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Smith, L.E., Webster, R.K. orcid.org/0000-0002-5136-1098, Weinman, J. et al. (3 more authors) (2017) Psychological factors associated with uptake of the childhood influenza vaccine and perception of post-vaccination side-effects : a cross-sectional survey in England. *Vaccine*, 35 (15). pp. 1936-1945. ISSN 0264-410X

<https://doi.org/10.1016/j.vaccine.2017.02.031>

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Psychological factors associated with uptake of the childhood influenza vaccine and perception of post-vaccination side-effects: A cross-sectional survey in England



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ARTICLE INFO

Article history:

Received 5 July 2016

Received in revised form 9 February 2017

Accepted 14 February 2017

Available online 8 March 2017

Keywords:

Public health

Side-effects

Influenza vaccination

Child vaccination

ABSTRACT

Objectives: To identify predictors of: uptake of the childhood influenza vaccine in the 2015–2016 influenza season, parental perceptions of side-effects from the influenza vaccine and intention to vaccinate one's child for influenza in the 2016–2017 influenza season.

Design: Cross-sectional online survey.

Setting: Data were collected in England shortly after the end of the 2015–2016 immunization campaign.

Participants: 1001 parents or guardians of children aged between two and seven.

Main outcome measures: Self-reported uptake of the childhood influenza vaccine in the 2015–2016 influenza season, perception of side-effects from the influenza vaccine and intention to vaccinate one's child in the 2016–2017 influenza season.

Results: Self-reported uptake of the childhood influenza vaccine was 52.8%. Factors strongly positively associated with uptake included the child having previously been vaccinated against influenza, perceiving the vaccine to be effective and perceiving the child to be susceptible to flu. Factors strongly negatively associated with uptake included perceiving the vaccine to be unsafe, to cause short-term side-effects or long-term health problems and believing that yearly vaccination may overload the immune system. Predictors of intended vaccine uptake in 2016–2017 were similar. Participants who perceived side-effects after the 2015–2016 vaccination reported being less likely to vaccinate their child next year.

Side-effects were more likely to be reported in first-born children, by participants who knew another child who had side-effects, those who thought that the vaccine would interact with medication that the child was currently taking, and those who believed the vaccine causes short-term side-effects.

Conclusions: Perceptions about the childhood influenza vaccine show strong associations with uptake, intended uptake and perception of side-effects. Attempts to improve uptake rates from their current low levels must address these perceptions.

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1. Introduction

In 2012, the British Joint Committee on Vaccination and Immunisation (JCVI) recommended that the influenza vaccination programme be extended to include children aged two to sixteen, in an attempt to limit the number of children who suffer from complications of influenza and to reduce morbidity and mortality

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<http://dx.doi.org/10.1016/j.vaccine.2017.02.031>

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among adults who may contract influenza from children. In the first two influenza seasons that the vaccine was offered to children, uptake in those aged two to four was around 30–40% [1,2]. In the 2015–2016 flu season, the influenza vaccine was offered to all two to four year olds via their GP and five to seven year olds in school (school years one and two). Children were offered the nasal flu spray (live attenuated influenza vaccine, Fluenz Tetra); if contraindicated, children were offered an inactivated vaccine (injection) [3]. Initial yearly figures for the 2015–2016 influenza season indicate that uptake was 30.0–37.7% in children aged two to four, 54.4% in children in school year one, and 52.9% in children

in school year two [4], falling short of the Public Health England target of 40–60% uptake in two to four year olds [3].

Factors associated with parental rejection of other vaccinations for their children include poorer parental socio-economic and employment status [5]; believing that the vaccine is unsafe [6] or ineffective [7], and that children are given too many vaccines [8]. Concerns that the vaccine causes side-effects are also commonly cited as reasons for not wanting to vaccinate one's child [7,9–11].

Although acute symptoms are common following many vaccinations, their causes are not always straightforward. While some may be directly attributable to vaccination, others may reflect pre-existing or coincidental symptoms that are misattributed to the vaccine, while still others may occur due to a 'nocebo' effect triggered by a self-fulfilling expectation of symptoms [12–14]. Expectations may be caused by seeing someone else experience symptoms after vaccination [15] or through exposure to information suggesting that side-effects are common.

We used a cross-sectional survey of parents whose child was eligible to receive the influenza vaccine in England during the 2015–2016 influenza season to test whether self-reported uptake of the vaccine and parental perception of side-effects were associated with attitudes towards influenza and the vaccine. We also tested whether these factors, together with parental perception of side-effects, were associated with intention to have their child vaccinated in the 2016–2017 season. Items assessing parental understanding of current messages about these issues were also included, in order to test the clarity of current communication about the risk of side-effects and the efficacy of the vaccine.

2. Method

2.1. The survey

We commissioned the market research company Ipsos MORI to conduct an online survey of parents or guardians of children aged between two and seven years on 31st August 2015 living in England. Data collection took place between 16th and 30th March 2016.

Ipsos MORI recruited participants from an existing panel of people willing to take part in internet surveys ($n = 160,000$ in England). Quotas based on parent age and gender (combined), location, working status, gender of child and age of child were set to reflect the known demographic profile of parents of children in England [16]. We intended to recruit 1000 participants to provide us with a sample error of about plus or minus 3%. Panel participants typically receive points for every survey they complete; for our survey, participants received points worth 75p. The study was approved by the King's College London Psychiatry, Nursing and Midwifery Research Ethics subcommittee (reference number HR-15/16-2132).

