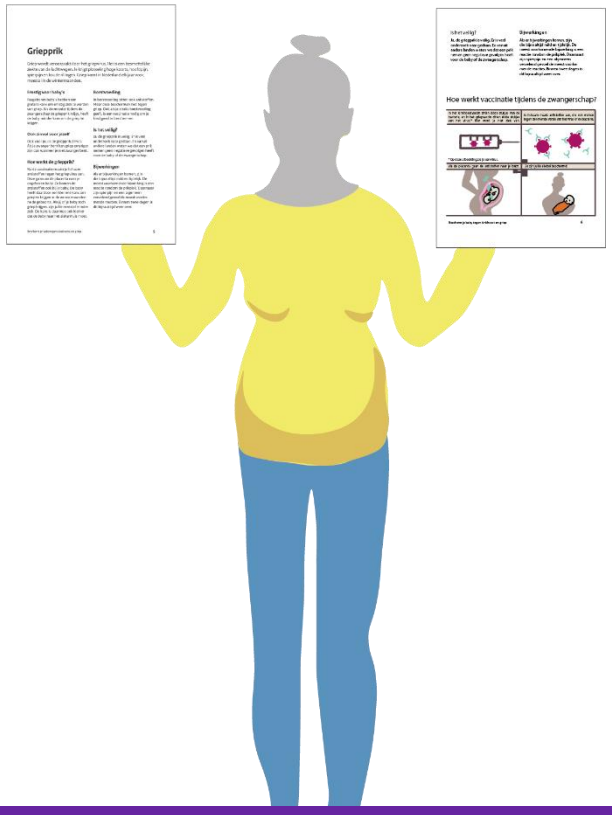
The use of infographics in a leaflet about vaccination during pregnancy



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Summary

The addition of Health Belief Model-based infographics to a leaflet about pertussis and influenza vaccination during pregnancy positively influences participants' engagement with and opinion on the leaflet. It also influences vaccination intent for pertussis.

Study design

2x1 between-subjects design | Questionnaire | Interviews

Population

177 Dutch-speaking pregnant people

Mean age 31.7 years old
First pregnancy 66%
High education overrepresented

Comparison

Original leaflet

Text-based version of leaflet

87

Infographic leaflet

Original leaflet with extra infographics

90

Outcomes

	Version RIVM preferred	Version INFO preferred
Intent to completely read the leaflet	p = .041*	
Rating of the leaflet	p < .001* until p = .496	
Health beliefs	p > .20	
Vaccination intent pertussis	p = .05*	
Vaccination intent influenza	p = .622	

Abstract

Background: Dutch pregnant people are invited to get the pertussis and the influenza vaccine. They are informed about this by their midwives, and they receive a leaflet about vaccination during pregnancy. Though this leaflet is well-received and effective, it contains mostly text. There is plenty of research indicating the usefulness of visuals such as infographics, yet the effect of integrating these into a leaflet about vaccination is not known. Therefore, this study aimed to investigate the effect of infographics in a leaflet about vaccination on pregnant people's opinion on the leaflet, health beliefs, and vaccination intent.

Methods: One hundred and seventy-seven Dutch-speaking pregnant people either received the original version of the leaflet (n = 87) or the version of the leaflet with additional infographics (n = 90), which was followed by filling in a questionnaire. The questionnaire measured pregnant people's opinion on the leaflet, their health beliefs, and their vaccination intent for influenza and pertussis. Data were collected from May 1st until May 31st, 2023. Also, three exploratory interviews were conducted, in which participants were asked to compare the two leaflets.

Results: The infographic version of the leaflet had more engagement (measured by the intent to completely read the leaflet) and was rated better than the original version. Interviewees indicated a strong preference for the version with infographics. No significant differences were found for the Health Belief Model variables between the groups. Vaccination intent for pertussis was significantly higher for the infographic group. Vaccination intent for the flu did not differ between the two groups.

Conclusions: The original version of the leaflet was good, but the infographics made it better. This research highlights the importance of incorporating visual aids in healthcare communication targeted at pregnant people.

Contents

Introduction

Vaccination in the Netherlands

The COVID-19 pandemic gave rise to a lot of discussion about public acceptance of vaccination and vaccination programs. Outside of these crisis-like situations, Dutch people generally seem willing to vaccinate their children, with vaccine rates of children in the Netherlands being steady at about 90-95% until 2021 (RIVM, n.d.). However, in 2022, for the first time in years, the vaccine rate dropped below 90% (NOS, 2023). This shows that the high vaccine rates in the Netherlands should not be considered a given, and it is important to sustain efforts to keep vaccine rates high.

Vaccination in the Netherlands is regulated by the Dutch National Immunisation Programme (NIP). Babies and children receive vaccinations against 12 diseases, including which the Tdap vaccine against tetanus, diphtheria and acellular pertussis (RIVM, n.d.). Though vaccine coverage is generally high, babies younger than five months have an incidence of pertussis of around 200 in 100,000 each year (Immink et al., 2023). Babies only receive their first pertussis vaccination at the age of 2 months, meaning that they are especially susceptible to pertussis in their first few months. Maternal immunization has been shown to be a cost-effective way to reduce the number of newborn babies contracting severe pertussis (Westra et al., 2010).

The Dutch Institute for Public Health and the Environment (RIVM) incorporated maternal pertussis vaccination (MPV) in the NIP from December 2019 onwards. Most recent national estimates of MPV indicate a coverage of approximately 71% in 2021 (NOS, 2023; Pluijmakers & de Melker, 2021; van Lier et al., 2021). However, a slightly more recent cross-sectional study among 1361 (recently) pregnant people found a MPV rate of 95% (Widdershoven et al., 2023).

In addition to MPV, as of October 2022, pregnant people in the Netherlands are invited to get the influenza vaccine (RIVM, n.d.). Both pregnant people and newborn babies are more likely to suffer from severe consequences after an influenza infection. The influenza vaccine helps protect both pregnant people and their newborn baby against influenza (Widdershoven et al., 2023). Vaccination rates for the maternal influenza vaccination are not yet known. However, at the start of 2022 – when the influenza vaccine was not yet implemented for pregnant people – 28% of pregnant people reported a positive intention towards receiving the maternal influenza vaccination (Widdershoven et al., 2023). A possible reason for this low positive intention as mentioned by Widdershoven et al. (2023) is that awareness of influenza vaccination among pregnant people was expected to be low, because no campaigns about it were implemented at that time.

Communication about vaccines through leaflets

Communication efforts can indeed be effective in increasing awareness and uptake of a vaccine, as was the case for MPV (van Zoonen et al., 2021). In the case of MPV, the RIVM asked obstetric care providers to make pregnant people aware of MPV, and to hand out a letter and an information leaflet about MPV. Dutch midwives have indicated that the information leaflet was highly appreciated by pregnant people, and that the leaflet seemed to positively affect vaccination intent (Immink et al., 2023). Since implementing the influenza vaccine for pregnant people, the RIVM has created a new version of the leaflet about vaccination during pregnancy, which includes information on both the MPV and the influenza vaccine. This leaflet about vaccination during pregnancy is the topic of this research.

The main goal of the leaflet is to ensure that pregnant people can make a well-informed decision about vaccination (RIVM, personal communication, December 2022). Therefore, the main function of the leaflet is to provide pregnant people with the information they need to make that decision. Previous

research has shown that knowledge on healthcare topics such as pain relief, pregnancy-related decision making, and vaccination can be increased through information leaflets (Stewart et al., 2003; Zibellini et al., 2020; Meharry et al., 2014; Yudin et al., 2009). An increase in knowledge about vaccination has been linked to a higher intent to get vaccinated in multiple studies as well (Kilich et al., 2020; Zingg & Siegrist, 2012; Fan et al., 2021). Finally, Meharry et al. (2014) showed that a text-based leaflet about influenza vaccination during pregnancy, specifically focused on the aspects of the Health Belief Model, led to a significant increase in vaccine uptake.

Health Belief Model

The Health Belief Model (HBM) was developed by Rosenstock and Hochbaum to help understand "the widespread failure of people to accept disease preventives or screening tests for the early detection of asymptomatic disease" (Rosenstock, 1974). Since vaccination is a clear example of a disease preventive, the HBM is specifically applicable in the context of vaccination during pregnancy (Meharry et al., 2014).

The HBM consists of four aspects which together serve as predictors for the intent to get vaccinated: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Janz & Becker, 1984). Table 1 gives a short explanation of all four elements.

Table 1: *Description of the four aspects of the HBM in the context of this research, based on Janz & Becker (1984).*

Aspect of HBM	Description in context of this research
Perceived susceptibility	The subjective risk a pregnant person feels of contracting influenza or pertussis.
Perceived severity	Medical and social consequences a pregnant person expects to experience when they are infected with influenza or pertussis.
Perceived benefits	The belief a pregnant person has on how vaccination against influenza or pertussis will benefit them.
Perceived barriers	Barriers a pregnant person experiences related to getting the vaccine.

The COVID-19 pandemic gave rise to lots of research on the HBM and its relation to vaccination intent. Multiple meta-analyses have shown that across different cultures, the HBM is a good means to predict the intent to get vaccinated for COVID-19 (Yenew et al., 2023; Limbu & Gautam, 2023). Anraad et al. (2020) applied the HBM to the topic of maternal pertussis vaccination (MPV), and showed that beliefs about the safety and effectiveness (i.e. perceived benefits and perceived barriers) were two of the main predictors of the intent to get vaccinated.

Research thus indicates that leaflets are still an effective and relevant method of informing people about health-related topics. Furthermore, the HBM shows that the concepts of perceived susceptibility, perceived severity, perceived benefits, and perceived barriers should be prioritized in a leaflet about vaccination.

