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Knowledge, attitudes, and practices regarding seasonal influenza vaccination during pregnancy in Costa Rica: A mixed-methods study

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Abstract

Background: Influenza increases stillbirth risk, morbidity and mortality in pregnant women. Vaccination protects pregnant women against severe disease and indirectly protects their infants, but coverage among pregnant women remains low worldwide. We aimed to describe knowledge, attitudes, and practices (KAP) regarding seasonal influenza vaccination among postpartum women and prenatal care physicians in Costa Rica.

Methods: We conducted cross-sectional KAP surveys to women one to three days after childbirth at Costa Rican Social Security Fund maternity hospitals, and obstetricians and general practitioners who provided prenatal care in 2017. Principal components analysis, multiple imputation, and logistic regression were used to examine associations between influenza vaccination and demographics, prenatal care, and sources of information—separately for postpartum women and physicians. We also held two focus groups of six healthcare workers each to further describe vaccination KAP.

Results: We surveyed 642 postpartum women and 146 physicians in maternity hospitals in five Costa Rican provinces of whom 85.5 % (95 % CI: 82.6 %−88.0 %) and 57.9 % (95 % CI: 49.6 %−65.7 %) were vaccinated for influenza, respectively. Factors associated with influenza vaccination for postpartum women included tetanus vaccination (aOR: 3.62, 95 % CI: 1.89–6.92); received vaccination recommendations from clinicians during prenatal check-ups (aOR: 3.39, 95 % CI: 2.06–5.59); had other children in household vaccinated for influenza (aOR: 2.25, 95 % CI: 1.08–4.68); and secondary/university education (aOR: 0.15–0.31) with no formal education as

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2022.10.023.

reference. For postpartum women, reasons for vaccination were perceived benefits for mother and infant, whereas not being offered vaccines was most cited for non-vaccination. Most prenatal care physicians recommended influenza vaccines during prenatal check-ups but believed vaccination causes flu-like symptoms.

Conclusion: Vaccination campaigns and provisions of free vaccines effectively increased knowledge and coverage among women in Costa Rica. To improve access, women should be offered vaccines during prenatal care appointments. Educating healthcare workers about vaccine benefits for themselves and patients is needed to mitigate safety concerns.

Keywords

Central America; Vaccination coverage; Pregnant women; Healthcare workers; Influenza vaccines; Postpartum women; Prenatal care

1. Introduction

The World Health Organization (WHO) estimates 5–10 % of adults and 20–30 % of children become infected with influenza annually, resulting in 3–5 million severe cases and 290,000–650,000 deaths [1]. Approximately 82 % of hospital deaths from acute lower respiratory infections occur in low- and lower-middle income countries [2]. In Costa Rica from 2010 to 2015, the annual influenza-associated respiratory hospitalization rate was 99 per 100,000 people (95 % CI: 46–213 per 100,000) aged < 5 years, 15 per 100,000 (95 % CI: 8–26) aged 5–64 years, and 88 per 100,000 (95 % CI: 45–173) aged ≥ 65 years [3]. Diseases of the respiratory system constitute the fourth leading cause of death (3.4 per 10,000) in Costa Rica, accounting for 9 % of all deaths [4].

Pregnant women in all three trimesters are at increased influenza-related morbidity and mortality risk, particularly those with chronic medical conditions, which may be attributed to physiological, hormonal, and immunologic changes during pregnancy [5]. Influenza also increases risk of stillbirth [5]. WHO Strategic Advisory Group of Experts on Immunization (SAGE) and Centers for Disease Control and Prevention's (CDC) Advisory Committee on Immunization Practices (ACIP) recommend influenza vaccination for pregnant women at any stage of pregnancy [6,7]. These recommendations are based on evidence of direct protection against severe disease to pregnant women and indirect protection to infants younger than six months through passive antibody transfer, the latter of whom are not eligible for influenza vaccination with currently licensed vaccines [8,9]. A systematic review of countries in the tropics demonstrated that vaccinating pregnant women prevented 50 % of laboratory-confirmed influenza in healthy mothers and 49–63 % in infants < 6 months [10]. SAGE and ACIP also recommend vaccinating healthcare workers to protect the individual, maintain continuity of healthcare services during epidemics, and protect vulnerable patients [6,7].

Despite these recommendations, vaccination coverage among pregnant women remains low worldwide, which may be attributed to misconceptions regarding vaccine efficacy or side effects, underestimating influenza severity, and lack of access to vaccines [11]. Many studies have shown direct physician recommendations are key reasons for vaccination among

pregnant women [12,13], but healthcare workers with unfavorable attitudes or aversion to vaccination may be less likely to recommend vaccines to patients [14]. Few studies have examined factors affecting vaccination among both pregnant/postpartum women and prenatal care physicians from the same regions or healthcare facilities.