2.1.1. Selection of index child

Where participants had two or more eligible children, the survey software chose one child for them to think about when answering questions, based on the need to fill quotas for child age. If parents had two children of the same age, they were asked to choose one to think about for the duration of the survey.

2.1.2. Vaccine uptake, perception of side-effects and intended vaccine uptake

Participants were asked whether their child had received the influenza vaccination "this winter (2015/16)" and to state their main reasons for vaccinating or not vaccinating their child. Participants whose child had been vaccinated were asked whether the child had experienced any out of a list of 23 symptoms "because of the child flu vaccine." We included symptoms listed as vaccine

side-effects by the manufacturer, common symptoms taken from the Patient Health Questionnaire (PHQ-15 [17]) and other symptoms suggested by the literature [18] or by parents during our piloting. Participants who reported symptoms were asked how severe, overall, the symptoms had been and how worried they had been about them. Two items, based on those used by Paya-prom et al. [19], asked participants to rate on a five point scale whether they wanted or intended the child to be vaccinated for influenza next year.

2.1.3. Personal characteristics and perceptions and attitudes about influenza and the vaccination

We asked participants to report personal characteristics (see Table 1). Participants also rated 19 statements relating to the participant's perceptions of influenza and vaccination (see Table 2), adapted from previous work [20] on a 5-point Likert scale from "strongly agree," to "strongly disagree."

2.1.4. Terminology used in vaccine communications

Understanding of current communications regarding the effectiveness of the vaccine was assessed by one item asking participants to imagine that the childhood influenza vaccine was "50% effective." Participants endorsed one of five options for what this means, including the correct answer "if a child had a 50% chance of catching flu before being vaccinated, they now have half that chance (i.e. 25%)."

We included four items to assess understanding of terms used to communicate the incidence of acute side-effects. The four items described side-effects that were "very common" (runny or stuffy nose), "common" (fever), "uncommon" (rash) and "very rare" (severe allergic reaction) as indicated by the patient information leaflet [21]. These terms are recommended for use in patient information leaflets by European Commission guidelines and are intended to reflect side-effects that affect more than one in ten patients (very common), up to one in ten (common), up to one in 100 (uncommon) and up to one in 10,000 (very rare) [22]. Items stated, for example, that "the patient information leaflet mentions that fever is a common side-effect" and asked participants to estimate how many out of 10,000 vaccinated children would develop the specified symptom. The patient information leaflet does not describe any "rare" side-effects, so participants' understanding of this term was not assessed.

2.2. Analysis

Where relevant, we excluded data from participants who did not know or could not remember if their child had been vaccinated or had experienced side-effects. Scores for the two items assessing intention to vaccinate in 2016–2017 were combined to produce an intention score from 2 to 10 [19], with a higher score indicating a stronger intention. If participants had answered "don't know" to one or both intention questions they were excluded from the intention analysis. We defined a score of six or lower as indicating a low intention to vaccinate again in the next year, and a score of seven or more as high intention.

We recoded perceptions and attitudes about influenza and the vaccine as "agree" or "disagree". Responses of "don't know" and "neither agree nor disagree" were treated as missing data. Binary logistic regressions were used to calculate univariate associations between perceptions, personal characteristics and outcomes. Multivariate logistic regressions were used to calculate the same associations adjusting for personal characteristics. Associations between personal characteristics, perceptions and side-effect reporting, side-effect severity and side-effect worry with the outcome 'intended vaccination' were calculated using linear

Table 1
Participants' personal characteristics and associations with influenza vaccine uptake and intention to vaccinate.

