

ORIGINAL ARTICLE

Impact assessment of an education course on vaccinations in a population of pregnant women: a pilot study

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Keywords

Vaccine • Pregnancy • Hesitancy • Education

Summary

Introduction. Although the benefits of vaccinations have been extensively demonstrated, vaccination coverage remains unsatisfactory as result of many people's poor knowledge and negative perception of vaccination.

We evaluated the impact of an education course on vaccinations in a population of pregnant women.

Methods. A total of 214 pregnant women were invited to participate in this project, which was undertaken at the Obstetrics and Gynaecology Department of Careggi University Hospital in Florence (Italy). Anonymous questionnaires were administered to women before and after the intervention.

A descriptive and statistical analysis was carried out in order to compare the responses obtained before and after the intervention.

Results. Adherence to the initiative was good (98%): initially, the respondents were not hostile to vaccinations, though many (43%) were poorly or insufficiently informed. The educational intervention had a positive impact. After the intervention, the number of women who rated their level of knowledge of vaccinations as poor or insufficient had decreased by 30% and the number of "hesitant" respondents had decreased with respect to all aspects of the study, especially the decision to be vaccinated during pregnancy.

Conclusions. Hesitancy stems from a lack of accurate information. Healthcare professionals need to improve their communication skills. Appropriate education during pregnancy, when women are more receptive, may have a highly positive impact. These observations need to be considered in the planning of courses to prepare pregnant women for delivery also in other maternal-foetal centres in Italy.

Introduction

The introduction of vaccination into clinical practice has significantly helped to reduce infectious diseases. However, paradoxically, vaccinations have become "victims of their own success". Indeed, following the disappearance of infectious diseases as a result of the effectiveness of immunization programmes, attention has turned to rare side-effects, which have been blown up and distorted to create alarming news bereft of any scientific validity. Today, these attitudes and fears are amplified through the web in an uncontrolled way [1, 2]. The unavoidable result has been a gradual decline in vaccination coverage for some infectious diseases that were under control for many years [3].

Nowadays, it is common to find (not only on the web) information with little or no scientific basis. Such information is usually in contrast with the principles of vaccinology. This misinformation has led to mistrust and scepticism towards vaccination, which demonstrates that the media play a key role in channelling health-related information and affect parents' decisions about having their children vaccinated. Health authorities should therefore broadcast evidence-based preventive medicine messages through the media [4, 5].

"Vaccine hesitancy" is defined as delayed administration or refusal of vaccination, despite the availability of vaccination services and effective vaccines [6-8].

The WHO Strategic Advisory Group of Experts (SAGE) on Immunization has demonstrated the negative impact that "vaccine hesitancy" has on achieving pre-established targets, which are mainly measured in terms of vaccination coverage [9]. In order to recognize, monitor and correctly address vaccine hesitancy, and to promptly respond to anti-vaccination lobbies in the case of misinformation, it is important to develop institutional procedures and health policy acts - such as those recently introduced in Italy - that impose mandatory vaccination for infants as a prerequisite to school attendance [10]. However, these strategies must be combined with correct information campaigns that have solid scientific foundations.

Pregnant women are particularly interested in obtaining information regarding the health of the unborn, and the prevention of infectious disease by means vaccines is of particular interest to them.

Two vaccinations are recommended during pregnancy: one against pertussis (with combined vaccines including diphtheria and tetanus - TDPa) and the other against influenza, in the case of pregnancy during the flu season. These two vaccinations are safe and protect the mother

(influenza vaccine) and her baby in the first six months after birth (TDPa) [11, 12]. All major scientific societies recommend these vaccinations during pregnancy [13-17]. Both during pregnancy and after the birth, the territorial healthcare service accompanies the expectant mother / couple from conception through the first year of life of the child, providing support and ensuring the continuity of care; information to encourage vaccination can be provided in this context, since health promotion interventions conducted “around” the time of birth are internationally recognized to be among the best in terms of efficiency and effectiveness.

The aims of the current pilot study were: to evaluate pregnant women’s knowledge of and attitudes towards vaccination, their sources of information on vaccination, and the impact of an educational intervention carried out by experts on vaccination.

Methods

The study was approved by the Ethics Committee of the University of Florence.

Pregnant women at different gestational ages, who were referred to the Obstetrics and Gynaecology Department at the University of Florence from October 2017 to May 2018 in order to attend either childbirth preparation courses or prenatal diagnostic counselling on congenital defects, were invited to participate in the study.