Unlike many middle-income countries, all governments in Central America have seasonal influenza vaccination programs, which generally follow SAGE recommendations. Costa Rica began influenza vaccination for risk groups in 2004 [15], including children 6–35 months of age, people with chronic diseases, adults > 60 years of age, pregnant women at any gestational age, and healthcare workers who provide direct care to patients [16]. Influenza vaccines are available free-of-charge for risk groups during national campaigns which begin in June and last for six weeks.

Currently, there are no studies evaluating factors affecting vaccination among pregnant women in Costa Rica. We therefore aimed to describe knowledge, attitudes, and practices (KAP) regarding seasonal influenza vaccination among postpartum women and healthcare personnel who provide prenatal care. We surveyed women in their immediate postpartum period instead of pregnant women to better evaluate vaccination coverage throughout pregnancy. Information resulting from this study will support the country's authorities in prioritizing access, education, and communication strategies to facilitate influenza vaccination for these populations.

2. Methods

2.1. Study design

We used a quantitative and qualitative approach to evaluate seasonal influenza KAP. Quantitative methods included cross-sectional KAP surveys from June 26-July 31, 2017, among women one to three days after childbirth, and obstetricians and general practitioners who provided prenatal care at maternity hospitals of the Costa Rican Social Security Fund (CCSS). Qualitative methods included focus groups of healthcare workers in leadership roles. These individuals were subject matter experts on influenza vaccination, public policy, resource allocation, and clinical application and included teaching staff in healthcare facilities and universities, staff in medical and nursing headquarters, vaccination program coordinators, infectious disease specialists, and pulmonologists. Questionnaire, sampling, and focus group methods are provided in Supplementary Methods.

3. Setting

Costa Rica has a total area of 51,100 km^2 and is divided into seven provinces, 81 cantons, and 463 districts. It has a population of 5,151,000 [17]. San José is the capital and largest city with 1,441,000 residents. Public healthcare services have been provided by CCSS since 1993, which cover 87 % of the population [18]. Health expenditure accounts for 7.3 % of Costa Rica's Gross Domestic Product and there are 2.9 physicians/1,000 population [17]. Costa Rica has an estimated birth rate of 14.3 births/1,000 population (2022), fertility rate of 1.9 children born/woman (2021), infant mortality rate of 8.6 deaths/1,000 live births (2021),

and maternal mortality rate of 27 deaths/100,000 live births (2017) [17]. Seasonal influenza typically peaks in November, followed by a second smaller peak in July [19].

3.1. Statistical analysis

Frequency distributions of demographics were reported for postpartum women (age group, province of residence, race, education, occupation, comorbidities, number of children in household, average age and vaccination status of other children, number of prenatal visits, received vitamin supplements during pregnancy, tetanus vaccination status, clinician recommended vaccine, self-reported and verified vaccination) and prenatal care physicians (age group, sex, profession, years in profession, province, service network, treated influenza patients, self-reported vaccination). Frequencies and 95 % CIs were reported for vaccination knowledge, reasons for and for not receiving vaccination, and sources of information. Fisher's exact test was used to evaluate associations between knowledge variables and influenza vaccination. Principal components factor analyses were used to examine potential factors to represent knowledge variables for postpartum women and physicians (Supplementary Methods). Logistic regression was used to analyze associations between characteristics (demographics, prenatal care variables, sources of information regarding vaccination), and self-reported influenza vaccination—done separately for postpartum women and physicians (Supplementary Methods).

Among all postpartum women and physicians included, there were small amounts of missing data for demographics and knowledge variables. This ranged from 0.2% for tetanus vaccination status to 3.6% for race. We used multiple imputation with predictive mean matching for these missing data to increase statistical power and minimize selection bias, which was done separately for postpartum women and physicians (Supplementary Methods). Statistical analyses were done in R software, version 4.1.2 (R Foundation for Statistical Computing).

4. Ethics statement

This study was approved by the Research Ethics committee of UVG (Protocol number 156-11-2016) and Center for Strategic Development and Information on Health and Social Security of CCSS (study code AB-1513-17). It was registered with the National Health Research Council of Costa Rica. Written informed consent was obtained for all participants.

