and the acceptability of the MenB vaccine among a sample of parents in Italy. An interesting finding is that a large proportion of parents had heard about meningococcal meningitis and considered the vaccine very useful. This knowledge is very important and an excellent starting point for planning public health action to take the vaccination coverage rates against meningococcal B at optimal levels.

In our study almost all parents agreed that meningitis is a serious disease and the majority perceived their child/children as having a risk of contracting meningitis. Similar results were found in a study conducted in Canada where almost all parents considered meningitis a serious disease and 65% were worried about their child/children's susceptibility to contract meningitis.[12]

Another important observation was that almost two-thirds of our sample (64.1%) had a positive attitude toward vaccinating their child/children with the MenB vaccine. This result can be compared with those of other studies reported in the literature even though they were performed with different samples and methodologies. This finding was similar to the results of 2 studies conducted in France where 52.8% and 54% of the parents were favorable to vaccinating their children,[1315] and to a survey performed in Italy where 64.4% of parents had a positive attitude to vaccinating their child/children.[17] Furthermore, higher rates of acceptability of the vaccine among parents have been reported in a study already cited conducted in Canada (93%),[12] in Australia (85.2%),[14] and in the United Kingdom (84%).[16]

The main important reasons reported more frequently regarding the positive attitude toward willingness to vaccinate their child/children were that the vaccine was effective against Meningococcal and the parents' trust in vaccinations. Although the main reasons stated for non-acceptance of the vaccination were that it was not considered safe and effective not believing in the usefulness of vaccinations and that the vaccine was available only recently. These reasons given by parents were also found among the reasons listed for accepting or not accepting vaccination against Meningococcal serogroup B in the studies already cited,[12,1315] and also among the reasons cited by parents for accepting or not accepting other vaccinations.[18-21]

In our sample, a low proportion of parents had immunized their children with the list of recommended vaccines, particularly with pneumococcal and MenC vaccines. These findings can be explained by the fact that the knowledge of the public related to vaccination of preventable diseases, in particular regarding meningitis, is still very inadequate and that public vaccination strategies, that aim at achieving a higher vaccine coverage, are not fully effective.

Different factors in our study were significantly associated, at multivariate regression analysis, with parents' knowledge and acceptability regarding the MenB vaccine: in particular educational level and having administered at least one recommended vaccination were associated to the acceptability of vaccines. Indeed, the role of these factors on the parents' willingness to immunize their child/children is also confirmed by previous surveys.[14-17] Moreover, a strongly associated predictor of the attitude of parents toward willingness to vaccinate their child/children with the MenB vaccine in our study was the positive attitude toward the effectiveness of the MenB vaccine. This association has also been found in several studies that investigated the factors associated with the parent's acceptability of vaccination for their children, although with different aims.[22-24] Moreover, in Italy a study conducted among parents has confirmed the results of our investigation regarding the association between the positive attitude of parents toward vaccinating their children and the perceived benefits and the need of additional information about the vaccination.[25]

The multivariate regression analysis showed that the higher educational level was a strongly associated factor of the knowledge that the vaccine is a preventive measure of meningitis. Similar results were found in 2 previous studies performed in Italy where the parents with a higher education were more likely to know the vaccinations.[25,26] In contrast, the results of our study showed that health care providers might not be the best source of information for parents since the parents' knowledge of the vaccine was negatively influenced by the information provided by physicians.

This result shows how important it is that parents are successfully informed by health care workers on the safety and effectiveness of all vaccinations to increase awareness of their effectiveness and consequently increase vaccination coverage rates.

Almost half of the parents of the sample had vaccinated their children with all recommended vaccinations and an interesting result of logistic regression analysis was that parents with a more high level of education were more likely to have this appropriate behavior. The positive impact of a higher educational level of parents on children's vaccination status has been confirmed also by other studies.[27-29] This survey has several limitations due to the study design. The first is that, since this is a cross-sectional study, it is not possible to establish the causal and temporal direction of association between the outcomes of interest and the predictors. The second is that respondents may be influenced in giving the answers by the most appropriate defined attitudes, and this could be overestimating the positive attitudes toward the willingness to vaccinate their child/children. To contain this limitation the questionnaire was self-administered and anonymous

and the confidentiality of responses was ensured. Thirdly, since we had asked parents to indicate the previous children's vaccinations, a recall bias may have occurred that could lead to underestimate or overestimate the vaccination status of children. Moreover a possible non-response bias must be considered, while it can be assumed that the characteristics of respondents and non-respondents are similar because they are equally distributed on the basis of age of the children selected in each school. Finally, since the questionnaire was delivered at home, some parents could have informed themselves better on the topic of this survey before responding to the questionnaire. Despite these limitations, the sample size was appropriate with a high response rate and the findings of this survey have provided additional important information on parents' knowledge and attitudes regarding the MenB vaccine in Italy.

In conclusion, considering the results of this study, it looks appropriate that the knowledge of the public about meningitis and its related vaccinations is improved through correct health education, and it is important that effective vaccine strategies are implemented by policy makers, particularly considering the high proportion of parents who have expressed a willingness to vaccinate their children and the need to have additional information regarding the vaccination. In view of this, the counseling of physicians is a key factor for decision making regarding vaccination and therefore further studies are needed to understand the attitudes and behaviors of physicians regarding vaccination practices.