Participants gave their informed consent to participate in the study. Each participant agreed to:

- fill in a “pre-intervention” questionnaire (supplementary file 1);
- listen to an informative and educational intervention on the prevention of infectious diseases carried out by highly qualified doctors of the Department of Health Sciences of the University of Florence;
- fill in a “post-intervention” questionnaire (supplementary file 2).

The “pre-intervention” questionnaire consisted of two sections. The first concerned the woman’s knowledge of and attitudes toward vaccinations and, in detail, the Italian vaccination schedule [10, 18]. The second section included personal information (age, country of origin and educational qualification).

The “post-intervention” questionnaire was identical to the “pre-intervention” one, except for those items (e.g. personal information) which could not be influenced by the intervention.

The 30-minute interventions on vaccine prevention were conducted by experts on vaccinations. The interventions were supported by the use of a set of slides, the paper version of which was then distributed to each participant. The topics covered were: what a vaccine is; how a vaccine works; the “herd immunity” effect; vaccine contraindications and risks; the National Plan for Vaccine Prevention (PNPV) 2017–2019 (explained in detail); the success of vaccines; recent epidemics; false myths; vaccines during pregnancy; the law on obligatory vaccinations; and advice on how to obtain correct information.

A descriptive analysis of the sample was carried out in terms of the participants’ socio-demographic characteristics, obstetric history, previous vaccination experience and sources of information. With regard to questions on the level of concern about infectious diseases, we dichotomized answers into two levels: no/low/moderate concern vs high/very high concern.

A statistical analysis of paired data was performed by means of Stata 12, and was applied only to those questionnaires filled in on both occasions (pre- and post-test). We evaluated the impact of the educational intervention on two sets of questions: the first contained questions on the women’s intention to be vaccinated during pregnancy and to have their children vaccinated, and their opinion of mandatory vaccinations; the second included questions that investigated their opinion of the most frequent fake news about vaccines. To do this, we first assigned a variable score to each answer: “0” to answers against vaccines; “1” to neutral/hesitant answers; “3” to answers in favour of vaccines. The variable score “2” is not expected. We then inserted the scores of the individual replies into each of the two above-mentioned sets of questions in the pre- and post-questionnaires. We calculated the average of the pre- and post-scores for these two sets of questions and, to conclude, we performed a paired-sample t-Test to compare the two averages; subjects who answered only one of the two questionnaires were excluded from the analysis.

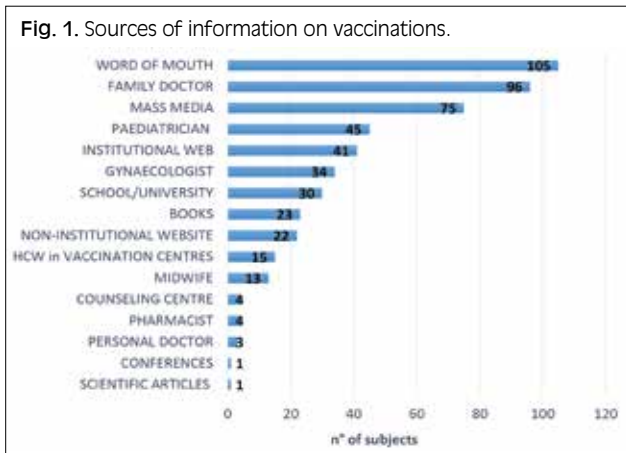
Results

Of the 214 pregnant women invited to participate in the survey, 210 (98%) accepted and signed the informed consent form: 201 (96%) of these completed both pre- and post-questionnaires.

The sample consisted of 198 Italian women (94%) and 12 foreign women (6%). The average age of the participants was 34 years. Educational qualifications were specified by 163 women: 73 (45%) were graduates; 50 (31%) had a high school diploma; 29 (17%) had obtained post-graduate qualifications; 7 (4%) had a professional diploma; 3 (2%) a middle-school diploma; and 1 (1%) an elementary school diploma.

The questions regarding previous vaccination experiences and sources of information on vaccinations showed that 60 women (29%) knew which vaccinations they had had during their lifetime. Of the women who had already had children (44), 36 (82%) reported that their children had had all the vaccinations proposed, while eight stated that their children had only had some of these vaccinations.

The most common sources of information were word of mouth (friends, family, etc.) (50%), the family doctor (45.7%), and the traditional mass media (TV, radio, newspapers) (35.7%). Paediatricians and gynaecologists were sources of information in 21.4% and 16.2% of cases, respectively. Moreover, 19.5% of the participants consulted institutional websites to retrieve information on vaccinations (Fig. 1).