5. Results

5.1. Sample characteristics

Of 676 eligible postpartum women, 34 (5 %) refused to participate. We surveyed 642 postpartum women in nine healthcare facilities in five of seven Costa Rican provinces. Thirty-seven (5.8 %) were adolescents at the time of the survey, 53.0 % were from San José, 66.9 % were Mestiza (mixed Amerindian/European ancestry), 58.7 % had exclusive homecare as their occupation, and 56.4 % had at least one other child (Table 1). Additionally, 133 participants (20.7 %) had finished or were attending primary school and 286 (44.5 %) secondary school. Medical records showed that 8.6 % had a premature delivery and 15.7 % had a concurrent chronic disease, the most prevalent being asthma (72

cases), chronic heart disease (13 cases) and diabetes (11 cases). Only one participant had not received prenatal care and 74.5 % were recommended influenza vaccination by a clinician during prenatal check-ups.

We also surveyed 146 prenatal care physicians who worked in CCSS maternity hospitals in five provinces. Of all physicians, 55 % were female, 60.3 % practiced in San José, 35.6 % specialized in gynecology/obstetrics, and 65 % had treated influenza patients (Table 2). Thirty-five (24.5 %) worked at another healthcare facility in addition to the hospital where they were surveyed, including 33 in private healthcare services. Median age and years of profession were 35 years (IQR: 29–44) and 8 years (IQR: 4–17 years).

5.2. Knowledge of influenza vaccination

Of all postpartum women, 97.0 % were aware of influenza vaccines and 91.7 % perceived them as safe (Table S2). However, 23.7 % were unaware influenza may be spread from person to person and only 65.6 % believed vaccination could protect them against severe disease. A greater proportion of vaccinated postpartum women (94.4 %) perceived the vaccine as safe than unvaccinated (76.3 %) ($P < 0.001$) (Fig. 1).

All physicians knew influenza may be transmitted from person to person and via droplets from coughs/sneezes, but 28.5 % were unaware influenza may be transmitted from birds or pigs to people (Table 3) (Figure S1). Of 146 physicians, 71 (48.6 %) learned about the influenza vaccine from mass media and 70 (47.9 %) from informal information at the healthcare facility (Table S3).

5.3. Influenza vaccination

Of all 642 postpartum women, 549 professed vaccination for seasonal influenza (85.5 %) (Table 1). We were able to verify 599 with vaccination cards or medical records, of whom 506 (84.5 %) were vaccinated. Of the 599 participants with verified records, 546 had term pregnancy, of whom 462 (84.6 %) were vaccinated. Of 140 physicians who knew their vaccination status, 81 (57.9 %) self-reported vaccination for seasonal influenza (Table 2). Influenza vaccination coverage was higher among postpartum women residing in San José and Heredia provinces than physicians practicing in those provinces ($P < 0.001$), whereas coverage was high among both postpartum women (94.8 %) and physicians (95.0 %) in Limón province (Figure S2).

For postpartum women, unadjusted analyses between demographics and prenatal care, and self-reported influenza vaccination are shown in Table 4. The final model for self-reported influenza vaccination included tetanus vaccination during pregnancy, receipt of clinician vaccination recommendation during prenatal check-up, vaccination status of other children in household, education, and province of residence. Adjusting for the other variables in the model, the odds of influenza vaccination were higher for women vaccinated for tetanus during pregnancy (aOR: 3.62, 95 % CI: 1.89–6.92), received vaccination recommendations from clinicians during prenatal check-ups (aOR: 3.39, 95 % CI: 2.06–5.59), had other children vaccinated for influenza (aOR: 2.25, 95 % CI: 1.08–4.68), and residence in Limón province (aOR: 3.29, 95 % CI: 1.19–9.06) with San José as reference (Table 4). The final model also demonstrated inverse associations between influenza vaccination and university

(aOR: 0.15, 95 % CI: 0.05–0.38), bachillerato (aOR: 0.25, 95 % CI: 0.08–0.72), and secondary education (aOR: 0.31, 95 % CI: 0.12–0.78) with no formal education/primary school as reference. Variance inflation factors were < 1.05, so there was no evidence of collinearity. Results were consistent when restricting to verified vaccinations (Table S4).

For physicians, the final model included work in Limón province (aOR: 15.73, 95 % CI: 1.97–125.86) and healthcare facility trainings as sources of information for vaccines (aOR: 3.44, 95 % CI: 1.36–9.62) (Table S5).

5.4. Attitudes regarding influenza vaccination

Most cited reasons for vaccination among 506 postpartum women with verified vaccinations were protecting their children (56.7 %) and protecting themselves (39.3 %) (Table 5). One of five mentioned they were vaccinated following instructions from the healthcare center, whereas half of unvaccinated participants cited not being offered vaccination as reason for non-vaccination. Twenty-seven (32.5 %) participants refused vaccination citing fear of contracting influenza and harm to neonate (Table 5).