Participant characteristics	Level	Influenza vaccine uptake				Intention to vaccinate child next flu season		
		Vaccinated n = 529	Not vaccinated n = 438	Odds ratio (95% CI)	Adjusted odds ratio (95% CI) ^b	Mean (SD)	B (95% CI)	Adjusted B (95% CI) ^b
Parent gender	Male	212 (52.6)	191 (47.4)	Reference	Reference	7.59 (2.35)	Reference	Reference
	Female	317 (55.9)	247 (44.1)	1.16 (0.89–1.50)	1.13 (0.79–1.64)	7.66 (2.59)	0.06 (–0.26 to 0.38)	–0.06 (–0.39 to 0.27)
Parent age	18–34	238 (60.7)	154 (39.3)	Reference	Reference	7.84 (2.45)	Reference	Reference
	35–44	238 (53.0)	211 (47.0)	0.73 (0.56–0.96)	0.88 (0.60–1.28)	7.58 (2.48)	–0.26 (–0.60 to 0.08)	–0.05 (–0.38 to 0.29)
	45+	53 (42.1)	73 (57.9)	0.47 (0.31–0.71)	0.84 (0.47–1.50)	7.10 (2.59)	–0.74 (–1.25 to –0.23)	–0.35 (–0.88 to 0.17)
Parent employment	Not working	126 (53.8)	108 (46.2)	Reference	Reference	7.66 (2.78)	Reference	Reference
	Working	403 (55.0)	330 (45.0)	1.05 (0.78–1.41)	0.98 (0.63–1.52)	7.62 (2.40)	–0.04 (–0.41 to 0.34)	–0.15 (–0.55 to 0.25)
Total household income before tax and other deductions	Under <£30,000	191 (56.7)	146 (43.3)	Reference	Reference	7.74 (2.60)	Reference	Reference
	≥£30,000	311 (54.3)	262 (46.7)	0.91 (0.69–1.19)	0.88 (0.60–1.29)	7.63 (2.39)	–0.10 (–0.44 to 0.23)	–0.07 (–0.41 to 0.28)
Parent highest educational or professional qualification	GCSE/vocational/A-level/ No formal qualifications	230 (54.1)	195 (45.9)	Reference	Reference	7.62 (2.63)	Reference	Reference
	Degree or higher (Bachelors, Masters, PhD)	289 (55.5)	232 (44.5)	1.06 (0.82–1.37)	1.18 (0.82–1.71)	7.66 (2.35)	0.03 (–0.29 to 0.35)	0.02 (–0.31 to 0.35)
Ethnicity	White	456 (56.0)	358 (44.0)	Reference	Reference	7.68 (2.48)	Reference	Reference
	Black and Minority	66 (48.9)	69 (51.1)	0.75 (0.52–1.08)	0.69 (0.42–1.12)	7.49 (2.50)	–0.20 (–0.65 to 0.26)	–0.16 (–0.61 to 0.28)
Parent chronic illness	None	343 (52.4)	312 (47.6)	Reference	Reference	7.52 (2.56)	Reference	Reference
	Present	183 (59.6)	124 (40.4)	1.34 (1.02–1.77)	1.06 (0.71–1.57)	7.84 (2.34)	0.32 (–0.19 to 0.66)	0.12 (–0.23 to 0.47)
Child gender	Male	259 (54.4)	217 (45.6)	Reference	Reference	7.62 (2.46)	Reference	Reference
	Female	270 (55.0)	221 (45.0)	1.02 (0.80–1.32)	1.23 (0.87–1.73)	7.63 (2.53)	0.01 (–0.31 to 0.33)	0.15 (–0.16 to 0.46)
First-born child	No	210 (47.1)	236 (53.9)	Reference	Reference	7.45 (2.64)	Reference	Reference
	Yes	319 (61.2)	202 (38.8)	1.78 (1.37–2.29)	1.35 (0.95–1.93)	7.78 (2.35)	0.34 (0.02–0.66)	–0.05 (–0.37 to 0.27)
Child age ^a		4.52 (1.68)		0.92 (0.85–0.99)	0.96 (0.87–1.06)	7.63 (2.49)	–0.09 (–0.18 to 0.01)	–0.04 (–0.13 to 0.05)
Child chronic illness	None	421 (52.4)	383 (47.6)	Reference	Reference	7.54 (2.55)	Reference	Reference
	Present	103 (66.9)	51 (33.1)	1.84 (1.28–2.64)	1.36 (0.82–2.26)	8.04 (2.15)	0.51 (0.08–0.93)	0.02 (–0.42 to 0.46)
Child previous flu vaccine	No	79 (19.9)	318 (80.1)	Reference	Reference	6.24 (2.78)	Reference	Reference
	Yes	434 (81.0)	102 (19.0)	17.13 (12.35–23.76)	15.54 (11.00–21.96)	8.61 (1.72)	2.37 (2.08–2.67)	2.25 (1.94–2.57)

Results highlighted in bold are significant.

^a Continuous variable. Presented as mean (sd).^b Adjusting for all other personal characteristics (both parent and child).

regressions, with a second set of linear regressions adjusting for personal characteristics. Only results of multivariate analyses are reported narratively; results of univariate analyses are shown in the tables.

Because rates of reported vaccine uptake, perceived side-effects, and intention to vaccinate the child did not change by more than 1% when using data weighted by age, gender, region and working status, we used unweighted data for our analyses.

Table 2
Associations between attitudes and perceptions vaccine uptake and intention to vaccinate.

