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Health Belief Model efficacy in explaining and predicting intention or uptake influenza vaccination during pregnancy

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Abstract

Introduction. The influenza vaccination is a priority during pregnancy due to infection-related-outcomes. The study aim is to assess the acceptance by women of influenza vaccination during pregnancy based on Health Belief Model (HBM).

Methods. A multicentre observational study was carried out with a convenience sample of 300 respondents.

Results. Most women (53.7%) declared that they worried to contract influenza during pregnancy and 80.7% of them agreed that there is a risk of contracting influenza during the first months of life. Vaccine benefits (adjOR 4.3 CI 95% 1.7-10.9 p <0.01), information on vaccination (adjOR 2.6 CI 95% 1.2-5.5 p <0.01) and trust in guidelines (adjOR 3.5 CI 95% 1.6-7.3 p <0.01) are some factors associated with intent/vaccination during pregnancy.

Conclusions. HBM confirms its effectiveness in explaining/predicting health behaviours. It is necessary to create trust in the vaccinations through an integrated work of health professionals to set up training programs and to provide effective health communication.

Key words

- Health Belief Model
- vaccination
- pregnancy
- health promotion

INTRODUCTION

Seasonal influenza is an acute respiratory illness that can appear with different signs and symptoms and with variable severity [1]. It is typically caused by a group of RNA viruses (A, B, C and D) and the symptoms develop after an incubation period of approximately 1-4 days (average of two days) [1]. Although chronic diseases significantly affect the European healthcare systems [2], COVID-19 pandemic has reminded us that the burden of infectious diseases can be equally severe. Influenza is an important global public health issue in terms of direct and indirect costs for the implementation of control measures and the management of cases and complications of the disease. One billion cases, 3-5 million severe cases, and 290,000-650,000 influenza-related respiratory deaths are estimated worldwide [3]. According to the Centres for Disease Control and Prevention (CDC), influenza was associated with 35 million illnesses, 16 million visits to healthcare providers, 380,000 hospitalizations and 20,000 deaths in the United States during the 2019-2020 influenza seasons [4]. The last report of ECDC showed that in the Europe, the circulation of viruses is comparable to previous seasons [5], with an influenza virus positivity in sentinel specimens below the epidemic threshold (10%) [6]. In Italy, in the 44th week of 2021, the estimated cases were about 207,000, for a total of about 573,000 cases since the start of surveillance. In this period the incidence was 0,8 cases per thousand cared with a level of incidence of influenza syndromes like illness which has been stably maintained at below the basal threshold throughout the season [7].

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The clinical manifestations of influenza in pregnancy are similar to those in the general population, ranging from fever, headaches to myalgia and malaise and often are accompanied by cough, sore throat and a runny nose [8]. Nevertheless, pregnant women have a higher risk of acute respiratory disease and of admission in intensive care unit than general population [9, 10]. This risk, in addition of risk of complications from influenza, is increased in case of chronic diseases such as cardiac and pulmonary disease, diabetes mellitus, renal disease, immunological disorder [11]. Moreover, the influenza in pregnant women may result in several adverse neonatal outcomes. A recent systematic review and meta-analysis on the effect of influenza virus infection on pregnancy outcomes showed that there was an increased risk of stillbirth, with no significant effect on preterm birth, foetal death, small for gestational age, and low birth weight [12]. Previous studies, focusing on one of different types of influenza viruses, showed, instead, that pregnant women were likely to adverse pregnancy outcomes, including preterm birth, small for gestational age, stillbirth, low birth weight and others [13-15].