Previous research on leaflets

Many studies that evaluate leaflets for pregnant people lack any description of the contents or lay-out of the leaflet (for instance Stewart et al., 2003; Zibellini et al., 2020; Yudin et al., 2009). Only very few studies have been done about the elements that make a leaflet for pregnant people effective – and the number of aspects that these studies investigated were limited.

An aspect that has been shown to be effective is translating technical terms into lay language (Wilson et al., 2019). This makes the leaflet easier to understand, leading to increased knowledge and

understanding, which is linked to increased vaccination intent (Kilich et al., 2020; Zingg & Siegrist, 2012; Fan et al., 2021). Another aspect that is effective is explicitly stating that the vaccine protects both the mother and the infant (Meharry et al., 2014). This aspect is clearly related to the HBM: mentioning that the vaccine protects the mother and baby is a benefit of the vaccine.

On the one hand, adding information to a leaflet about vaccination provides more explanation and can thus be expected to result in better understanding. On the other hand, lengthy leaflets can be expected to decrease the intent to read, especially for pregnant people with low (health) literacy. These conflicting statements are clearly reflected by Sudo (2011), who showed that pregnant people prefer a leaflet with detailed content, yet they also like clear statements and condensed information.

Visuals

A possible method of integrating a lot of information into a leaflet in a condensed manner, is through the addition of visuals. To the authors' best knowledge, there are no previous studies that specifically discuss the effects of any form of visuals in leaflets about vaccination for pregnant people. Lazard & Atkinson (2014) compared visual and text-based pro-environmental messages and conclude that visuals are effective tools to communicate messages for attitude and behaviour change. They recommend the evaluation of visuals in other contexts.

The current RIVM leaflet contains only photos, but no visuals that serve an explanatory purpose. Nonetheless, in literature there is general agreement on the positive effects of the addition of visuals to healthcare education (Ferguson, Shapiro & McDonald, 2023; Charbonneau, 2013). Reasons for this include i) they efficiently capture the audience's attention, ii) they are better understood and remembered longer, and iii) they are efficiently remembered (Heley, Gaysynsky & King, 2022). Visuals have even been said to have the power to influence health-related behaviours and outcomes (Entwistle & Williams, 2008).

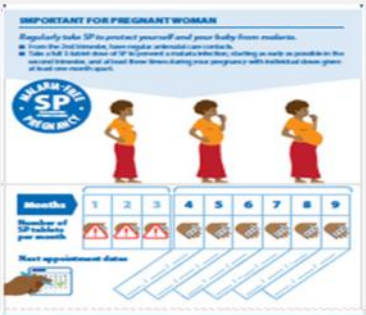
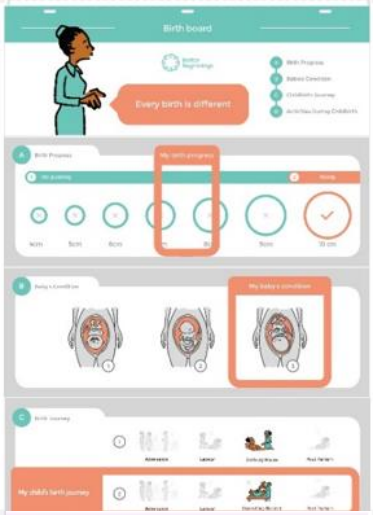
One type of explanatory visual that is effective in promoting health-related knowledge and behaviours, is the infographic (Park & Tang, 2018). Infographics (short for 'information graphics') contain a combination of texts, numbers, charts, graphs and other images (Featherstone, 2014). An infographic generally has a well-structured layout, that allows the audience to quickly find information within it. Only very few studies discuss the creation of infographics for pregnant people. An overview of the four studies that were found about infographics for pregnant people is given in Table 2. None of these studies specifically discuss a theoretical basis for the infographics that were made, nor were the infographics tested on a (semi-)large scale. Also, none of these infographics are related to the topic of vaccination during pregnancy. This shows that there is room for new research on the use of infographics for pregnant people.

Research question

This study aims to address the research gap on the use of HBM-based infographics (in leaflets) about vaccination for pregnant people. This will be investigated in the context of the leaflet about MPV and the influenza vaccine for Dutch pregnant people, as developed by the RIVM. The research question that is investigated in this study is:

How does the addition of Health Belief Model-based infographics to a leaflet about vaccination during pregnancy influence pregnant people's opinion on the leaflet, health beliefs, and vaccination intent?

Table 2: *Overview of the four existing studies that discuss the creation of infographics targeted at pregnant people, including a description of the content of the infographic, a screenshot of the infographic, and whether the infographic was evaluated by the target audience.*

Study	Content of infographic	Screenshot of infographic	Evaluated by target audience?
Faye & Lugand (2021)	When to take preventive malaria treatment		Yes, co-creation; perceived as user friendly
Salgado et al. (2017)	Multiple visuals that are helpful during pregnancy, i.e. a calendar showing development of baby		Yes, co-creation; they were enthusiastic about and highly interested in the products
Umaroh et al. (2023)	COVID-19 prevention		Yes, they were moderately enthusiastic because the lay-out was perceived as dull
Lakshminrushima et al. (2020)	COVID-19 prevention		No

Methods

A short overview of the overall method is given in Figure 1. The research question was tested using a questionnaire about participants' opinion on the leaflet, their health beliefs, and their vaccination intent. Two versions of the leaflet were tested. Version RIVM is the original version, as made and currently used by the RIVM. Version INFO is the adjusted version, containing additional infographics made by the author. Participants were randomly assigned to one of the two leaflet groups and filled in the questionnaire after receiving the leaflet. At the end of the questionnaire, participants could leave their e-mail address if they were interested in participating in a 20-minute interview.

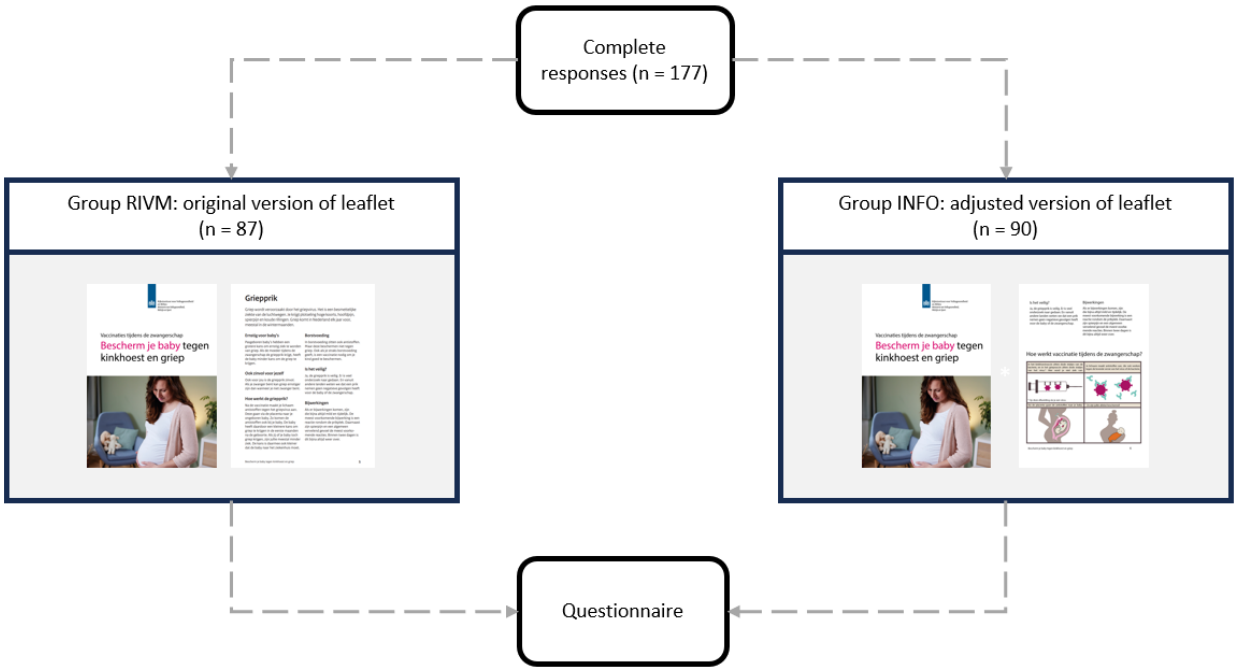


Figure 1: *Overview of the method, including the number of complete responses in total and in both groups.*

Participants and recruitment

The sample consisted of currently pregnant people, in any trimester. Inclusion criteria for participation in this research were i) being currently pregnant and ii) being able to read Dutch. The ability to read Dutch was important since the leaflet was in Dutch. Participants were recruited through a combination of targeted sampling and convenience sampling. One hundred twenty out of 555 midwife practices in the Netherlands (Nivel, 2016) were contacted. Of these, 26 spread the questionnaire. This was done either by placing a poster or flyer with a QR code to the questionnaire in their practice, or by spreading the questionnaire link via social media. The link to the questionnaire was also spread by WIJ Special Media, a Dutch company with a database of pregnant people in the Netherlands. The questionnaire link was shared via Facebook groups for pregnant people, as well as on the Utrecht University intranet. Friends, family and colleagues were asked to send the questionnaire to pregnant people in their own circle. The database of WIJ Special Media yielded the most responses, though the exact percentage of responses originating from each of the different sampling methods is not known.

Procedure

The Qualtrics platform was used to upload and spread the questionnaire. Data were collected from May 3rd 2023 until May 31st 2023. Figure 2 gives an overview of participants and responses that were excluded. As can be seen, 177 pregnant people completed the questionnaire. Of these, 51% (n = 90)

received version INFO, and 49% (n = 87) received version RIVM. Average time to read the leaflet and complete the survey was around 15 minutes. Figure 2 also shows that three exploratory interviews were performed.