During the pre-intervention phase, the quality of the information received from health professionals was judged to be excellent (9%), good (31%), sufficient (31%), insufficient (17%), and scarce (11%).

The results of the educational intervention in terms of knowledge of the recommended/mandatory paediatric vaccinations are shown in Table I.

Table II reports the pre- and post-intervention percentages of women with the highest level of fear of vaccine-preventable diseases.

Table III reports the pre- and post-intervention answers to questions on the women's intention to have their neonates vaccinated and to receive the recommended vaccination during pregnancy, and on their opinion of mandatory vaccination.

The percentage of pregnant women who disagreed with the introduction of mandatory vaccinations for school

Tab. I. Pre- and post-intervention knowledge of recommended/mandatory paediatric vaccinations.

Vaccination	Pre (%) N = 210	Post (%) N = 201	Post – Pre %
Diphtheria	103 (49)	179 (89)	+ 40
Tetanus	151 (72)	179 (89)	+ 17
Pertussis	142 (68)	180 (90)	+ 22
Poliomyelitis	116 (55)	157 (78)	+ 23
Hib	30 (14)	154 (77)	+ 63
Hepatitis B	99 (47)	174 (87)	+ 40
Hepatitis A	57 (27)	26 (13)	- 14
Measles	163 (78)	181 (90)	+ 12
Rubella	145 (69)	165 (82)	+ 13
Mumps	102 (49)	148 (74)	+ 25
Varicella	115 (55)	147 (73)	+ 18
Men B	98 (47)	150 (75)	+ 28
Men C	103 (49)	141 (70)	+ 21
Pneumococcus	58 (28)	123 (61)	+ 33
HPV	13 (6)	57 (28)	+ 22
Influenza	15 (7)	40 (20)	+ 13
Tuberculosis	35 (17)	24 (12)	- 5
Rotavirus	29 (14)	127 (63)	+ 49

The recommended/mandatory paediatric vaccinations according to Italian Vaccine Prevention Plan 2017-2019 are reported in bold.

Tab. II. Percentage of women highly concerned about vaccine-preventable diseases before and after the educational intervention.

Disease	High concern (%)	
	Pre N = 210	Post N = 201
Diphtheria	23	38
Tetanus	37	42
Pertussis	39	50
Poliomyelitis	37	40
Hepatitis B	43	47
Measles	32	47
Rubella	26	36
Mumps	20	36
Varicella	23	33
Hib meningitis	63	62
Men C meningitis	68	69
Men B meningitis	67	68
Pneumococcus meningitis	61	63
Rotavirus	21	29

attendance was not changed significantly by the educational intervention; however, the percentage of hesitant future mothers decreased from 19% to 9% (Tab. III).

The average score on the items concerning the women's intention to be vaccinated during pregnancy and to have their children vaccinated was 35.46 (95% CI 33.62-37.30) and 42.57 (95% CI 41.31-43.82) after the intervention. The paired-sample t-Test showed significant differences between the mean pre-intervention and post-intervention scores ($t = 7.36$, $p < 0.001$).

The participants' self-assessment of their level of knowledge of vaccinations changed significantly with the educational intervention, as shown by the reduction (from 43% to 13%) in answers indicating a low level of knowledge (poor/insufficient level).

Table IV shows the effectiveness of the educational intervention in modifying attitudes towards some of the most frequent fake news regarding vaccination. The average score on the questions that investigated the women's opinion of the most frequent fake news about vaccines was 17.45 before the intervention (95%CI 16.51-18.39) and 22.47 (95%CI 21.63-23.32) after the intervention. The paired-sample t-Test showed a significant difference between the two averages ($t = 10.61$, $p < 0.001$).

Discussion

This study yielded information on pregnant women's knowledge about vaccination preventable infectious diseases and their attitude towards vaccinations. Moreover, it provided a measure of the impact and the effectiveness of an educational intervention held by health personnel. Indeed, this survey was conducted by administering pre- and post-intervention questionnaires. Questionnaires filled in before and after the educational intervention were subjected to a comparative assessment of the same answers.

Tab. III. Pre- and post-intervention answers concerning the intention to vaccinate the future neonate, to receive the recommended vaccinations during pregnancy and opinions on mandatory vaccination.