Due to pregnancy and neonatal outcomes, the influenza vaccination is a priority among pregnant women. According to the position paper of the World Health Organization, pregnant women are a priority group for seasonal influenza vaccination [16]. The Global Influenza Initiative recommends the inactivated influenza vaccination to all pregnant women, regardless of trimester, in order to prevent seasonal influenza morbidity and mortality [17]. The Italian Ministry of Health in the "National Vaccination Prevention Plan" (2017) recommends the vaccine against influenza for all women who, during influenza season, are in second or third trimester [18]. This recommendation represents an indicator of the new National Prevention Plan [19]. Pregnant women should not receive a live-attenuate vaccine because some concerns about safety emerged [20]. A systematic review showed the effectiveness of influenza vaccine in pregnant women in reducing the influenza like illness and the neonatal influenza in vaccinated women, without serious adverse events [21]. Furthermore, in another systematic review and meta-analysis, pregnant women who were vaccinated for influenza had a lower risk of premature/preterm birth (<37 weeks) and of very preterm birth (<32 weeks) as compared to those women who were not vaccinated and there was no increased risk for infants [22].

An estimated 50% of pregnant women in the US protected themselves and their babies from influenza by getting an influenza vaccine [23]. In Italy, the national surveillance system on vaccination coverage regards other population groups and it is still not available for pregnant women [24]. More often, pregnant women receive the information on vaccination from healthcare professionals, who play a key role in informing the women on risk and benefits of vaccination. If there is not a good and effective health communication, the women are unaware of the benefits and may believe that influenza vaccination is contraindicated during pregnancy [25], impacting on the choice to get vaccinated. In this context, Health Belief Model (HBM) is useful to predict health choices and behaviours, based on different factors that influence the health choices and behaviours of an individual and the access to healthcare services [26]. Its effectiveness has been demonstrated in different areas [27, 28] also during pregnancy and in assessing the seasonal influenza vaccination degree of acceptance of this population [29-31].

To our knowledge, there is no Italian study on HBM effectiveness investigating the factors that influence the choice to vaccinate against influenza during pregnancy. Therefore, the aim of this study is to assess the factors that influence the acceptance by Italian pregnant women of influenza vaccination based on HBM constructs and the associated characteristics.

METHODS

Design

A multicentre observational study was carried out.

Participants and setting

All women in the 2nd and 3rd trimester of pregnancy, met at the maternal clinic of two Italian hospitals, were asked to participate in the study. The exclusion criteria were not being able to read and understand the Italian language. From October 2019 to January 2020, the convenience sample included 300 respondents and none refused to answer the questionnaire. One hundred and fifty women came from an accredited Italian private facility and another 150 from a public one. After explanation of study's purpose and methods, the women accepted to participate to the study and gave their oral informed consent. The women of the two different centres completed an anonymous self-administered questionnaire. All had the opportunity to have any further clarifications during the compilation.

Study instrument

The questionnaire, including validated items on the effectiveness of the HBM in predicting the levels of acceptance of influenza vaccination during pregnancy [29], was divided into two sections. The first included 6 socio-demographic items and 2 related to the intention to vaccinate. The second section included 8 items related to HBM constructs (*risk susceptibility, risk severity, benefits, barriers*) on influenza vaccination using a 5-point Likert scale, ranging from "1-Completely agree" to "5-Completely disagree" (Cronbach's alpha = 0.77). Other 6 items were in common with the section related to pertussis vaccination.

Authorization and privacy

The Heads of the Health Department of both hospitals authorized the administration of the anonymous questionnaire. The responders were informed and agreed to the use of anonymous data in accordance with Italian and European data protection legislation.

Data analysis

Categorical variables of greater interest were reported as frequency and percentage. The bivariate analysis allowed to assess the presence of significant asso-

ciations, leading the definition of the logistic regression model. In this way it was possible to identify predictors of vaccination or the intention to be vaccinated against influenza. Odds ratio (OR) and 95% confidence intervals (CI) were calculated. Statistical analyses were conducted using STATA v16. Significance was set at a p-value <0.05.

RESULTS

Demographic characteristics

As for the previous study on pertussis vaccination [32], the average age of the sample was 33.3 years (SD ± 6), 83.3% were Italian and 53.3% were married. About parity, 50% of women were nulliparous, the other 50% said they had 1 (37%) or 2 or more children (13%) *(Table 1)*. Of 300 women, 30% were vaccinated or planned to get vaccinated against influenza during the current pregnancy.