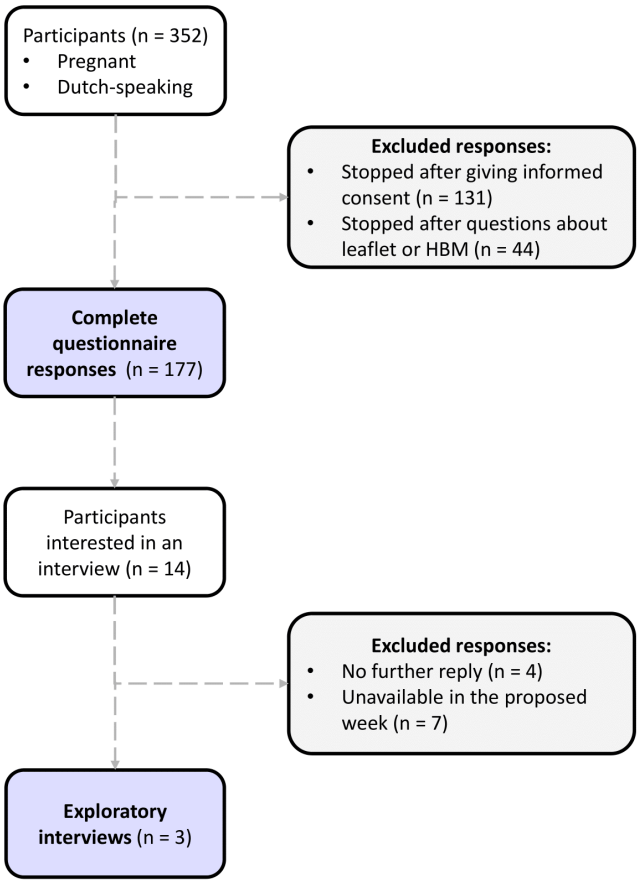


Figure 2: *Overview of the included and excluded responses, both for the questionnaire and the exploratory interviews.*

Instruments/measures

Leaflet

Version RIVM of the leaflet was the leaflet about vaccination during pregnancy that is currently in use (RIVM, 2023a). Version INFO was textually identical to version RIVM but contained a total of five additional infographics. In some cases, a photo in version RIVM version was replaced by an infographic in version INFO. This decision was made based on feedback of contact persons at the RIVM, who indicated that these photos were in some cases used to fill up white spaces in the leaflet and therefore did not serve an important function.

The topics of the infographics were related to the aspects of the HBM. In version RIVM, text that related to the HBM aspects was identified, and these topics were elaborated on in the infographics. Table 3 gives an overview of the five infographics (text in the infographics is in Dutch), including the information they intend to convey and the HBM aspect they relate to (infographics are also displayed in Appendix 1). The infographics contained some additional information that was not present in original version of the leaflet, such as the number of Dutch babies that are hospitalized with pertussis every year. Infographics were made in collaboration with and approved by the RIVM, so that they integrated well into the leaflet.

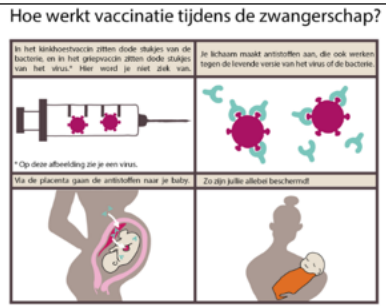
Infographics were mostly designed using a book with practical tips on how to make infographics (van den Broek, 2021). The process of designing was based on the five phases for the design of infographics, provided by Kuba and Jeong (2023): create structure and grid; establish visual hierarchy; define visual rules; replicate visual rules; validate and revise. Table 4 illustrates the step-by-step implementation of these five phases, using the infographics about pertussis and influenza in numbers (1 and 3 in Table 3) as an example. Additionally, Hernandez-Sanchez and colleagues (2021) give 12 tips to make successful health-related infographics. A few of these tips were implemented as follows:

- Set the purpose of the infographics: the purpose of the infographics was to inform pregnant people about specific aspects of the HBM in relation to vaccination during pregnancy.
- Draft the infographic: infographics were sketched on paper multiple times before drawing them on a computer.
- Choose colours appropriately: the colours that were used in the infographics are colours that are used by the RIVM in their leaflets.
- Properly review the infographics to avoid misprints and errors: infographics were checked multiple times by the author, supervisor, and contact persons at the RIVM.

Table 3: *The information in the five infographics, and the HBM aspect they relate to.*

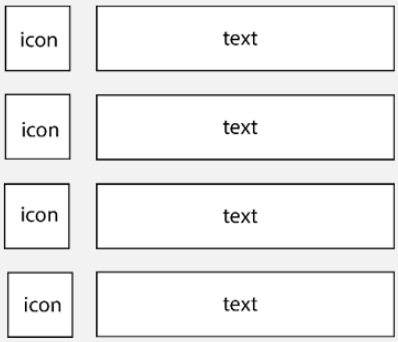
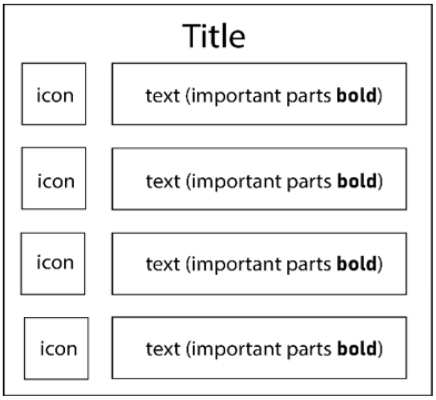
Infographic number and screenshot	Short summary of infographic	Specific information that addresses HBM aspects	HBM aspect			
			SUS	*SEV*	*BEN*	*BAR*
1 	Numbers about pertussis, related to susceptibility and severity.	Yearly number of infections and time of being infectious. Annual numbers of babies hospitalized and dying after a pertussis infection.	X 	 X	 	
2 	Vaccination schedule for newborn babies, indicating that the first pertussis vaccination (at 2 months) is not necessary if the mom receives the pertussis vaccine during pregnancy.	Getting the MPV means that a baby no longer needs to get their first pertussis vaccination.			X	
3 	Numbers about influenza, related to susceptibility and severity.	Yearly number of infections and time of being infectious. Annual numbers of pregnant people and babies being hospitalized with influenza.	X 	 X	 	

Table 3 (continued): *The information in the five infographics, and the HBM aspect they relate to.*

Infographic number and screenshot	Short summary of infographic	Specific information that addresses HBM aspects	HBM aspect			
			SUS	*SEV*	*BEN*	*BAR*
4 	Explanation of how vaccination during pregnancy works.	The vaccine contains inactivated parts of the bacterium or virus, which cannot make you sick.				X
		Maternal vaccination protects both the mom and the baby.			X	
5  	Calendars that indicate in what months pregnant people can receive a certain vaccine.	The influenza vaccine is not available all year round, indicating that susceptibility for influenza is lower outside of the influenza season (not very straightforward).	(X)			
		The calendars quickly help pregnant people find when they can get which vaccine – they do not have to calculate this themselves.				X

Abbreviations used in table: SUS = perceived susceptibility; SEV = perceived severity; BEN = perceived benefits; BAR = perceived barriers.

Table 4: *Overview of the infographic design based on the five phases as provided by Kuba & Jeong (2023).*

Design phase (Kuba & Jeong, 2023)	Visualization of infographic in this design phase	Description of this design phase
Create structure & grid		• It was decided that a combination of icons and text would be used for this infographic. • Margins and grid were drawn on paper as a first sketch.
Establish visual hierarchy		• A box was added around the infographic to make it stand out from the rest of the leaflet. • Title was added in a bigger font size to make it stand out. • Important parts of the text were made bold.
Define visual rules		• Colours were chosen based on previous RIVM leaflets. • Colour use was similar for all icons. • Font and font size were chosen based on previous RIVM leaflets.
Replicate visual rules		• The layout of the pertussis infographic was replicated to make a similar infographic about influenza. • The font and colours in this infographic were also used in all other infographics.
Validate and revise	-	• Feedback was given by supervisor and contact persons at the RIVM.

Questionnaire

The questionnaire measured the following components: demographic details; previous illness and vaccination; intent to read; rating of the leaflet; (perceived) knowledge; HBM variables (perceived susceptibility, perceived severity, perceived benefits, perceived barriers); intent to vaccinate.

Parts of the questionnaire that were based on other studies were translated to Dutch and later translated back to English, to check for possible translation errors. This was done independently by two individuals.

Demographic details included age, pregnancy trimester, parity and most recently completed level of education.

Previous illness and vaccination included 6 questions, based on Meharry et al. (2014). Questions 1) and 2) were only asked if participants indicated they already have children. Questions were 1) Have you had an influenza or pertussis infection during earlier pregnancies? (answer options: yes/no/unsure); 2) Have your children been infected with influenza or pertussis in the first few months after they were born? (answer options: yes/no/unsure); 3) Have you had an influenza infection before? (answer options: yes/no/unsure); 4) Have you had the influenza vaccine before? (answer options: yes/no/unsure); 5) Have you had a pertussis infection before? (answer options: yes/no/unsure); 6) Have you had the pertussis vaccine before? (answer options: yes/no/unsure).

Intent to read consisted of 4 questions, based on Sudo (2011). These were 1) If you saw this leaflet at your midwife or hospital, would you take it? (answer options: yes/no); 2) Would you read the leaflet after taking it? (answer options: partly/completely/no); 3) Would you keep the leaflet after reading it? (answer options: yes/no); 4) Would you share the leaflet with others after reading it? (answer options: yes/no).