	Yes n° (%)		No n° (%)		Don't know n° (%)		No Response n° (%)	
	Pre N = 210	Post N = 201	Pre N = 210	Post N = 201	Pre N = 210	Post N = 201	Pre N = 210	Post N = 201
For which of the following diseases do you want to have your child vaccinated?								
Diphtheria	139 (66)	177 (88)	4 (2)	3 (1.5)	50 (24)	14 (7)	17(8)	7 (3.5)
Tetanus	163 (78)	184 (92)	2 (1)	2 (1)	29 (14)	9 (4)	16 (7.6)	6 (3)
Pertussis	146 (70)	183 (91)	7 (3)	1 (0.5)	40 (19)	11 (5)	17 (8)	6 (3)
Hepatitis B	160 (76)	187 (93)	1 (0.5)	0 (0)	33 (16)	7 (3)	16 (7.6)	7 (3.5)
Hib	110 (52)	174 (87)	12 (6)	2 (1)	71 (34)	17 (8)	17 (8)	8 (4)
Poliomyelitis	152 (72)	171 (85)	3 (1)	4 (2)	39 (19)	20 (10)	16 (7.6)	6 (3)
Measles	146 (70)	180 (90)	8 (4)	2 (1)	39 (19)	14 (7)	17 (8)	7 (3.5)
Mumps	136 (65)	174 (87)	8 (4)	1 (0.5)	48 (23)	21 (10)	18 (8.5)	7 (3.5)
Rubella	142 (68)	174 (87)	7 (3)	3 (1.5)	43 (20)	19 (9)	18 (8.5)	7 (3.5)
Varicella	134 (64)	163 (81)	14 (7)	6 (3)	44 (21)	24 (12)	18 (8.5)	8 (4)
Pneumococcus	142 (68)	178 (89)	2 (1)	2 (1)	49 (23)	14 (7)	17 (8)	7 (3.5)
Men B	155 (74)	185 (92)	1 (0.5)	0 (0)	37 (18)	11 (5)	17 (8)	5 (2.5)
Men C	162 (77)	138 (69)	1 (0.5)	12 (6)	30 (14)	44 (22)	17 (8)	7 (3.5)
Rotavirus	99 (47)	138 (69)	15 (7)	12 (6)	80 (38)	44 (22)	17 (8)	7 (3.5)
Pertussis and influenza vaccination are recommended during pregnancy. Would you be willing to be vaccinated?								
	72 (34)	130 (65)	67 (32)	33 (16)	68 (32)	37 (18)	3 (1.4)	1 (0.5)
Do you agree with the introduction of mandatory vaccines for school attendance?								
	142 (68)	160 (80)	24 (11)	21 (10)	40 (19)	19 (9)	4 (2)	1 (0.5)

Tab. IV. Attitudes of women towards the most frequent fake news about vaccinations.

	Yes		No		Don't know		No response	
	Pre*	Post°	Pre*	Post°	Pre*	Post°	Pre*	Post°
The effectiveness of the vaccines has been scientifically proven	174	190	6	5	30	4	/	2
Autism could be caused by vaccinations	25	9	92	169	90	21	3	2
The substances contained in the vaccines are dangerous for humans	24	12	118	169	68	17	/	3
Unvaccinated children are more resistant to infections	25	19	143	160	42	19	/	3
The administration of multiple vaccines at the same time may be harmful to my child's health	57	32	66	141	78	23	9	5
The side effects of the vaccines worry me	83	56	70	115	48	25	9	5
Vaccines are mainly a lucrative business for the pharmaceutical industries	34	17	111	148	56	32	9	4
I have seen / heard of severe side effects of the MPR vaccine	41	36	70	125	90	32	9	8
I have seen / heard of severe cases of measles	100	110	30	54	70	29	10	8
I prefer my child to catch measles naturally rather than to be vaccinated	15	18	142	162	44	16	9	5

Legend: Pre* = 210 women; Post° = 201 women.

Participation in the initiative was very good and “compliance” was excellent, in that the vast majority of participants answered all the questions. The level of education of the women enrolled ranged from medium to high. The most used sources of information about vaccinations were word of mouth and the mass media, while general practi-

tioners and specialists (paediatricians and gynaecologists) were rarely consulted. These results are in line with census data on parents aged between 35 and 55 years [19]. The educational intervention carried out in our project had a positive impact: after the intervention, the percentage of women who considered their level of knowledge

of vaccines to be poor or insufficient had decreased significantly.