Among 146 physicians, 92.9 % believed influenza vaccination causes flu-like symptoms and 24.0 % believed it can harm pregnant women (Table 3), including eight who mentioned Guillain-Barré syndrome. However, 98.6 % believed healthcare workers should be vaccinated for influenza annually, 91.8 % believed pregnant women are a priority group for vaccination, and 92.4 % recommended vaccinations during prenatal check-ups. Of 129 physicians who recommended vaccinations, 80.6 % had referred patients to the same healthcare facility during prenatal care appointments and 13.2 % to private providers (Table S6).

Of 59 physicians not vaccinated for influenza, reasons cited included lack of time (32.2 %), not being offered vaccination (20.3 %), and fear of side effects (18.6 %) (Table S7).

5.5. Focus groups

Focus group findings may be categorized as sources of information, methods of disseminating information, reasons for and for not receiving vaccination, and vaccination campaign limitations.

The most reliable sources of vaccine information identified were WHO and Pan American Health Organization. Other sources included television, radio, social networks, workplace trainings, scientific articles, and information reported by CCSS. Participants noted the challenge of discerning reliable sources of information on the internet and underscored the importance of crosschecking facts with reputable sources like the CDC. One participant described a “triangulation” process of weighing information quality, “*Triangulation refers to the process of synthesizing information from three sources: the healthcare institution, published scientific literature, and social networks*.” Seasonal influenza vaccination information should be disseminated to healthcare workers and the general public using a multi-faceted approach (pamphlets, videos, posters, others). Messages of health impacts of influenza that elicit fear are particularly effective at promoting vaccination. Promotional information should be tailored to local communities and should reach remote communities.

Formal workplace trainings by subject matter experts are also useful but need to stress influenza severity and allow opportunities to clarify uncertainties about vaccination.

All focus group participants agreed healthcare workers should be vaccinated annually. Reasons shared included building immunity, protecting at-risk groups, and reducing hospital expenses and mortality. Reasons discussed for non-vaccination included underestimating influenza severity, misinformation, and concerns regarding vaccine safety, quality, and side effects. One participant shared, "*I did not get sick before I was vaccinated. After getting the vaccine, I now get sick more often*." Participants generally agreed that although vaccination may cause transient adverse effects, it does not cause serious health problems. One participant said, "*Although every-one's immune system responds differently, most vaccines cause little pain or itching that resolves quickly—never death*.".

Focus groups also suggested human and economic resource limitations inhibit vaccination campaigns. One participant noted, "*Staff have too many functions in hospitals. They're required to vaccinate and educate patients simultaneously. Additional staff is needed during campaigns*." Another stressed the need for improved immunization information systems and surveillance systems to capture more cases, "*There is a need for a specific diagnosis of influenza, or a strategy to associate influenza cases with their etiology, even in the absence of a laboratory test*.".

6. Discussion

Influenza vaccination coverage for postpartum women in Costa Rica (85.5 %) was in the upper range (1.7 %−88.4 %) reported in a systematic review of vaccination coverage among postpartum women across 21 studies [20]. Vaccination coverage for prenatal care physicians (57.9 %) was nearly identical to that reported for all healthcare workers (including non-obstetric) in direct contact with patients in Costa Rica (57.7 %) [21]. These findings are consistent with similar cross-sectional studies in Honduras reporting influenza vaccination coverage of 82.3 % and 52.0 % among postpartum women and healthcare workers [12,14].

The finding that postpartum women who were recommended vaccination by clinicians were over three times more likely to be vaccinated than women who were not is supported by other studies [11–13,20]. Vaccine safety concerns to mother and infant may be mitigated from direct provider recommendations, particularly from vaccinated healthcare workers [22]. Providers who are regularly vaccinated were shown to recommend vaccines more frequently to pregnant women [23]. Indeed, we found 95 % vaccination coverage among both postpartum women and physicians in Limón province, suggesting an association between healthcare providers' confidence in vaccines and willingness to recommend vaccination. Although almost all physicians indicated they recommended vaccination to pregnant women, only three-quarters of postpartum women said they received recommendations which represents missed opportunities to improve coverage.

The most cited reason for non-vaccination among postpartum women was not being offered vaccination, which is consistent with other research [12,24]. A systematic review of maternal vaccination uptake (including non-influenza vaccines) found healthcare provider

recommendations were the most mentioned reasons for vaccination among pregnant women and coverage was higher among those who received both recommendations and offers (63.4–73.6 %) than those who only received recommendations (33.5–47.5 %) [25]. Although almost all postpartum women had received prenatal care, vaccines may not always be available during prenatal care appointments. Indeed, 81 % of physicians had offered vaccinations during prenatal care appointments, but 33 % had also referred them to other CCSS healthcare facilities and 13 % to private providers. Vaccinations should be offered during prenatal care appointments concomitant with recommendations, so patients are not inconvenienced with additional appointments.