Rating of the leaflet consisted of 7 questions, based on Drossaert, Boer & Seydel (1996). Questions were 1) Give your opinion about the amount of text in the leaflet; 2) Give your opinion about the amount of images in the leaflet; 3) Give your opinion on the level of difficulty of this leaflet; 4) Rate the level of attractiveness of the leaflet; 5) Rate the extent to which the images in the leaflet are informative; 6) Rate the extent to which the images in the leaflet contribute to the leaflet; 7) Give an overall score for the leaflet.

All items were measured on a 5-point Likert scale, unless otherwise stated. For 1) and 2), [1] was anchored at “too little”, [3] at “just right” and [5] at “too much”. For 3), [1] was anchored at “too easy”, [3] at “just right” and [5] at “too difficult”. For 4) and 6), [1] was anchored at “low” and [5] at “high”; for 5), [1] was anchored at “high” and [5] at “low” (reverse scale). Question 6) consisted of a 10-point scale.

The **ranking of infographics question** was only shown to group INFO, where they were asked to rank the five infographics from most [1] to least [5] useful.

(perceived) knowledge consisted of 4 questions, which were set up by the RIVM in relation to their goals of the leaflet. Questions were 1) Does breastfeeding (without vaccination) give enough protection against influenza and pertussis? (answer options: yes/no/unsure); 2) After reading the leaflet, I know when to get the pertussis vaccine (answer options: yes/no); 3) After reading the leaflet, I know when to get the influenza vaccine (answer options: yes/no); 4) After reading the leaflet, I feel well-informed about vaccination during pregnancy (answer options: yes/no).

Furthermore, all participants got two optional questions, where they were asked at what point during pregnancy someone with a certain due date could receive their vaccine.

HBM variables consisted of 12 questions. All questions except for 3) and 11) were based on Myers & Goodwin (2011). Question 3) in Myers & Goodwin (2011) was originally related to current perceived susceptibility, and as the questionnaire was conducted outside of the influenza season, this question was considered irrelevant. The question was replaced with "I think pregnant people and (newborn) babies have a greater risk of getting pertussis", based on Jones & Wallis (2022). Question 11) in Myers and Goodwin (2011) was "I am scared of needles", but they showed that this statement had no significant correlation with the intent to get vaccinated. Therefore, it was replaced with "The pertussis vaccine is harmful", based on Grandahl et al. (2017).

Every participant answered every HBM question a total of four times: about themselves and about their baby, both for pertussis and influenza. All questions were measured on a 7-point Likert scale, with [1] anchored at "strongly agree" and [7] at "strongly disagree", based on Myers & Goodwin (2011). The section below contains the items for pertussis, but items for influenza were identical – except for a change in the name of the disease and vaccine.

> Perceived susceptibility was measured using three items: 1) The chance of getting pertussis in the next few months is great; 2) I am worried about the likelihood of getting pertussis, during and right after pregnancy; 3) I think pregnant people and (newborn) babies have a greater risk of getting pertussis. Cronbach's alpha was 0,83. Therefore, the mean of these items was taken as a measure of the perceived susceptibility, with low scores indicating a high level of perceived susceptibility.
>
> Perceived severity was measured using three items: 4) Complications from pertussis are serious; 5) Getting very sick from pertussis is likely; 6) I am afraid of getting pertussis. Cronbach's alpha was 0,825. Therefore, the mean of these items was taken as a measure of the perceived severity, with low scores indicating a high level of perceived severity.
>
> Perceived benefits were measured using three items: 7) Getting the pertussis vaccine will decrease my frequency of having to consult the doctor; 8) By getting the pertussis vaccine you decrease your chance of getting pertussis, or you will not get pertussis at all; 9) The pertussis vaccine is a good idea because I feel less worried about catching pertussis. Cronbach's alpha was 0,912. Therefore, the mean of these items was taken as a measure of the perceived susceptibility, with lower scores indicating a high level of perceived benefits.
>
> Perceived barriers were measured using three items: 10) Getting the pertussis vaccine is not worth it; 11) The pertussis vaccine is harmful; 12) The side effects of the pertussis vaccine interfere with my usual activities. Cronbach's alpha was 0,888. Therefore, the mean of these items was taken as a measure of the perceived susceptibility, with lower scores indicating a high level of perceived barriers. A high level of perceived barriers must be interpreted in opposite ways compared to high levels of perceived susceptibility, severity, and benefits. This was considered in the analyses.

Vaccination intent consisted of 2 questions, being 1) Would you take the influenza vaccine if you were offered it now? (answer options: yes/no/unsure/I would rather not say); 2) Would you take the pertussis vaccine if you were offered it now? (answer options: yes/no/unsure/I would rather not say).

Interviews

Exploratory interviews lasted 20 minutes, and were performed online (via Microsoft Teams), as participants mentioned this would be most convenient to them. All three participants were interviewed individually. Before the interviews, participants received both versions of the leaflet. During the interviews, participants were asked to compare and give their opinion on the two versions of the leaflet. They were specifically asked about i) parts of the leaflet they found (not) useful; ii) the amount of text in the leaflet; iii) the infographics and iv) the extent to which the leaflet influenced their opinion on vaccination. The complete setup and interview guide can be found in Appendix 2.

Data analysis

Questionnaire

Analyses were performed using SPSS 27.0. Before performing a statistical test, the appropriate assumptions were checked. Differences between group RIVM and group INFO were assessed with Chi square (categorical data) or Mann-Whitney U (ordinal data) tests (Field, 2018). Values of $p \leq .05$ were considered to be significant. Hierarchical logistic regression was used to identify variables that influence one's intent to get vaccinated. This was carried out separately for the flu and for pertussis. Variables entered into block 1 were pregnancy trimester, education level, previous illness and previous vaccination. In block 2, all the HBM variables were added. The version of the leaflet was not added into any block, since no significant differences were found between the HBM variables for the two groups.

Interviews

Because the focus in this research is on the questionnaire, interviews were not analysed in depth. Instead, quotes are mostly used in the discussion to support explanations, and to suggest directions for further research.

Results

Demographic details (including previous illness and vaccination)

Table 5 gives an overview of the demographic details, including previous illness and vaccination, of participants per group. In short: average age was 31.7 years, most participants (about 50%) were in their 3rd trimester, and most participants (>75%) were highly educated. Most participants have had influenza before (about 85%), while only a minor amount have had pertussis before (about 8%). Over 90% of participants stated that they had received the pertussis vaccine before, and about one-third (35%) has received the influenza vaccine at least once. Most participants (about 65%) were in their first pregnancy. Among participants who were not in their first pregnancy, about 20% reported that either they or their children had contracted pertussis or influenza during or around their previous pregnancy.

A t-test comparing average age for group RIVM (M = 31.7, SE = 0.46) to group INFO (M = 31.7, SE = 0.43) showed a minor difference, - 0.044, BCa 95% [-1.316, 1.104], which was not significant, $t(173.4) = -0.070$, $p = .945$. There was no significant difference between the spread across pregnancy trimesters for both groups ($\chi^2(2) = 4.820$, $p = .093$). There was no significant difference between the amount of first and non-first pregnancies ($\chi^2(1) = 0.916$, $p = .339$). There was also no significant difference between the level of education for both groups ($\chi^2(5) = 5.764$, $p = .340$).

Table 5: *Overview of average age, pregnancy trimester, indication of whether the current pregnancy is someone's first, education level, and previous illness and vaccination for both groups.*

Question topic and answer		Group RIVM (n = 87)		Group INFO (n = 90)	
Average age		31.7 years		31.7 years	
Pregnancy trimester	1st	15	(17%)	6	(7%)
	2nd	30	(35%)	37	(41%)
	3rd	42	(48%)	47	(52%)
Education level	High school	3	(3%)	1	(1%)
	Secondary vocational	17	(20%)	28	(31%)
	University of applied science	32	(37%)	33	(37%)
	University bachelor	6	(7%)	4	(4.5%)
	University master	27	(31%)	20	(22%)
	PhD	2	(2%)	4	(4.5%)
Had influenza before?	Yes	72	(83%)	80	(89%)
	No/unsure	15	(17%)	10	(11%)
Had influenza vaccine before?	Yes	31	(36%)	31	(34%)
	No/unsure	56	(64%)	59	(66%)
Had pertussis before?	Yes	7	(8%)	6	(7%)
	No/unsure	80	(92%)	84	(93%)
Had pertussis vaccine before?	Yes	79	(91%)	85	(94%)
	No	8	(9%)	5	(6%)
First pregnancy?	Yes	61	(70%)	57	(63%)
	No	26	(30%)	33	(37%)
Influenza or pertussis during previous pregnancy?	Yes	6	(23%)	7	(21%)
	No/unsure	20	(77%)	26	(79%)
Current children: influenza or pertussis in first months?	Yes	4	(15%)	6	(18%)
	No/unsure	22	(85%)	27	(82%)

Intent to take, read, keep and share

Table 6 shows participants' intent to take, read, keep and share the leaflet.

In both groups, almost all participants (85%) indicated they would take the leaflet if they saw it somewhere. The intent to take the leaflet was not significantly different for the two groups ($\chi^2(1)$ = 0.571, p = .450).

The intent to read the leaflet was answered as either "partly" or "completely" by all participants in both groups. There was a significant association between the version of the leaflet and whether participants would read it completely ($\chi^2(1)$ = 4.174, p = .041). The odds ratio showed that the odds of completely reading the leaflet were 1.96 times higher if they received version INFO than if they received version RIVM.

The intent to keep the leaflet after reading it was about 50% in both groups. The two groups showed no significant difference between the intent to keep the leaflet ($\chi^2(1)$ = 0.164, p = .746).

The intent to share the leaflet was 30% in group RIVM, and 43% in group INFO. There was no significant difference between the two groups for the intent to share ($\chi^2(1)$ = 2.508, p = .113).