Table 1
Women's socio-demographic characteristics and frequencies of influenza vaccination or intention to get vaccinated

Data of participants'	N (%)
Mean age in years	33.3 (SD ± 6)
Nationality	
Italian	250 (83.3%)
Foreigner	50 (16.7)
Marital status	
Married	160 (53.3)
Unmarried	133 (44.3)
Separate/Divorced	7 (2.4)
Educational level	
University degree	143 (47,7)
Secondary school	132 (44)
Lower secondary	20 (6.7)
Primary school	5 (1.6)
Occupation situation	
Employed	201 (67)
Housewife	35 (11.7)
Unemployed	33 (11)
Student	4 (1.3)
Other	27 (9)
Parity	
Nulliparous	250 (50)
1 or ≥2	250 (50)
Influenza vaccination or intention to get vaccinated	
No	210 (70)
Yes	90 (30)

HBM and influenza vaccine

Figure 1 shows the frequency of the HBM dimensions. With regard to *risk susceptibility,* 53.7% of women declared that they worried to contract influenza during pregnancy and 80.7% of them agreed that there is a risk of contracting influenza during the first months of life. About the foetal complication following the influenza during pregnancy, 14% disagreed and 40% were unsure. Even the perception of complications and severity during the first months of life had 56% of women agree. On the other hand, 68.7% agreed that vaccination during pregnancy could reduce the risk for mother to contract influenza and 47.7% agreed that vaccine during pregnancy protects the child before and after birth. Moreover, only 15% of women have had the perception that the vaccine against influenza could transmit the disease to themselves and 12.7% that the vaccine is unsafe during pregnancy for the baby's health.

Compared to pertussis vaccination [32], women seem less worried that their baby may get the influenza during the first few months of life (7.3% *vs* 18.3%). With regard to *risk severity*, 14% of women disagreed that the influenza contracted during pregnancy could lead to complications for the baby, while the 40% were unsure. Related to the possibility of contracting the influenza in the first months of life, 56% of women agreed that the influenza increases the risk of severe illness and complications. Compared to pertussis, more women disagreed that the influenza vaccine during pregnancy reduces the mother's risk of contracting the influenza (8% *vs* 2%).