Perception statement	Level	Influenza vaccine uptake				Intention to vaccinate child next flu season		
		Vaccinated n = 529	Not vaccinated n = 438	Odds ratio (95% CI)	Adjusted odds ratio (95% CI) ^a	Mean (SD)	B (95% CI)	Adjusted B (95% CI) ^a
The child flu vaccine has not been tested enough for me to feel it is safe	Disagree	315 (77.8)	90 (22.2)	Reference	Reference	8.82 (1.64)	Reference	Reference
	Agree	89 (34.9)	166 (65.1)	0.15 (0.11–0.22)	0.16 (0.10–0.26)	6.48 (2.80)	–2.34 (–2.68 to –2.00)	–1.78 (–2.12 to –1.44)
The child flu vaccine can cause unpleasant short-term side-effects	Disagree	151 (79.5)	39 (20.5)	Reference	Reference	8.89 (1.55)	Reference	Reference
	Agree	206 (47.5)	228 (52.5)	0.23 (0.16–0.35)	0.26 (0.16–0.43)	7.13 (2.73)	–1.76 (–2.18 to –1.35)	–1.37 (–1.77 to –0.96)
The child flu vaccine can cause long-term health problems	Disagree	293 (72.9)	109 (27.1)	Reference	Reference	8.69 (1.72)	Reference	Reference
	Agree	86 (45.5)	103 (54.5)	0.31 (0.22–0.45)	0.26 (0.15–0.42)	6.64 (2.92)	–2.05 (–2.43 to –1.67)	–1.83 (–2.22 to –1.45)
The flu vaccine would interact with other medications that [child] is currently taking	Disagree	370 (55.1)	302 (44.9)	Reference	Reference	7.66 (2.59)	Reference	Reference
	Agree	71 (64.5)	39 (35.5)	1.49 (0.98–2.26)	0.74 (0.41–1.32)	8.21 (1.96)	0.55 (0.04–1.06)	0.05 (–0.46 to 0.55)
Vaccinating [child] against flu each year will overload his/her immune system	Disagree	316 (68.7)	144 (31.3)	Reference	Reference	8.54 (2.03)	Reference	Reference
	Agree	90 (45.0)	110 (55.0)	0.37 (0.27–0.52)	0.27 (0.16–0.44)	6.92 (2.67)	–1.62 (–2.00 to –1.25)	–1.43 (–1.80 to –1.05)
Another child I know had side-effects from the vaccine	Disagree	312 (56.5)	240 (43.5)	Reference	Reference	7.96 (2.41)	Reference	Reference
	Agree	113 (58.9)	79 (41.1)	1.10 (0.79–1.54)	0.647 (0.41–1.02)	7.49 (2.58)	–0.48 (–0.88 to –0.73)	–0.83 (–1.21 to –0.44)
A health professional has recommended that [child] <u>should</u> be vaccinated	Disagree	112 (33.6)	211 (66.4)	Reference	Reference	6.66 (2.75)	Reference	Reference
	Agree	284 (76.3)	88 (23.7)	6.08 (4.37–8.47)	3.61 (2.36–5.50)	8.61 (1.98)	1.95 (1.59–2.30)	1.11 (0.72–1.49)
A health professional has recommended that [child] <u>shouldn't</u> be vaccinated	Disagree	381 (57.6)	280 (42.4)	Reference	Reference	7.79 (2.50)	Reference	Reference
	Agree	84 (62.7)	50 (37.3)	1.24 (0.84–1.81)	0.853 (0.51–1.44)	7.95 (2.28)	0.16 (–0.30 to 0.63)	–0.13 (0.58–0.32)
A friend/relative has recommended that [child] shouldn't be vaccinated	Disagree	363 (56.8)	276 (43.2)	Reference	Reference	7.84 (2.51)	Reference	Reference
	Agree	90 (60.0)	60 (40.0)	1.14 (0.79–1.64)	0.73 (0.45–1.18)	7.77 (2.33)	–0.07 (–0.51 to 0.38)	–0.41 (–0.85 to 0.02)
If I don't vaccinate [child], then [child] will get flu	Disagree	66 (25.2)	196 (74.8)	Reference	Reference	5.43 (2.67)	Reference	Reference
	Agree	225 (74.8)	76 (25.2)	8.79 (6.00–12.87)	4.46 (2.66–7.48)	8.85 (1.62)	3.42 (3.06–3.78)	2.90 (2.48–3.31)
Flu would be a serious illness for [child]	Disagree	69 (38.8)	109 (61.2)	Reference	Reference	6.25 (3.04)	Reference	Reference
	Agree	370 (62.2)	225 (37.8)	2.60 (1.84–3.67)	1.66 (1.03–2.66)	8.26 (2.09)	2.01 (1.61–2.41)	1.40 (0.99–1.81)
Flu would be a serious illness for me	Disagree	113 (43.3)	148 (56.7)	Reference	Reference	6.65 (2.93)	Reference	Reference
	Agree	287 (62.0)	176 (38.0)	2.14 (1.57–2.91)	1.40 (0.92–2.13)	8.26 (2.07)	1.61 (1.24–1.98)	0.97 (0.60–1.35)
Flu would be a serious illness for someone living in [child]'s household	Disagree	98 (45.2)	119 (54.8)	Reference	Reference	6.47 (2.96)	Reference	Reference
	Agree	301 (61.6)	188 (38.4)	1.94 (1.41–2.69)	1.36 (0.87–2.12)	8.24 (2.19)	1.78 (1.38–2.17)	1.27 (0.88–1.66)

(continued on next page)

Table 2 (continued)