Table 6: *Overview of intent to take, read, keep and share the leaflet for both groups.*

Question topic and answer		Group RIVM (n = 87)	Group INFO (n = 90)
Intent to take	Yes	76 (87%)	75 (83%)
	No	11 (13%)	15 (17%)
Intent to read	Partly	42 (55%)	29 (39%)
	Completely	34 (45%)	46 (61%)
	No	0 (0%)	0 (0%)
Intent to keep	Yes	40 (53%)	37 (49%)
	No	36 (47%)	38 (51%)
Intent to share	Yes	23 (30%)	32 (43%)
	No	53 (70%)	43 (57%)

Rating of the leaflet

Table 7 gives an overview of mean and median scores and outcomes of the statistical tests for the seven variables that were measured related to participants' ratings of the leaflet.

Overall, version INFO was rated better than version RIVM. Significant differences were found for the number of images in the leaflet (U = 3816.50, z = 2.643, p = .008, r = .20), the extent to which the images are informative (U = 2742, z = 3.565, p < .001, r = .27), and the extent to which the images contribute to the leaflet (U = 5466, z = 4.947, p < .001, r = .37).

Table 7: *Overview of the results of Mann-Whitney U tests for the questions related to participants' ratings of the leaflet.*

Question	Mean (SD)		Median		*U*	*z*	*p*	*r*
	RIVM	INFO	RIVM	INFO				
Amount of text	3.11 (0.73)	3.31 (0.77)	3	3	3793	1.552	.121	.12
Number of images	2.93 (0.47)	3.1 (0.48)	3	3	3817	2.643	.008*	.20
Level of difficulty	2.85 (0.56)	2.93 (0.47)	3	3	4069	0.681	.496	.051
Attractiveness	3.37 (0.78)	3.54 (0.84)	3	4	4336	1.334	.182	.10
Images: informative?	2.75 (1.06)	3.35 (1.05)	3	3.5	2742	3.565	< .001*	.27
Images: contribute to leaflet?	3.00 (1.06)	3.78 (0.91)	3	4	5466	4.947	< .001*	.37
Overall rating	7.32 (1.28)	7.70 (1.07)	8	8	4530	1.943	.052	.15

** indicates that a significant difference was found between the two groups.*

Participants in group INFO were asked to rank the infographics in the leaflet from most to least useful. Based on their responses, a total score was calculated for each of the infographics. Table 8 shows the overall order by which the infographics were ranked.

Table 8: *Relative rank of and votes for the five infographics. For more details on the contents of each infographic, see the methods section.*

Rank	Description infographic	Number of times voted on position				
		1	*2*	*3*	*4*	*5*
1.	Pertussis numbers	25	21	16	28	1
2.	Vaccination schedule baby	17	23	24	13	14
3.	How does vaccination work	18	18	22	16	17
4.	Calendar	19	11	20	17	24
5.	Influenza numbers	12	18	9	17	35

(Perceived) knowledge

Table 9 gives an overview of the answers given to the questions related to (perceived) knowledge. Overall, (perceived) knowledge was high. Percentages of desired or correct answers were higher in group INFO for all questions. The two groups showed no significant difference on whether participants correctly answered the knowledge question on breastfeeding ($\chi^2(1) = 3.281$, $p = .070$). The two groups also showed no significant difference on whether participants indicated they knew when to get the pertussis vaccine($\chi^2(1) = 2.093$, $p = .148$). There was also no significant difference between the two groups on whether participants indicated they knew when to get the influenza vaccine ($\chi^2(1) = 3.018$, $p = .082$). Finally, the two groups showed no significant difference on whether participants indicated they felt well-informed on the topic of vaccination during pregnancy ($\chi^2(1) = 0.180$, $p = .177$).

Both optional questions asking when someone with a certain due date could get both vaccinations were answered correctly by about four-fifths (79%) of group INFO, while only one-third (36% and 28%) of group RIVM answered them correctly. There was a significant association between the version of the leaflet and whether participants would answer extra question 1 correctly ($\chi^2(1) = 31.404$, $p < .001$). The odds ratio showed that the odds of correctly answering extra question 1 were 6.76 times higher if they received version INFO than if they received version RIVM. There was also a significant association between the version of the leaflet and whether participants would answer extra question 2 correctly

($\chi^2(1) = 34.308$, $p < .001$). The odds ratio showed that the odds of correctly answering extra question 2 were 9.37 times higher if they received version INFO than if they received version INFO.

Table 9: *Overview of the answers given to the questions related to (perceived) knowledge.*

Question topic and answer		Group RIVM (n = 87)		Group INFO (n = 90)	
Knowledge question – breastfeeding	No (correct)	57	(66%)	70	(78%)
	Yes/unsure (wrong)	30	(34%)	20	(22%)
"I know when to get the pertussis vaccine"	Yes	85	(98%)	90	(100%)
	No	2	(2%)	0	(0%)
"I know when to get the influenza vaccine"	Yes	77	(86%)	86	(96%)
	No	10	(14%)	4	(4%)
"I feel well-informed after reading the leaflet"	Yes	76	(87%)	84	(93%)
	No	11	(13%)	6	(7%)
When can someone with due date X get the pertussis vaccine?	Correct	30	(36%)	65	(79%)
	Wrong	53	(64%)	17	(21%)
When can someone with due date Y get the influenza vaccine?	Correct	18	(28%)	55	(79%)
	Wrong	46	(72%)	15	(21%)

HBM variables

For each HBM question, mean and median scores for both groups as well as outcomes of the Mann-Whitney U test are reported in Table 10. A visualization of the data is given in Appendix 3.

A significant difference was found between the two groups for *pertussis: perceived barriers for the baby*, with group INFO showing a lower level of perceived barriers ($Mdn_{INFO} = 7$, $Mdn_{RIVM} = 6$; $U = 3201$, $z = -2.272$, $p = .023$, $r = -.171$). Since no significant differences were found for the other HBM variables, the rest of this results section describes both groups simultaneously.

Table 10: *Overview of the results of Mann-Whitney U tests for the HBM variable questions, for pertussis as well as influenza. All questions were answered on 7-point Likert scales.*

Disease, HBM variable and mom/baby			Mean (SD)		Median		*U*	*z*	*p*	*r*
			RIVM	INFO	RIVM	INFO				
Pertussis	*Perceived susceptibility*	Mom	4.94 (1.28)	5.00 (1.20)	5	5	3881	-0.103	.918	-.008
		Baby	3.97 (1.34)	4.1 (1.37)	4	4	3693	-0.671	.502	-.050
	Perceived severity	Mom	5.08 (1.20)	5.17 (1.03)	5	5	3892	-0.72	.943	-.054
		Baby	3.01 (1.51)	3.00 (1.28)	3	3	3821	-0.284	.776	-.021
	Perceived benefits	Mom	2.72 (1.47)	2.78 (1.28)	2	3	3563	-0.936	.349	-.071
		Baby	2.43 (1.51)	2.27 (1.22)	2	2	3782	-0.140	.889	-.011
	Perceived barriers	Mom	5.53 (1.56)	5.9 (1.16)	6	6	3496	-1.282	.200	-.096
		Baby	5.74 (1.53)	6.23 (1.12)	6	7	3201	-2.272	.023*	-.171
Influenza	*Perceived susceptibility*	Mom	4.08 (1.48)	4.03 (1.30)	4	4	3685	-0.301	.763	-.023
		Baby	3.51 (1.59)	3.30 (1.17)	3	3	3676	-0.331	.741	-.025
	Perceived severity	Mom	5.19 (1.51)	5.04 (1.39)	6	5	3530	-0.906	.365	-.068
		Baby	3.73 (1.62)	3.37 (1.35)	3	3	3414	-1.262	.207	-.095
	Perceived benefits	Mom	3.57 (1.69)	3.79 (1.62)	3	4	3533	-0.893	.372	-.068
		Baby	3.36 (1.62)	3.26 (1.50)	3	3	3738	-0.271	.786	-.020
	Perceived barriers	Mom	5.07 (1.56)	5.20 (1.49)	5	5	3623	-0.492	.623	-.037
		Baby	5.12 (1.52)	5.19 (1.45)	5	5	3719	-0.197	.844	-.015

** indicates that a significant difference was found between the two groups*

Pertussis: mom versus baby

Perceived susceptibility was significantly higher for babies than for moms (W_s = 223,50, z = -9.359, p < .001, r = -.70). Perceived severity was also significantly higher for babies than for moms (W_s = 133.50, z = -10.569, p < .001, r = -.79). Perceived benefits were again higher for babies than for moms (W_s = 743,50, z = -6.184, p < .001, r = -.47). In contrast, perceived barriers were higher for moms than for babies (W_s = 2746.50, z = 3.797, p < .001, r = .29).

Influenza: mom versus baby

Perceived susceptibility was higher for babies than for moms (W_s = 403, z = -8.112, p < .001, r = -.62). Perceived severity was higher for babies than for moms (W_s = 58, z = -10.564, p < .001, r = -.80). Perceived benefits were also higher for babies than for moms (W_s = 741, z = -6.263, p < .001, r = -.47). There was no significant difference between perceived barriers for moms and babies (W_s = 1678.50, z = 0.700, p = .484, r = .053).

Vaccination intent

Table 11 gives an overview of the participants' intent to get the pertussis or influenza vaccine. For chi-square tests, the answer categories "no", "unsure" and "rather not say" were grouped, to meet the assumption that 80% of variables should have a minimum count of 5 (Field, 2018).

As can be seen, about 40% in both groups intend to get the influenza vaccine. The two groups showed no significant difference between their intent to get the influenza vaccine ($\chi^2(1) = 0.243$, p = .622). The intent to get the pertussis vaccine was much higher for both groups: 87% for group RIVM, and 96% for group INFO. There was a significant association between the version of the leaflet and whether participants indicated they intended to get the pertussis vaccine ($\chi^2(1) = 3.834$, p = .050). The odds ratio showed that the odds of getting the pertussis vaccine were 1.1 times higher if they received the leaflet with infographics than if they received the original version.