Material and methods

This cross-sectional investigation was conducted from October to December 2015 among 910 parents of children between 5 and 13 y of age in the geographic area of Naples and Salerno (Italy). The parents were selected through 2-stage cluster sampling. In the first stage primary and middle schools were selected from the list of public schools in the geographic area. In the second stage, the parents of children were recruited from each selected school through a simple random sampling.

The sample size, determined before study initiation, was calculated assuming that 65% of the respondents would have a positive attitude to vaccinate their children against MenB, an error of 5%, and a confidence level of 95%. Considering a response rate of 60%, the sample was increased to a total of 910 parents.

Before starting the study, the Heads of each school were contacted and approval to conduct the survey was requested. Data for the study was collected by self-administered anonymous structured questionnaire that was built ad hoc for the present survey. The questionnaires were delivered to children in sealed envelopes by trained research assistants and it was requested that they were taken home to parents. In the envelope there was also a letter, an informed consent form and another envelope to facilitate the return of the completed questionnaire. Within the letter the purpose of the study was clarified, it was stated that participation was strictly voluntary and that the data collected would not be used for anything other except the research aim. It was asked that only one of the parents fill out the questionnaire. If the questionnaire was not returned in the prescribed time, the research team made a reminder phone calls to the head teacher to increase the response rate.

The questionnaire was used to explore several topics: 1) parental characteristics, including age, marital status, employment status, educational level, nationality, number of children; 2) knowledge about meningitis (definition, modes of transmission, susceptible population), preventive measures (vaccine, antibiotics), and availability of MenB vaccine; 3) parent's attitudes regarding the risk for their child/children of contracting meningitis, utility of MenB vaccine and positive attitude toward vaccinating their child/children; 4) parents' behaviors related to the immunization of their children with obligatory and/or recommended vaccinations; 5) sources and need of information regarding meningitis and the MenB vaccine.

For the questions regarding knowledge, participants were asked to provide answers with options "no," "do not know" and "yes" with various choices. Parents' attitudes regarding the risk for their child/children of contracting meningitis were measured on a 10-point Likert scale with a score ranging from 1 (not at all worried) to 10 (very worried). Parents' attitudes regarding the utility of the MenB vaccine were measured on a 10-point Likert scale with a score ranging from 1 (useless) to 10 (very useful). The positive attitude of parents with a willingness to vaccinate their child/children was measured with a question which required a "no" or "yes" response. The respondents were also asked to report direct reasons for their willingness or unwillingness to administer the MenB vaccine to their child/children. Questions pertaining to behaviors were close-ended with nominal or categorical (yes or no) responses.

A pilot study on 40 parents was performed to evaluate the validity of the questionnaire, the comprehensibility of the wording of each question and the filling's length. Following, the changes to improve the clarity of the questions were incorporated into the survey form and the respondents of the pilot study were not included in the final sample. The internal reliability was estimated through Cronbach's α.[30] Approval of this survey was obtained by the Ethics Committee of the University of Campania "Luigi Vanvitelli" after examining the study protocol and the questionnaire.

Statistical analysis

The results of descriptive analysis are reported as frequencies and percentages. Moreover, we have performed multivariable logistic models using a forward stepwise procedure to assess the independent predictors of the following outcomes of interest: knowledge that the vaccine is a preventive measure of meningitis compared with non-knowledge (non-knowledge = 0; knowledge = 1) (Model 1), parents' perceived risk for their children to contract meningitis compared with non-perceived risk (non-perceived risk = 0; perceived risk = 1) (Model 2), positive attitude of parents to vaccinating their child/children with the MenB vaccine compared with non-positive attitude (non-positive attitude = 0; positive attitude = 1) (Model 3) and having immunized their children with all recommended vaccination (no = 0; yes = 1) (Model 4). The following explanatory variables were included in all models: parent (mother = 0; father = 1), age (continuous, in years), marital status (others = 0; married = 1), at least one parent who is a health care professional (no = 0; yes = 1), parents' educational level (3 categories: middle school or lower = 1; high school = 2; Baccalaureate degree/Graduate degree = 3), number

of children (≥ 2 = 0; 1 = 1), physician as source of information about the MenB vaccine (no = 0; yes = 1) and need for additional information about vaccine (no = 0; yes = 1). Also, the knowledge that the vaccine is a preventive measures of meningitis (no = 0 yes = 1) was included in Models 2 and 3. Moreover, perceived risk by respondents for their child/children to contract meningitis (< 10 = 0; 10 = 1), parents' attitude toward the utility of the MenB vaccine (< 10 = 0; 10 = 1), agreeing that meningitis is a serious and preventable disease (agree = 0; uncertain/disagree = 1) and having immunized the child/children with other recommended vaccinations (none = 0; at least one = 1) were included in Model 3.

The results of the logistic regression analysis are expressed as odds ratios (ORs) and 95% confidence intervals (CIs). The significance level for variables entering and removing in the logistic regression models was set respectively at 0.2 and 0.4. All reported *p*-values were assessed using 2-sided tests with statistical significance of *p*-value of ≤0.05. The statistical package Stata 10 was used to carry out the analysis.[31]

Disclosure of potential conflicts of interest

The authors report no conflict of interest.

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