Prejudices against vaccinations during pregnancy, due to false beliefs, emerged from the comparative assessment of questions relating to the intention to be vaccinated during pregnancy. Indeed, the percentage of women favourable to vaccinations significantly increased, underlining the effectiveness of a qualified educational approach. Furthermore, before the educational intervention, answers to the question regarding experiences of post-vaccination side-effects revealed the existence of many false beliefs about vaccines. Indeed, 32 women (15%) claimed to have had direct or indirect personal experience of one or more post-vaccination side-effects, specifically, autism, pain, meningitis, measles, malaise, swelling, fever, vomiting, drowsiness, visual disturbances, deafness, fainting, arm stiffness, adenoid problems, psychomotor deficiency, diarrhoea, poliomyelitis, fulminant leukaemia, and arm infection. In the post-intervention questionnaire, however, the reported number of personal negative experiences, direct or indirect, following the MMR vaccination was seen to have decreased. In theory, this should not have been influenced by the intervention; the higher number of experiences reported in the pre-intervention questionnaire was therefore probably due to conditioning linked to false beliefs or “fake news” rather than to real personal experiences.

The safety of vaccinations during pregnancy has been clearly demonstrated by many scientific studies worldwide. Despite this evidence, vaccination hesitancy among pregnant women is still high, and stems from a lack of accurate information, probably as a result of the use of unqualified information sources. Indeed, regarding the taboo against vaccines in pregnancy, De Martino affirms that the recommendations of healthcare providers are the keystone of vaccination uptake [20]. Moreover, a study conducted in 2016 revealed that increasing vaccination coverage against pertussis among pregnant women depends not only on recommendation by physicians, but also on educational interventions and campaigns to promote maternal immunization [21]. Indeed, in line with the literature data, the percentage of pregnant women in our study who were positively oriented toward vaccination increased after the educational intervention.

Our respondents' answers to the question concerning mandatory vaccination for school attendance confirm that providing correct information reduces maternal vaccination hesitancy, encouraging subjects to adopt a pro-vaccination stance; however, it does not significantly influence the no-vaccine position [22, 23]. These findings are in line with the results of a 2018 multi-centre study, which demonstrated that it is necessary to strengthen the quality of information and confidence in health professionals in order to increase the acceptance of mandatory vaccines and reduce vaccine hesitancy [24].

Our sample consisted of women who were generally positively oriented toward vaccinations, but whose information was deficient; these gaps were significantly

filled by the educational intervention, as was shown by the comparative evaluations of the pre- and post-intervention answers. The efficacy of our intervention is demonstrated by the fact that those women who were positively oriented toward vaccinations before the intervention did not subsequently change their position, while those who were hesitant became more confident.

Other studies have investigated knowledge and attitudes regarding vaccinations among parents of young children [25, 26] or among future parents [27]. On the basis of self-reported vaccination status, Giambi et al. classified parents in three categories: a) pro-vaccination; b) hesitant; and c) anti-vaccination. The three groups were compared in terms of attitudes, beliefs, and sources of information, in order to identify the profiles of these three categories. Vaccine safety was perceived as a concern by all parents, and more so by hesitant and anti-vaccination parents. Like pro-vaccination parents, hesitant parents considered vaccination an important preventive tool and trusted their family paediatricians, which suggests that they could benefit from appropriate communication interventions. Training health professionals and providing homogenous information on vaccinations, in line with national recommendations, are crucial, in order to respond to the concerns of these parents. It is therefore important to know the characteristics of the individual categories, as this knowledge can help to guide appropriate educational programmes. Indeed, health professionals need to identify what drives parents' decisions concerning the vaccination of their children, in order to communicate more effectively with them [28-31].

A limitation of the present study is that the timing of each questionnaire in relation to the stage of pregnancy was not recorded; this information would have allowed the researchers to evaluate the possible influence of gestational age on the respondents' replies.

Further studies will be performed in order to explore the socio-demographic characteristics of the study sample in greater depth and to evaluate the effectiveness of the intervention on specific population groups.

Conclusions

The present study not only provides an overview of the state of knowledge of future mothers, but also demonstrates that a qualified intervention is able to modify and reduce vaccine hesitancy. Educational interventions held during pregnancy, when women are more receptive, may have a highly positive impact on lifetime attitudes towards vaccination.

In order to increase the sample size and to confirm the results of this pilot study, it would be useful to involve other maternal-foetal centres in Italy, the ultimate aim being to improve the health of both women and children.

Acknowledgements

Funding sources: this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest statement

None declared.

Authors' contributions

AB, SB, DA and DP conceived and designed the study. AM, FP, GS and VS collected data. AB, SB, AM, FP carried out the educational interventions. GS and AM performed statistical analysis and interpreted results. AB, SB, PB, AM and DP participated in drafting the article or revising it critically for important intellectual content. All authors gave their final approval of the manuscript.

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■ Received on November 6, 2018. Accepted on February 20, 2019.

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