Table 11: *Overview of participants' intent to get the influenza and pertussis vaccine.*

Vaccine and answer		Group RIVM (n = 87)		Group INFO (n = 90)	
Influenza	Yes	37	(43%)	35	(39%)
	No	32	(37%)	31	(34%)
	Unsure	16	(18%)	24	(27%)
	Rather not say	2	(2%)	0	(0%)
Pertussis	Yes	76	(87%)	86	(96%)
	No	7	(8%)	2	(2%)
	Unsure	2	(2.5%)	2	(2%)
	Rather not say	2	(2.5%)	0	(0%)

HBM and demographic variables as a model for vaccination intent

Hierarchical logistic regression for the intent to get the pertussis vaccine yielded results with very high standard errors, which is most likely caused by almost all participants giving the same answer to this question (Field, 2018; Austin & Branner, 2003). Because these results do not give any useful information, they are not reported here.

The results of hierarchical logistic regression for the intent to get the influenza vaccine are given in Table 12. In block 1, both the pregnancy trimester and previous influenza vaccination significantly influence the intent to get the influenza vaccine. Those in their second or third pregnancy trimester

are 3.14 times more likely to intend to get the influenza vaccine, compared to those in their first trimester. Those who have previously received the influenza vaccine, are 3.26 more likely to intend to get the influenza vaccine, compared to those who have not previously received the influenza vaccine.

Block 2, which contains all the eight HBM variables, does significantly improve the overall fit of the model, yet there are no specific HBM aspects that significantly influence the intent to get the influenza vaccine (i.e. all individual p-values are > .05). This means that HBM aspects help predict pregnant people's intent to get the influenza vaccine, but that the results do not give insight into specific HBM aspects that influence this intent.

Interviews

When asked to compare both versions of the leaflet, all three interviewees indicated a clear preference towards version INFO. They thought the infographics were the most useful part of the leaflet, as well as the short summary of the leaflet that was given at the start. All infographics were positively rated. Participants indicated that there were no further aspects of the leaflet that they would like to be visualized. They also indicated that they could imagine the infographics specifically changing someone's opinion about vaccination.

Table 12: *Results of hierarchical logistic regression for the intent to get the influenza vaccine. Variables were placed in two blocks, which are both reported on in the table below.*

	Variable		B	SE	p	95% CI for Odds ratio		
						Lower	***Odds ratio***	***Upper***
Block 1*	*Age*		0.039	0.043	.370	0.955	1.040	1.132
	Education level		0.492	1.138	.666	0.135	1.635	15.219
	Pregnancy trimester		1.145	0.537	.033*	1.096	3.141	9.001
	Previous influenza infection		0.047	0.508	.927	0.387	1.048	2.837
	Previous influenza vaccination		1.180	0.360	.001*	1.609	3.255	6.588
	Model: $\chi^2(11) = 26.170$, $p = .006$. 70.9% of results are explained by block 1.							
Block 2*	*Perceived susceptibility*	Mom	0.189	0.126	0.133	0.944	1.208	1.545
		Baby	-0.136	0.144	0.347	0.658	0.873	1.158
	Perceived severity	Mom	0.113	0.86	0.186	0.947	1.120	1.325
		Baby	-0.005	0.102	0.958	0.814	0.995	1.216
	Perceived benefits	Mom	0.219	0.133	0.099	0.959	1.245	1.616
		Baby	0.105	0.147	0.475	0.832	1.111	1.483
	Perceived barriers	Mom	-0.183	0.148	0.215	0.624	0.833	1.112
		Baby	-0.181	0.156	0.244	0.615	0.834	1.132
	Model: $\chi^2(8) = 86.713$, $p < .001$. 84.3% of results are explained by the combination of blocks 1 and 2.							

** indicates that the block or variable significantly impacted the fit of the model.*

Discussion

This study was set out to investigate the effects of adding infographics to a leaflet about vaccination during pregnancy. Identifying the effects of the addition of infographics to a leaflet is an important step in realizing the importance and use of infographics in the context of vaccination during pregnancy.

In this study, two versions of a leaflet about vaccination during pregnancy were compared: version RIVM (original, text-based version) and version INFO (same as version RIVM, but with five infographics added to it). It was investigated whether the version of the leaflet influenced pregnant people's opinion on the leaflet, their health beliefs, and their vaccination intent. Through a combination of an online questionnaire and exploratory interviews, the following answers to the research question were found:

- The addition of infographics positively impacted pregnant people's opinion on the leaflet.
- The addition of infographics positively impacted pregnant people's vaccination intent for pertussis, but not for influenza.
- The addition of infographics had no impact on pregnant people's health beliefs.

The quotes below reflect pregnant people's preference for version INFO:

> "In general I really prefer version [INFO]. In version [INFO] the images were much more informative, and they contributed to the leaflet … I thought that was a really big improvement." (Interview 1)

> "I would choose [version INFO], simply because it has all those useful [infographics]." (Interview 3)

> "I would especially keep the [infographics] for people who only partly read the leaflet, because that way they can quickly find information." (Interview 3)

The preference for version INFO is in line with previous research which showed that a combination of text and visuals is generally preferred over text alone (Frankel & DePace, 2012; Estrada & Davis, 2015; Garcia-Retamero & Cokely, 2017). The positive reactions to the infographics in the interviews are in line with previous studies in which pregnant people also positive about infographics developed for them (Faye & Lugand, 2021; Salgado et al., 2017). Both Faye & Lugand (2021) and Salgado et al. (2017) used an infographic with a calendar in it to indicate that an action could only occur within a certain timeframe. The concept of a calendar was also used in an infographic in this study. In the questionnaire, participants were specifically asked questions to assess their understanding of the calendar infographic, which showed that participants understood it well. In the interviews, participants also specifically indicated they appreciated the calendar. This is illustrated by the following quotes:

> "The calendar on page 8 is really great. Yes, I think it is amazing. I was puzzling a bit, like "do I need the influenza vaccine or not?", because my due date is the end of September. I think this is useful to know when you have to go. I mostly think, people just want to know this." (Interview 1)

> "I thought the calendar [was really useful], because I forget everything all day long, so that was very easy." (Interview 3)

Therefore, a calendar can be identified as a useful element within infographics targeted at pregnant people.

Participants who received version INFO were twice as likely to read the leaflet completely, compared to those who received version RIVM. This is an important finding, because for an educational leaflet about any topic to be effective, one of the most important contributors is the extent to which the leaflet is read (Castle, Skinner & Hampson, 1999). The finding is in line with Oelke et al. (2012), who found that visuals are an effective means to make a text easier to read. Those who completely read the leaflet are more engaged with the leaflet compared to those who partly read the leaflet, which may be linked to increased learning (Padak & Bardine, 2011). One of the interviewees explained that the infographics made her more likely to read and engage with the leaflet:

> "I feel more drawn to a leaflet when it has [infographics]… I start by looking at the images, and when they interest me enough, I will read the text" (Interview 2)

Previous research by Meharry et al. (2014) found that an HBM-based leaflet significantly increased maternal influenza vaccine uptake. In this study, MPV intent was significantly higher for version INFO. Because the infographics specifically focused on aspects of the HBM, this study confirms the finding that the HBM is an effective basis for leaflets about vaccination during pregnancy. However, an unexpected finding is that there was no significant difference between the two groups for their intent to get the influenza vaccine. A possible reason for this is that pregnant people have low interest in receiving the influenza vaccine (Widdershoven et al., 2023), as also came forward in the interviews:

> "To me, influenza is associated with grandparents who are vulnerable because of illnesses. … And pertussis is linked to little babies who could get it and become really sick from it." (Interview 3)

The low interest in the influenza vaccine is also reflected by the infographic about influenza in numbers being voted as least useful. In a leaflet, pregnant people focus on the information that interests them most (Sudo, 2011). Participants possibly paid more attention to the infographics about pertussis and less to those about influenza, meaning that they did not benefit from the information that was in the influenza-related infographics. This may then have resulted into to a lack of difference in vaccination intent for influenza between the two groups.

The information in the leaflet is not the sole basis on which pregnant people decide about vaccination (Bisset & Paterson, 2018). However, the significant difference between the two groups for pertussis, as well as the interview quotes, clearly show that the addition of infographics does aid them in making a well-informed decision. This is also illustrated in the following quote:

> "If the version of the leaflet with infographics is used, I can imagine [it could change someone else's opinion]. In that leaflet it is clearly indicated what the advantage is of vaccination … and especially why you would do it *now*, instead of once your baby is born." (Interview 1)

An unexpected result was that practically no significant differences were found between the two groups for any of the HBM variables, except for *pertussis: perceived barriers for the baby*. Meharry et al. (2014) showed that an HBM-based leaflet (compared to no leaflet) significantly increased pregnant people's perceptions of safety and benefit of vaccine uptake. The infographics used in this study did not achieve such an effect. It is possible that there is a ceiling effect (Ho & Yu, 2015), with a maximum increase in HBM scores already being reached by the text in the leaflet. Because the study design included no control group or pre-test, there is no insight on the average HBM scores of participants prior to reading the leaflet. Therefore, such a ceiling effect could not be identified in this study.

The average MPV intent in this study was about 92%, which is higher than the national estimates of 70% (NOS, 2023) but similar to the 95% that was found by Widdershoven et al. in about 1300 pregnant

people (2023). Widdershoven et al. (2023) also found that at the start of 2022, 28% of Dutch pregnant people indicated they would consider getting the influenza vaccine during pregnancy. The intent to get the influenza vaccine is higher in this study; around 41%. It may therefore be hypothesized that the higher intent to get the influenza vaccine is caused by reading the leaflet. Especially since Widdershoven et al. (2023) mention that at the time of their study, there was no communication about the influenza vaccine yet (contrary to the pertussis vaccine).