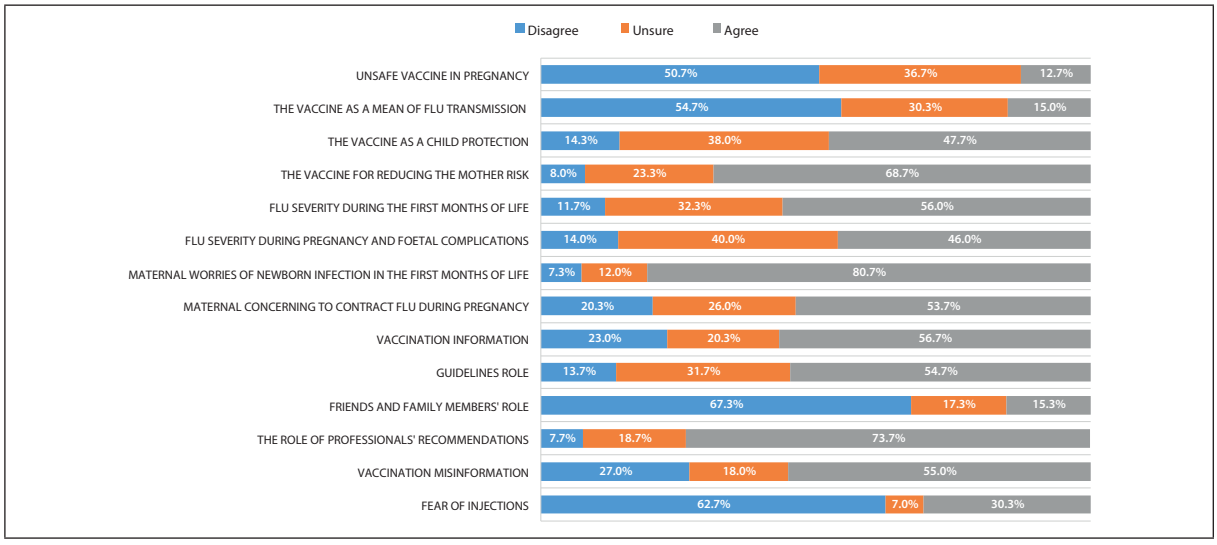

Figure 1
Frequency of the HBM model dimensions (n = 300).

Nonetheless, perceived benefits remained high. Even for the protection of the baby before and after birth through vaccination, women showed a greater degree of agreement on influenza vaccination than vaccination against pertussis (14.3% *vs* 5.3%). The barriers are almost overlapping in the two types of vaccine.

HBM confirmed its effectiveness in explaining or predicting health behaviours and choices also for flu vaccination *(Figure 2)*.

As for the common section, the associations found in the previous study are confirmed [32]: the Italian nationality showed a significant association also with not being afraid of injections (adjOR 3 CI 95% 1.6-5.8 p <0.01), with not being discouraged by friends and family to vaccinate during pregnancy (adjOR 2.9 CI 95% 1.6-5.5 p <0.01) and with the perception of not having received all information needed to decide whether to get vaccinated or not (adjOR 0.4 CI 95% 0.2-0.8 p <0.01). Moreover, being employed was associated with the fact that injections do not represent an obstacle to vaccination (adjOR 2.3 CI 95% 1.3-3.9 p <0.01), with not being worried to lack of knowledge on vaccinations during pregnancy (adjOR 1.9 CI 95% 1-3.8 p <0.05) and with not having been discouraged by friends and family to get the vaccination (adjOR 2.1 CI 95% 1.2-3.6 p <0.01). Fear of injections represented a barrier in women aged less than or equal to 31 years (adjOR 0.4 CI 95% 0.3-0.7 p <0.01) *(Table 2)*.

Having one or more children was associated with the idea that the influenza in the first months of life of baby can increase the risk of severe illness and complications (adjOR 1.7 CI 95% 1.08-2.7 p <0.05). The Italian nationality was negatively associated with the concern of contracting influenza during pregnancy (adjOR 0.5 CI 95% 0.2-0.9 p <0.05) and of related complications for the baby (adjOR 0.4 CI 95% 0.2-0.7 p <0.01) *(Table 2)*.

The logistic regression model *(Table 3)* showed that the perception of vaccine benefits (adjOR 4.3 CI 95% 1.7-10.9 p <0.01), of having received all the information needed (adjOR 2.6 CI 95% 1.2-5.5 p <0.01), the trust in guidelines (adjOR 3.5 CI 95% 1.6-7.3 p <0.01), the fear of contracting the disease (adjOR 5.1 CI 95% 2.6-10.3 p <0.01) and not being worried to lack of knowledge on vaccinations during pregnancy (adjOR 3.1 CI 95% 1.5-6.4 p <0.01) are factors associated with intent or vaccination against influenza during pregnancy.

DISCUSSION

Our study aimed to assess the factors that influence the acceptance of influenza vaccination during pregnancy and confirmed the effectiveness of HBM in explaining and predicting health behaviour already demonstrated in a previous study [32].

In our study 30% of women declared to be vaccinated/intention to get vaccinated during pregnancy against influenza. Rodrigues-Blanco *et al.* [33] reported 66% of intention to be vaccinated in postpartum women.