Perception statement	Level	Influenza vaccine uptake				Intention to vaccinate child next flu season		
		Vaccinated n = 529	Not vaccinated n = 438	Odds ratio (95% CI)	Adjusted odds ratio (95% CI) ^a	Mean (SD)	B (95% CI)	Adjusted B (95% CI) ^a
Having the child flu vaccine is an effective way of preventing [child] from catching flu	Disagree	29 (23.4)	95 (76.6)	Reference	Reference	4.62 (2.77)	Reference	Reference
	Agree	427 (71.6)	169 (28.4)	8.28 (5.27–13.01)	4.56 (2.58–8.08)	8.75 (1.63)	4.14 (3.77–4.51)	3.43 (3.03–3.82)
I don't like [child] having vaccinations in general	Disagree	308 (63.0)	181 (37.0)	Reference	Reference	8.26 (2.23)	Reference	Reference
	Agree	103 (47.2)	115 (52.8)	0.53 (0.38–0.73)	0.53 (0.34–0.82)	6.71 (2.95)	–1.55 (–1.96 to –1.15)	–1.34 (–1.73 to –0.95)
I don't know enough about the child flu vaccine	Disagree	242 (77.3)	71 (22.7)	Reference	Reference	8.49 (2.23)	Reference	Reference
	Agree	124 (32.8)	254 (67.2)	0.14 (0.10–0.20)	0.16 (0.10–0.25)	6.80 (2.61)	–1.69 (–2.06 to –1.32)	–1.08 (–1.45 to –0.70)
Vaccinating [child] against flu each year is too much of an ongoing time commitment	Disagree	381 (60.3)	251 (39.7)	Reference	Reference	7.96 (2.47)	Reference	Reference
	Agree	82 (60.3)	54 (39.7)	1.00 (0.68–1.46)	0.59 (0.35–1.00)	7.74 (2.26)	–0.22 (–0.67 to 0.23)	–0.48 (–0.94 to –0.03)
The child flu vaccine does not suit my religious or cultural beliefs/values	Disagree	385 (57.0)	291 (43.0)	Reference	Reference	7.90 (2.38)	Reference	Reference
	Agree	74 (62.2)	45 (37.8)	1.24 (0.83–1.86)	0.93 (0.54–1.61)	7.57 (2.60)	–0.33 (–0.81 to 0.14)	–0.55 (–1.02 to –0.09)
The vaccination campaign is just about making money for the manufacturers	Disagree	314 (70.4)	132 (29.4)	Reference	Reference	8.59 (1.86)	Reference	Reference
	Agree	77 (39.9)	116 (60.1)	0.28 (0.20–0.40)	0.23 (0.14–0.38)	6.20 (3.04)	–2.39 (–2.77 to –2.00)	–2.14 (–2.53 to –1.75)
Perception of side-effects	No	–	–	–	–	9.17 (1.13)	Reference	Reference
	Yes	–	–	–	–	8.62 (1.61)	–0.54 (–0.78 to –0.31)	–0.53 (–0.79 to –0.26)
Severity of side-effects	Very mild	–	–	–	–	9.29 (1.60)	Reference	Reference
	Mild	–	–	–	–	8.68 (1.28)	–0.61 (–1.11 to –0.11)	–0.63 (–1.18 to –0.08)
	Moderate	–	–	–	–	7.82 (1.98)	–1.47 (–2.11 to –0.83)	–1.59 (–2.27 to –0.91)
	Severe	–	–	–	–	7.20 (1.92)	–2.09 (–3.49 to –0.69)	–2.02 (–3.46 to –0.58)
Worry about side-effects	Not at all worried	–	–	–	–	9.13 (1.54)	Reference	Reference
	Not very worried	–	–	–	–	8.53 (1.56)	–0.60 (–1.18 to –0.02)	–0.44 (–1.07 to 0.19)
	Fairly worried	–	–	–	–	8.49 (1.25)	–0.65 (–1.25 to –0.04)	–0.53 (–1.19 to 0.13)
	Very worried	–	–	–	–	8.25 (2.63)	–0.88 (–1.72 to –0.04)	–0.72 (–1.60 to 0.16)

Results highlighted in bold are significant.

^a Adjusting for all personal characteristics (both parent and child).

3. Results

3.1. Participants

Of 11,563 people emailed the link to the survey, 1310 began it. After removing those who did not complete the survey (n = 268), who completed suspiciously quickly or who provided identical answers to multiple consecutive questions (“speeding” or “straightlining;” n = 34), or who experienced a technical malfunction during the survey (n = 7), 1001 parents or guardians completed the study (response rate = 8.7%).

Personal characteristics of participants and their children are shown in Table 1.

3.2. Vaccine uptake

529 participants (52.8%) reported that their child had been vaccinated for influenza in the 2015–2016 season, 441 (44.1%) reported that their child had not been vaccinated and 34 (3.4%) did not know. Participants' reasons for vaccinating or not vaccinating their child are reported in the supplementary materials. The most common reason for vaccinating was to protect the child from

influenza, cited by 61.2% of participants, whereas the most commonly reported reason for not vaccinating was because participants thought that the child was generally healthy and they were not overly worried about catching influenza (43.2%), followed by the perception that the vaccine causes side-effects (21.7%).

Associations between personal characteristics, perceptions about influenza and the vaccine and vaccination uptake in the 2015–2016 season are reported in [Tables 1 and 2](#). When controlling for all other personal characteristics, participants whose child had a previous influenza vaccination; who believed the influenza vaccine to be effective; perceived the child to be susceptible to flu; had a health professional recommend that the child should be vaccinated; and those who perceived influenza to be a serious illness for the child had increased the odds of vaccine uptake. Factors associated with lower likelihood of uptake included: feeling that they do not know enough about the vaccine; perceiving the vaccine to be unsafe; believing the vaccination campaign to be only about making money for the manufacturers; believing that the vaccine causes short-term side-effects and long-term health problems; believing that yearly vaccination would overload the child's immune system; not liking vaccines in general; and believing yearly influenza vaccinations to be too much of an ongoing time commitment.

3.3. Side-effect perception

Of participants who reported that their child had been vaccinated, 215 (41.0%) indicated that their child had experienced at least one side-effect. The most common side-effect reported was runny or stuffy nose ($n = 84$, 16.0%). "Flu" was reported as a side-effect by 33 participants (6.3%; see [supplementary materials](#) for full results).

Side-effects were described as "very mild" by 52 participants (24.3%), "mild" by 118 (55.1%), "moderate" by 39 (18.2%) and "severe" by 5 (2.3%). No-one reported "very severe" side-effects. 47 (21.8%) participants indicated that they were "not at all worried" about their child's side-effects, 80 (37.0%) stated that they were "not very worried," 68 (31.5%) were "fairly worried" and 21 (9.7%) were "very worried."