The actual influenza vaccination intent may be expected to be even higher than 41%, since the questionnaire was conducted in May – which is outside of the influenza season (CDC, 2022). Participants were specifically asked if they would take the influenza vaccine if they were offered it *now*, the timing of the questionnaire has possibly influenced the way participants answered this question. This question better could have asked participants whether they would take the influenza vaccine in the influenza season (Benjamin & Bahr, 2016).

Because of the high MPV intent in this study, it was not possible to perform hierarchical logistic regression on the MPV intent. For the influenza vaccine, three predictors of the vaccination intent were found: pregnancy trimester, previous influenza vaccination, and the combination of the HBM variables. To the authors' best knowledge, there are no existing studies that report some type of regression analysis on the intent to get the maternal influenza vaccination in the Netherlands. However, Anraad et al. (2020) describe the fitting of a regression model to find variables that predict MPV intention. Anraad et al. (2020) did not find a relation between vaccination intent and pregnancy trimester or previous vaccination behaviour; they did find a relation between HBM aspects and maternal influenza vaccination. These differences might be related to different vaccines being investigated.

The HBM variables overall significantly increased the fit of the model in the case of influenza. The current statistical method did not provide insights into specific variables that contributed to this significant increase. Therefore, results are somewhat inconclusive, and further in-depth analysis is needed on this aspect. This is beyond the scope of the current research project but will possibly be explored later when working on a publication. However, the addition of the HBM variables leads to an additional explanation of 14% of results ($p < .001$), which shows that they do play a role in explaining maternal influenza vaccination intent.

Limitations

The sample of pregnant people that participated in this research was reasonably representative of the average population of Dutch pregnant people. Average age was identical to the average age of Dutch moms in 2021 (CBS, 2021). About 7.5% of participants reported they have been infected with pertussis before, which is comparable to the 5% of the Dutch population that has had a symptomatic pertussis infection (RIVM, 2022). About 85% of participants reported they have had an influenza infection before. For influenza, the percentage of the Dutch population that has ever been infected is unknown. Since the influenza season results in about 10% of the population being infected every year (RIVM, 2023b), the percentage found in this study seems reasonable. In the study sample, about 75% had a degree from a university of applied science or higher – in the Dutch population this is on average 36% (OCW, 2022). Therefore, highly educated people are overrepresented in the sample. Since high levels of education are associated with higher health literacy (Jansen et al., 2018), highly educated people are expected to be more capable of processing information related to health and healthcare (Liu et al., 2020). This means that it is possible that participants were more positive about the leaflet and the infographics than the average population of Dutch pregnant people – though there is also literature stating that those with low literacy skills benefit strongly from visuals (Entwistle & Williams, 2008).

Interviews were only conducted with three pregnant people and saturation was not yet reached. This means that the results of the interviews possibly lack generalizability, though they do give an interesting insight into the opinion of different pregnant people.

A limitation of the study is that the questionnaire was spread in May, which is outside of the influenza season. Because of this, participants have possibly perceived themselves as less susceptible towards influenza infections, and this is especially expected to have caused a more negative intent towards receiving the influenza vaccine. Furthermore, there was neither a control group nor a pre-test in this study, meaning that the results of the leaflet cannot be compared in any way with those of people who did not (yet) view the leaflet. Such a control group or a pre-test would have been difficult to operationalize anyway, since it is part of the communication plan of the RIVM that midwives hand out the leaflet about vaccination during pregnancy to all pregnant people. Therefore, most participants had likely already seen the old version of the leaflet (which contains information only about pertussis and not influenza) prior to starting the questionnaire.

Future research

In this research, participants who were asked to rate infographics from most to least useful, rated two infographics with the exact same lay-out but about two different diseases both as most and least useful. This suggests that the information that is in the infographic plays a big role in how useful someone perceives an infographic. Future research should therefore aim to focus more specifically on what makes an infographic effective: is it the lay-out, is it the information that it conveys, is it a combination, or are other factors important as well? Besides, future research could investigate ways to draw people's attention to an infographic, even if they are not necessarily interested in its content.

Furthermore, future research should focus more specifically on vaccine-hesitant pregnant people. By investigating their needs and wishes in relation to deciding about vaccination, infographics can be tailored towards aiding vaccine-hesitant pregnant people in their decision.

Conclusion

The main finding of this study is that HBM-based infographics about vaccination during pregnancy are highly appreciated by pregnant people, and they can increase their vaccination intent. This study therefore highlights the importance of incorporating visual aids such as infographics in healthcare communication towards pregnant people. Being the first study to integrate infographics into a leaflet about vaccination during pregnancy, this study shows that infographics are a valuable addition to leaflets.

This research also provides valuable insights into the communication preferences and needs of pregnant people. Though more research on a larger scale might be needed before statements can be made about all pregnant people in the Netherlands, the current research suggests that pregnant people are more likely to engage with information when it is presented in a visually compelling and easily understandable format.

These results have important practical implications: it is highly recommended to incorporate visual elements when communicating healthcare topics to pregnant individuals.

The final quote below summarizes the main conclusion of this research:

> "Version [INFO] is really much more complete than version [RIVM]. That is because of the [infographics]." (Interview 2)

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Collected data

Data was collected in accordance with the ethical guidelines of the Science Faculty at Utrecht University. The study has been approved by the Science-Geosciences Ethics Review Board (SG ERB) at Utrecht University (reference number S-23984).

Collected data consists of questionnaire results and interview transcripts. This data can be accessed via OneDrive: Data research project Jeanne Muizelaar (only possible for Utrecht University employees).

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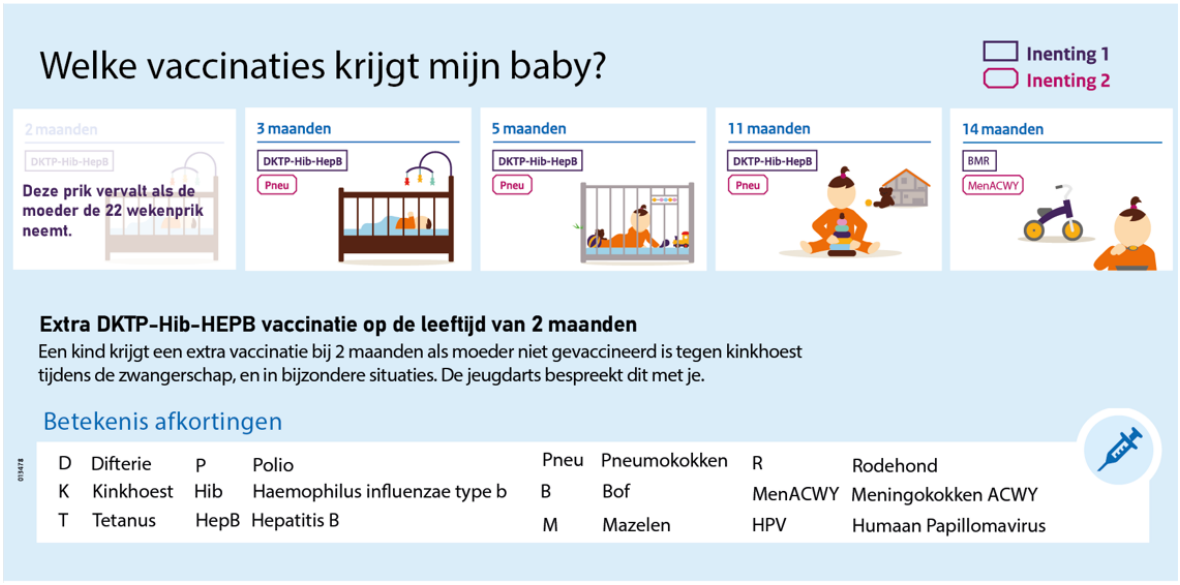
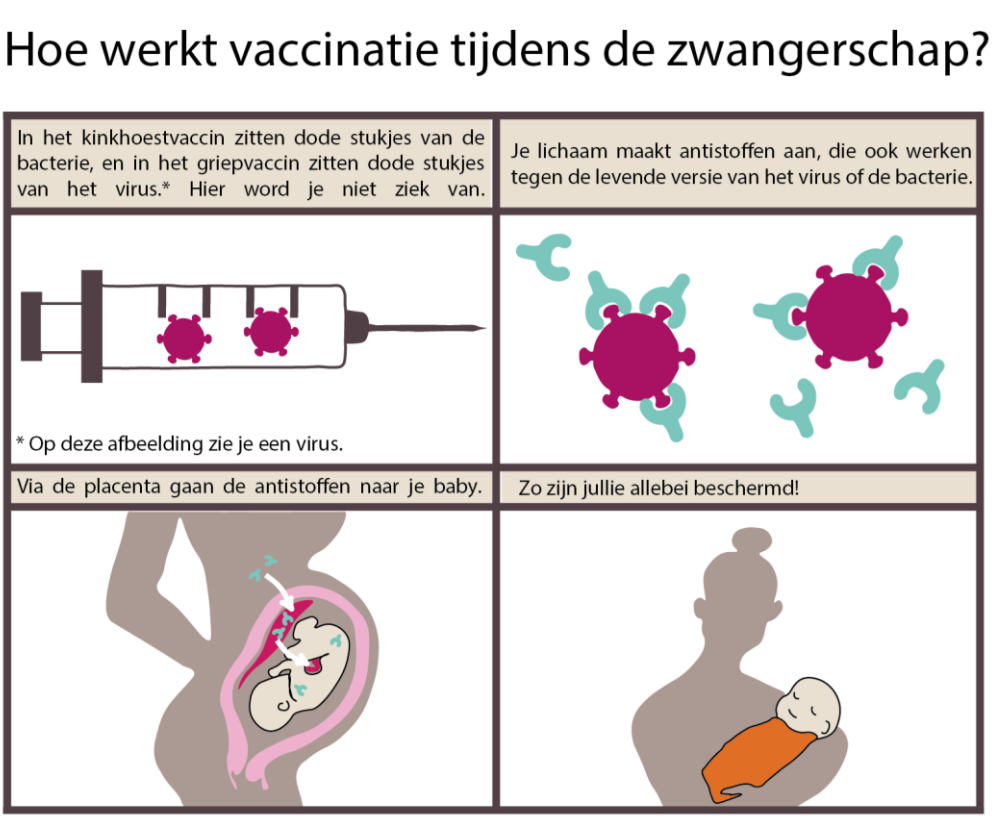
Appendix 1