Our results show that perceived benefits remained high, despite 40% of women were unsure about complications of influenza on the baby. The doubts on vaccine safety are the main reason for rejecting the vaccine [34-36]. Other reasons are: the belief that the vaccine is not necessary or effective, the distrust towards the vaccine, having a cold, the possibility of becoming sick, not believing in vaccines and not knowing the recommendations [33]. The so-called construct of the "good mother", described in the literature on the use of medications during breastfeeding [37, 38], is polarized between two profiles of pregnant women: on one hand, the women who are unsure of the flu vaccine safety and therefore avoid exposing the foetus to this perceived risk and, on the other hand, those who intend to get vaccinated in order not to expose the foetus to risks and complications in case of flu contracted during pregnancy.

Most of our women agreed that influenza increases the risk of severe illness and complications and this may have been a motivation for vaccination, perceiving the risk of disease higher than vaccine. In fact, the erroneous belief that the vaccine itself can cause influenza in case of cold like symptoms and clinical manifestations without fever could represent a barrier to vaccination [34]. In a historical period in which a pandemic is afflicting the world and in which various organism and institutions [39, 40] recommend anti-COVID-19 vac-

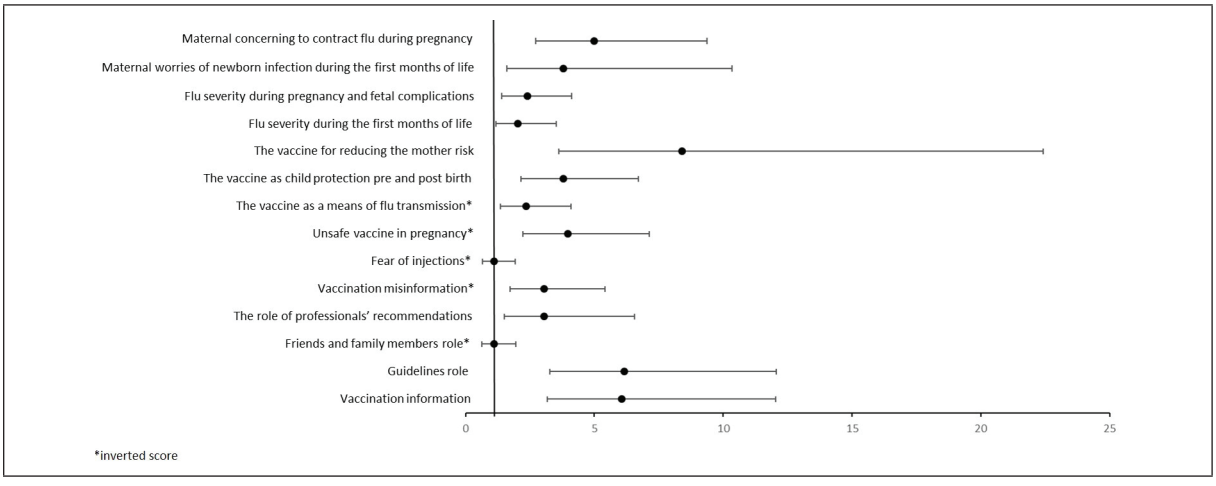

Figure 2
HBM and intention or uptake of influenza vaccination during pregnancy.

Table 2
HBM and social-demographic characteristics

	I'm worried about getting the flu during pregnancy (risk susceptibility)	If a pregnant woman contracts the flu, complications for her baby can develop (risk severity)	If a child contracts the flu in the first few months of life, the risk of severe illness and complications increases (risk severity)	I'm afraid of injections (barriers to action)*	I'm worried there may be things I don't know about vaccinations in pregnancy (barriers to action)*	Friends or family members have discouraged me from getting vaccinated during pregnancy (cues to action)*	I believe I have received all the information needed to decide whether to get vaccinated (self-efficacy)
Educational level High Low	-	-	-	-	-	-	54.9% 76%
Occupation situation Employed Unemployed	-	-	-	67.5% 47.2%	29.8% 18%	71.5% 80.7%	-
Parity 1 or ≥2 Nulliparous	-	-	62.7% 49.3%	-	-	-	-
Nationality Italian Foreigner	50.8% 68%	76.1% 66%	-	67.2% 40%	-	71.6% 46%	53.6% 72%
Age ≤31 >31	-	-	-	51.3% 69.9%	-	-	-

*Inverted score.

cination even in pregnant women, after a careful assessment of the risks and benefits, it is essential to avoid any form of misunderstanding.