Associations between personal characteristics, perceptions about influenza and the vaccine, and perception of side-effects are reported in [Tables 3 and 4](#). When controlling for all other personal characteristics, participants were more likely to report side-effects if the child had a chronic illness or was first-born. Participants had increased odds of perceiving side-effects if they: knew another child who had experienced side-effects from the influenza vaccine; thought that the influenza vaccine would interact with other medications that the child was taking; believed that yearly influenza vaccination was too much of an ongoing time commitment; believed that yearly vaccination will overload the immune system; believed the influenza vaccine can cause short-term side-effects or long-term health problems; believed the vaccine goes against one's religious or cultural beliefs; believed that the vaccination campaign is just about making money for the manufacturers; had a health professional, friend or relative recommend that the child should not be vaccinated; believed the vaccine to be unsafe; did not like vaccines for the child in general; believed influenza to be a serious illness for the child, oneself or someone in the child's household; or felt they did not know enough about the vaccine. Female participants and older participants were less likely to report side-effects.

3.4. Intended vaccine uptake

668 (70.3%) participants had a high intention to vaccinate their child in the 2016–2017 influenza season. Associations between

personal characteristics, perceptions about influenza and the vaccine, and intention to vaccinate in the 2016–2017 season are reported in [Tables 1 and 2](#). The pattern of results for intention to vaccinate was broadly similar to that for reported uptake. Participants who perceived side-effects following vaccination in the 2015–2016 influenza season were less likely to intend to vaccinate their child the following year, as were those who knew another child who had experienced side-effects from the vaccine. In those participants who stated that their child had experienced a side-effect as a result of the influenza vaccine, perceived severity of the side-effect was associated with decreased intention to vaccinate one's child.

3.5. Terminology used in vaccine communications

The correct interpretation of "50% vaccine effectiveness" was selected by 195 participants (19.5%; see [supplementary materials](#)). The most commonly endorsed option was that "50% of children who have the vaccine will be immune to flu" (28.8%, $n = 288$).

Estimates of the incidence of acute side-effects with different verbal descriptors of risk are reported in the [supplementary materials](#). The median estimate for a "very common" side-effect was 5000 in every 10,000 children (1 in 2), 2000 for "common side-effects" (1 in 5), 199 for "uncommon side-effects (1 in 50) and 50 for "very rare" side-effects (1 in 200). Interquartile ranges for these estimates overlapped greatly.

4. Discussion

We observed similar child influenza vaccine uptake rates (52.8%) as national estimates [4]. However, over 70% of participants reported intending to vaccinate their child in the 2016–2017 influenza season. Rather than reflecting a sudden increase in uptake between the two influenza seasons, this difference probably reflects the gap between intentions and behaviours that is commonly observed across many health behaviours [23].

The largest effect exerted by any factor on uptake was that of having previously vaccinated the child against influenza, a common finding in the literature [9,20,24]. Parental perceptions and attitudes were also strongly associated with uptake and intended uptake. In line with theories regarding factors that predict uptake of health protective behaviours [25] and other findings in the wider literature [9,10], perceptions about the risk associated with influenza (severity of the illness and child vulnerability) and believing the vaccine to be an effective way of reducing this risk were associated with uptake. Factors relating to possible future adverse events caused by the vaccine, such as it causing short-term side-effects, long-term health problems and overloading the child's immune system, were associated with a decrease in the odds of vaccination, as was perceiving the vaccine to be unsafe. These factors were also strongly associated with intention to vaccinate the child in the 2016–2017 season.

Observing side-effects following vaccination was associated with reduced intention to vaccinate the child again next year, a result also seen in other studies [11]. Of those who vaccinated their child, 41% perceived acute side-effects, in line with clinical trial data [26]. Beliefs and perceptions relating to possible adverse effects from the vaccine greatly increased the odds of perceiving side-effects. Social influences, including knowing another child who had experienced side-effects from the influenza vaccine and having friends, relatives or a health professional recommend against vaccination, were also found to predict perception of side-effects. These factors may contribute to parents' expectations that their child will experience side-effects following vaccination, with this expectation becoming self-fulfilling [12,13]. Personal

Table 3
Participants' personal characteristics and associations with perception of side-effects.

Parent characteristics	Level	Perception of side-effects ^c			
		Perceived side-effects n = 216	No perceived side-effects n = 310	Odds ratio (95% CI)	Adjusted odds ratio (95% CI) ^b
Parent gender	Male	97 (46.0)	114 (54.0)	Reference	Reference
	Female	118 (37.6)	196 (62.4)	0.71 (0.50–1.01)	0.65 (0.42–0.99)
Parent age	18–34	117 (47.6)	129 (52.4)	Reference	Reference
	35–44	84 (35.6)	152 (64.4)	0.57 (0.29–0.82)	0.58 (0.38–0.88)
	45+	14 (26.9)	38 (73.1)	0.38 (0.20–0.73)	0.45 (0.21–0.96)
Employment	Not working	44 (35.2)	81 (64.8)	Reference	Reference
	Working	171 (42.8)	229 (57.3)	1.38 (0.91–2.09)	0.96 (0.57–1.60)
Total household income before tax and other deductions	Under <£30,000	75 (39.5)	115 (60.5)	Reference	Reference
	≥£30,000	132 (42.9)	176 (57.1)	1.15 (0.80–1.66)	0.93 (0.60–1.45)
Parent highest educational or professional qualification	GCSE/vocational/A-level/No formal qualifications	75 (32.9)	153 (67.1)	Reference	Reference
	Degree or higher (Bachelors, Masters, PhD)	137 (47.7)	150 (52.3)	1.86 (1.30–2.67)	1.51 (0.97–2.36)
Ethnicity	White	178 (39.2)	276 (60.8)	Reference	Reference
	Black and Minority	35 (54.7)	29 (45.3)	1.87 (1.11–3.17)	1.55 (0.85–2.80)
Parent chronic illness	None	139 (40.6)	203 (59.4)	Reference	Reference
	Present	75 (41.7)	105 (58.3)	1.04 (0.72–1.51)	1.05 (0.68–1.63)
Child gender	Male	118 (45.7)	140 (54.3)	Reference	Reference
	Female	97 (36.3)	170 (63.7)	0.68 (0.48–0.96)	0.74 (0.50–1.09)
First-born child	No	64 (30.9)	143 (69.1)	Reference	Reference
	Yes	151 (47.5)	167 (52.5)	2.02 (1.40–2.92)	1.61 (1.06–2.43)
Child age ^a		4.52 (1.68)		0.95 (0.86–1.05)	0.95 (0.84–1.06)
Child chronic illness	None	159 (38.1)	258 (61.9)	Reference	Reference
	Present	54 (52.4)	49 (47.6)	1.79 (1.16–2.76)	1.67 (1.01–2.78)
Child previous flu vaccine	No	25 (32.1)	53 (67.9)	Reference	Reference
	Yes	189 (43.8)	243 (56.3)	1.65 (0.99–2.75)	1.43 (0.80–2.53)