Overview of infographics






Griep in cijfers
Elk jaar krijgt **10-15% van de pasgeboren baby's** de griep
Iemand met de griep kan **1 week** lang anderen **besmetten**
Elk jaar belanden **300 baby's** en **45 zwangere vrouwen** met de griep in het **ziekenhuis**


Kinkhoest in cijfers
Elk jaar krijgt **9% van de Nederlandse bevolking** kinkhoest
Iemand met kinkhoest kan **5 weken** lang anderen **besmetten**
Elk jaar belanden **170 baby's** met kinkhoest in het **ziekenhuis**
Gemiddeld **overlijdt** er in Nederland **1 baby** per jaar aan kinkhoest


Wanneer kan ik de 22-wekenprik halen?
Zoek de maand waarin je uitgerekend bent, en vind wanneer je de 22-wekenprik (kinkhoestprik) kunt halen.
Januari
september – januari
Februari
oktober – februari
Maart
november – maart
April
december – april
Mei
januari – mei
Juni
februari – juni
Juli
maart – juli
Augustus
april – augustus
September
mei – september
Oktober
juni – oktober
November
juli – november
December
augustus – december


Wanneer kan ik de griepprik halen?
Zoek de maand waarin je uitgerekend bent, en vind wanneer je de griepprik kunt halen.
Januari
oktober – januari
Februari
oktober – februari
Maart
november – februari
April
december – februari
Mei
januari – februari
Juni
februari
Juli
niet van toepassing
Augustus
niet van toepassing
September
niet van toepassing
Oktober
oktober
November
oktober – november
December
oktober – december

Appendix 2

Interview setup and guide

Participants can decide to participate in an individual interview (20 minutes) or a focus group session (60 minutes). Beforehand, they receive both versions of the leaflet, along with the following instructions:

Read both leaflets. When reading the leaflets, focus on the following aspects:

- *Identify any parts of the leaflet you think are unclear*
- *Identify any parts of the leaflet where you would like additional information*
- *Compare the two leaflets, and try to think of advantages and disadvantages of both leaflets*

During the (focus group) interview, the discussion will be more on the content of the leaflet and less about beliefs related to vaccination. The goal of the focus group is to find out participants' opinions about the leaflet and its content. To minimize the possible emotional burden, two measures will be taken:

1) At the start of the focus group, the focus group leader explicitly states that the goal of the focus group is to hear participants' opinions about the leaflet, and not about vaccination itself. If any of the participants bring up more sensitive topics related to vaccination, the topic of the conversation will be steered back to the leaflet as soon as possible.
2) All participants will be given contact information of the RIVM department that can help answer any questions they might have on the topic of maternal vaccination after the focus group discussion. This way, they know where they can go if they have unresolved questions or want to know more on the topic.

Participants are asked the following questions:

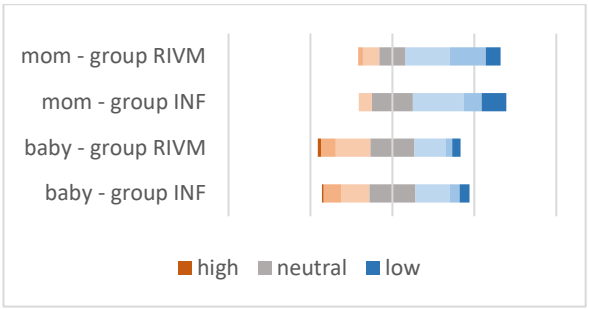
- Which parts of the leaflet did you value most?
- Are there any parts of the leaflet that were unclear to you?
- What is your opinion on the amount of text in the leaflet?
- Would you read the entire leaflet? Why?
- Do you have recommendations for improvement of the leaflet?
- Are there parts of the leaflet where you would prefer to see images instead of text?
- What is your opinion on the infographics in the leaflet?
- Did the leaflet influence your opinion about vaccination?

Appendix 3

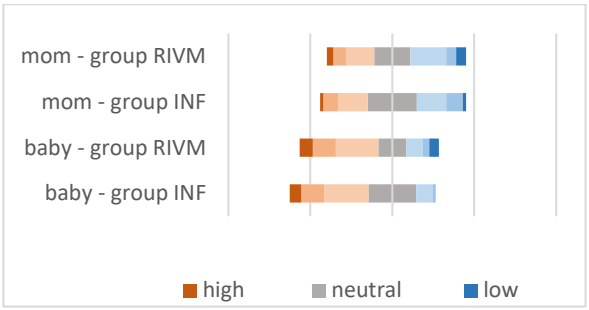
Results for the questions related to the Health Belief Model (HBM). Every graph shows the HBM variable for the mom and the baby, for both groups.

Perceived susceptibility

Pertussis

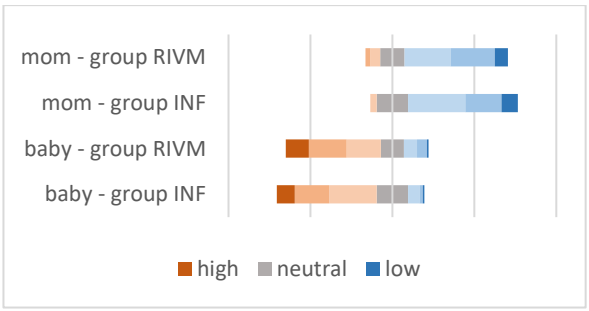


Influenza

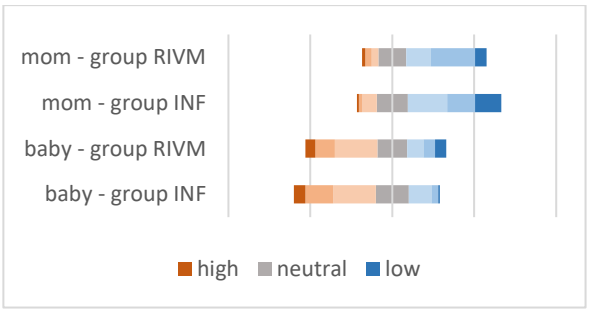


Perceived severity

Pertussis

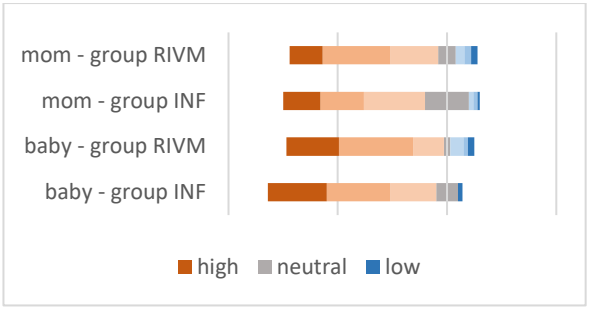


Influenza

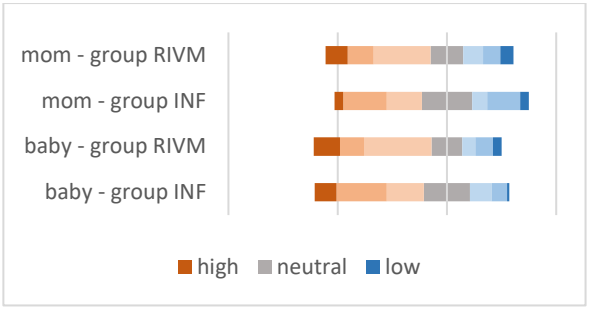


Perceived benefits

Pertussis

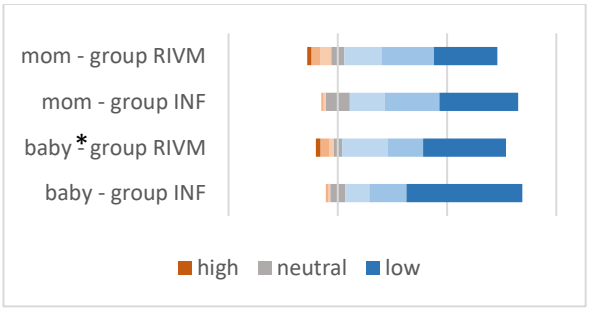


Influenza

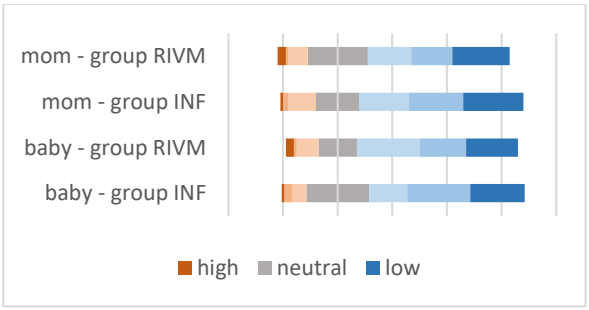


Perceived barriers*

Pertussis*



Influenza



** indicates that a significant difference was found between the two groups.*