In our study, the Italian nationality is a facilitator of vaccination. A previous study conducted in France [41] showed that during pandemic H1N1 influenza virus, the foreign nationality in pregnant women was a risk factor for not vaccination. There is a general perception that, while in Western Countries, pregnancy is considered as a potential risk condition, migrant women deem it as a physiological process [42].

Table 3
Logistic regression model

	Intention or uptake of influenza vaccination during pregnancy (Yes *vs* No)
	adjOR (CI 95%)
The vaccine for reducing the mother risk Disagree Agree	 1 4.3 (1.7-10.9)
Vaccination information Disagree Agree	 1 2.6 (1.2-5.5)
The trust in guidelines Disagree Agree	 1 3.5 (1.6 - 7.3)
Maternal concerning to contract flu during pregnancy Disagree Agree	 1 5.1 (2.6-10.3)
Vaccination misinformation* Disagree Agree	 1 3.1 (1.5-6.4)

*Inverted score.

Our previous study on HBM on pertussis [32] and this study on influenza show a higher *risk severity* perception for pertussis compared to influenza (80.3% *vs* 56%), and a related vaccination behaviour (being vaccinated or intention to vaccinate 48.3% *vs* 30%). The same phenomenon has been described by other authors [43, 44], showing that risk perception is increased for infancy vaccine-preventable diseases, compared to seasonal influenza, and is associated with lower influenza vaccination uptake. Pertussis, as other infancy vaccine-preventable diseases, is of greater concern compared to influenza, whose social representation could be of lower gravity due to its "seasonal" occurrence. Another reason for the higher gravity perception of pertussis and consequent vaccination behaviour in pregnancy could be the historical memory of its morbidity and mortality in early childhood in the last century. The perception of lower severity of influenza during pregnancy could be addressed by specific communication strategies.

Our logistic regression reconfirms the key role of healthcare professionals in providing information and recommendations on vaccinations. This is a factor positively associated to be vaccinated or to intention to get vaccinated. These results are confirmed for vaccination against pertussis [32] and for others health behaviours

on women's health [45]. In previous studies the recommendations on vaccination against influenza were provided by midwives, who represented the most helpful sources [35, 46]. Healthcare professionals' knowledge, attitudes and practices impact on infant health protection and promotion in many clinical settings [47], but their role is pivotal even before the birth, providing complete and exhaustive information to the expectant parents. The specific training for midwives for increasing the probability to receive the vaccination against influenza during pregnancy is needed [48]. The e-learning, proved effective in different areas of maternal-child fields such as breastfeeding [49, 50], could be a solution for improving knowledge and skills of healthcare professionals on vaccinations. In addition, the trust relationship established by midwife for mother and child health promotion is integral part of her/his habitual activities [51-53].

This study has some limitations: the use of a convenient sample of women and a questionnaire that includes items from validated questionnaires, but overall it has not undergone a validation process; the impossibility to assess the HBM effectiveness in the two groups of intentioned and vaccinated women, due to aggregated collection of data through questionnaire; the possible selection bias due to exclusion of women who could neither read nor understand Italian.

CONCLUSIONS

The vaccination is a public health priority. Through vaccination, it is possible to prevent several diseases and complications in the general population and in pregnant women, without high risks due to vaccination itself. Thus, it is necessary to create trust in the vaccinations through an integrated work of midwives, gynaecologists, paediatricians and others health professionals in order to set up training programs and to provide correct and effective health communication, as risk perception can constitute a predictor of decision making in health behaviours.

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Author contribution

All Authors participated in the interpretation of the study results and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Conflict of interest statement

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