Results highlighted in bold are significant.

^a Continuous variable. Presented as mean (sd).

^b Adjusting for all personal characteristics (both parent and child).

^c When asked why they had not vaccinated their child, three people indicated that they had answered the vaccination question incorrectly and that they had indeed vaccinated their child; these participants' results were recoded, but because of the scripting of the questionnaire, they were not asked side-effect perception questions. One participant who stated that their child had been vaccinated could not remember whether they had experienced any side-effects, therefore side-effect perception data for this participant were removed from the analysis. As such, side-effect perception data for 525 parents is presented.

characteristics that may link to perceptions of a child's general vulnerability, including whether the child had a chronic illness or was first-born also predicted parental perception of side-effects.

Our identification of strong predictors of vaccine uptake, perception of side-effects and intended uptake has important implications for future communications about the child influenza vaccine. To improve uptake, messages to parents should be targeted at perceptions that are both amenable to change and strongly associated with lack of uptake or side-effect reporting, in particular those surrounding possible future adverse events that may occur as a result of the vaccine. Communications should also emphasise that the vaccine is safe and effective while highlighting that children are susceptible to and are at risk of developing complications from influenza. In addition, all healthcare providers should be encouraged to provide strong vaccine recommendations; data indicate that almost half of participants disagreed that a health professional

had recommended vaccination. In order to assess the impact of specific attitudes and perceptions, we treated answers of "don't know" and "neither agree nor disagree" as missing data. In practice, approximately 5% and 15–25% of participants provided such responses for each item respectively. This suggests that a substantial proportion of the public are willing to admit their lack of knowledge about these issues and may be open to new information.

Implementing an effective communication strategy targeting these variables presents a number of challenges. Terminology used in past communications about the influenza vaccine discusses the "effectiveness" of vaccines [27,28], however, this terminology was found to be incompletely understood by participants. Given the association between perceived efficacy and uptake, research on how best to communicate about efficacy should now be a priority. Terminology surrounding the incidence of side-effects following

Table 4
Associations between attitudes and perceptions and perception of side-effects.

Perception statement	Level	Perception of side-effects			
		Perceived side-effects n = 216	No perceived side-effects n = 310	Odds ratio (95% CI) ^a	Adjusted odds ratio (95% CI)
The child flu vaccine has not been tested enough for me to feel it is safe	Disagree	103 (33.0)	209 (67.0)	Reference	Reference
	Agree	59 (66.3)	30 (33.7)	3.99 (2.42–6.57)	3.31 (1.87–5.88)
The child flu vaccine can cause unpleasant short-term side-effects	Disagree	37 (24.5)	114 (75.5)	Reference	Reference
	Agree	131 (63.9)	74 (36.1)	5.45 (3.42–8.71)	6.11 (3.61–10.35)
The child flu vaccine can cause long-term health problems	Disagree	88 (30.2)	203 (69.8)	Reference	Reference
	Agree	63 (73.3)	23 (26.7)	6.32 (3.69–10.83)	5.16 (2.70–9.85)
The flu vaccine would interact with other medications that [child] is currently taking	Disagree	116 (31.7)	250 (68.3)	Reference	Reference
	Agree	56 (78.9)	15 (21.1)	8.05 (4.37–14.82)	7.18 (3.42–15.04)
Vaccinating [child] against flu each year will overload his/her immune system	Disagree	99 (31.6)	214 (68.4)	Reference	Reference
	Agree	68 (75.6)	22 (24.4)	6.68 (3.91–11.43)	5.65 (2.96–10.80)
Another child I know had side-effects from the vaccine	Disagree	79 (25.6)	230 (74.4)	Reference	Reference
	Agree	83 (74.1)	29 (25.9)	8.33 (5.08–13.66)	7.27 (4.11–12.83)
A health professional has recommended that [child] <u>should</u> be vaccinated	Disagree	36 (32.4)	75 (67.6)	Reference	Reference
	Agree	136 (48.4)	145 (51.6)	1.95 (1.23–3.10)	1.66 (0.98–2.82)
A health professional has recommended that [child] <u>shouldn't</u> be vaccinated	Disagree	130 (34.4)	248 (65.6)	Reference	Reference
	Agree	61 (73.5)	22 (26.5)	5.29 (3.11–9.00)	4.17 (2.25–7.72)
A friend/relative has recommended that [child] shouldn't be vaccinated	Disagree	118 (32.9)	241 (67.1)	Reference	Reference
	Agree	59 (65.6)	31 (34.4)	3.89 (2.39–6.33)	3.46 (1.94–6.15)
If I don't vaccinate [child], then [child] will get flu	Disagree	27 (41.5)	38 (58.5)	Reference	Reference
	Agree	112 (50.2)	111 (49.8)	1.42 (0.81–2.48)	1.11 (0.57–2.18)
Flu would be a serious illness for [child]	Disagree	13 (19.1)	55 (80.9)	Reference	Reference
	Agree	164 (44.6)	204 (55.4)	3.40 (1.80–6.44)	2.43 (1.19–4.98)
Flu would be a serious illness for me	Disagree	31 (27.9)	80 (72.1)	Reference	Reference
	Agree	139 (48.4)	148 (51.6)	2.42 (1.51–3.90)	2.45 (1.41–4.24)
Flu would be a serious illness for someone living in [child]'s household	Disagree	28 (28.9)	69 (71.1)	Reference	Reference
	Agree	131 (43.8)	168 (56.2)	1.92 (1.17–3.15)	1.84 (1.04–3.25)
Having the child flu vaccine is an effective way of preventing [child] from catching flu	Disagree	15 (53.6)	13 (46.4)	Reference	Reference
	Agree	169 (39.8)	256 (60.2)	0.572 (0.27–1.23)	0.54 (0.22–1.28)
I don't like [child] having vaccinations in general	Disagree	98 (32.2)	206 (67.8)	Reference	Reference
	Agree	65 (63.1)	38 (36.9)	3.60 (2.25–5.74)	2.91 (1.71–4.94)
I don't know enough about the child flu vaccine	Disagree	82 (34.2)	158 (65.8)	Reference	Reference
	Agree	64 (52.0)	59 (48.0)	2.09 (1.34–3.26)	2.09 (1.26–3.46)
Vaccinating [child] against flu each year is too much of an ongoing time commitment	Disagree	117 (31.0)	260 (69.0)	Reference	Reference
	Agree	63 (76.8)	19 (23.2)	7.37 (4.22–12.87)	6.16 (3.17–11.98)
The child flu vaccine does not suit my religious or cultural beliefs/values	Disagree	124 (32.5)	257 (67.5)	Reference	Reference
	Agree	56 (75.7)	18 (24.3)	6.45 (3.64–11.43)	4.94 (2.55–9.57)
The vaccination campaign is just about making money for the manufacturers	Disagree	105 (33.8)	206 (66.2)	Reference	Reference
	Agree	56 (72.7)	21 (27.3)	5.23 (3.01–9.10)	4.49 (2.33–8.66)

Results highlighted in bold are significant.

^a Adjusting for all personal characteristics (both parent and child).

vaccination used in past communications [21,29] also gave rise to elevated estimates of incidence [30,31]. Verbal descriptors of risk often result in elevated estimates of incidence [30,31], something

reflected in our findings where for three out of four verbal descriptors of risk, median estimates of incidence of side-effects were higher than those described in the patient information leaflet

[21]. Additional research on how best to communicate this information is required.

One limitation of this study is its cross-sectional design, making causal inferences difficult to draw for some of the associations we observed. This is particularly problematic with respect to the association between perceptions and side-effect reporting. While it is possible that negative perceptions of the vaccine lead to an increased likelihood of side-effects being observed, it is also possible that observing side-effects leads to negative perceptions. In order to disentangle the direction of causality, a longitudinal study should be conducted. A second limitation relates to selection bias. Whether members of market research panels are psychologically representative of the general population in terms of attitudes to vaccination is unknown [32]. While it is possible that parents who had vaccinated their child were more likely to complete the study, rates of reported uptake were in line with national figures [4]. Particular strengths of the study include the timing of data collection soon after the end of the influenza vaccination campaign [33], reducing the likelihood of recall bias for our outcome measures.

This study is the first to investigate parental perceptions surrounding the newly introduced child influenza vaccine in the UK and the first to investigate the association between attitudes and side-effect perception following immunisation. Although a causal link cannot definitively be established, our data are consistent with the theory that past behaviour, attitudes and social influences affect both uptake and side-effect perception. Terminology currently used to describe vaccine side-effects in communications leads people to estimate a higher incidence of side-effects. Efforts to improve uptake should now focus on tackling these perceptions.

Author contributions

LS designed the survey materials with guidance from GJR, JY, RA and JW. RW designed survey materials relating to risk communication of side-effects. LS carried out data analysis and was responsible for drafting the manuscript, with guidance from GJR. All authors read and approved the final version of the manuscript.

Funding sources

The research was funded by the National Institute for Health Research Health Protection Research Unit (NIHR HPRU) in Emergency Preparedness and Response at King's College London in partnership with Public Health England (PHE). The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR, the Department of Health or Public Health England.

Conflicts of interest

None.

Acknowledgements

We thank the study participants; those from Ipsos MORI who worked on the study, in particular Stephanie Crowe and Louise Park; and Richard Pebody.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.vaccine.2017.02.031>.

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