Counterintuitively and in contrast to most studies [20,26,27], postpartum women with higher education were significantly less likely to have been vaccinated for influenza than women with no formal education. Our finding is consistent, however, with a study of older adults in Honduras [28] and a systematic review of factors associated with maternal influenza vaccination in low- and middle-income countries, which found that women with higher education were 36–42 % less likely to be vaccinated than women with primary or less than primary education [11]. One study found that pregnant women with higher education were three times more likely to search for pregnancy advice on the internet compared to women with less than high school education and many do not discuss information with their providers [29]. Another study showed that 22 % of pregnant women intended to decline influenza vaccination following exposure to online media articles on vaccination during pregnancy [30]. Physicians should be aware of these issues so they can direct pregnant women to reputable websites.

Consistent with other studies [14,31], the most cited reasons for non-vaccination among physicians were busy schedules and not being offered vaccines. Focus groups suggested more staff are needed during vaccination campaigns as healthcare workers are overworked. Furthermore, although a trivalent inactivated vaccine was used in Costa Rica during vaccination campaigns, almost all physicians believed vaccination causes flu-like symptoms and 39 % declined vaccination for fear of adverse effects, which is in accord with other studies of healthcare workers [14,21,32]. Mistrust in vaccination may stem from exposure to adverse effects of vaccinations in online media, which has been shown to significantly increase vaccine hesitancy and refusal rates [33]. This study was also conducted in 2017 after a heightened influenza season in Costa Rica from influenza A (H1N1)pdm09 and H3N2, which may have affected perceptions of influenza vaccine effectiveness [34]. Healthcare facility trainings were associated with higher vaccination coverage and may serve as convenient venues for offering vaccines and addressing questions.

Most cited reasons for vaccination among postpartum women were protection for self and neonates. A greater proportion of women who perceived vaccines as safe were vaccinated than those who did not. Data collection began three weeks after the launch of vaccination campaigns, which includes educational content on social media networks, radio spots, and posters which may have increased vaccine knowledge and awareness.

Similar to a study in Honduras [12], postpartum women with other children vaccinated for influenza were more likely to be vaccinated than those without other vaccinated children.

This may suggest that vaccines should be offered to pregnant women who visit a healthcare center to vaccinate their children. We also found that postpartum women vaccinated for tetanus were more likely to be vaccinated for influenza, which may suggest that patients with positive initial experiences with vaccines may be more likely to accept other vaccines. Other studies have shown that previous vaccination for influenza was associated with greater vaccination or intention to vaccinate during pregnancy [35,36].

This study had several limitations. First, this study was conducted five years ago. KAP regarding vaccination in Costa Rica might have changed in recent years following the COVID-19 pandemic. Second, we included postpartum women and prenatal care physicians from CCSS hospitals, which may not be representative of all postpartum women and prenatal care physicians in Costa Rica. Third, due to delays in authorizations for project implementation, we did not have time to sample enough participants for proposed sample size. Fourth, cross-sectional studies do not enable evaluation of temporality or causal inference. Fifth, we were unable to verify vaccination status of physicians, however, studies have shown strong concordance between self-reported vaccinations and those documented in registries [37]. Six, there may have been social desirability bias, which could explain the discrepancy between the proportion of clinicians who said they recommended vaccinations versus postpartum women who said they received recommendations. Seventh, stepwise logistic regression may be problematic if independent variables which have causal effects on vaccination were not statistically significant [38]. Finally, it was difficult to discern whether hierarchical relationships existed in the focus groups that could have influenced opinions. Notwithstanding these limitations, our study included both quantitative and qualitative components that demonstrated consistency between survey and focus groups. To our knowledge, this is the first study evaluating vaccination KAP during pregnancy in Costa Rica.

Pregnant women and their infants benefit from maternal influenza vaccination. Vaccination campaigns and provisions of free vaccines effectively increased knowledge and coverage among pregnant women in Costa Rica. To improve access, pregnant women should be offered vaccination during prenatal care appointments. Vaccines should also be offered to pregnant women who visit healthcare centers to vaccinate their other children, even if they do not attend prenatal care appointments. Additional out-reach promoting safety and efficacy of vaccination is needed using communication strategies tailored to local communities, which should involve engagement with community leaders.

Influenza vaccination uptake was considerably lower among prenatal care physicians. Educating healthcare workers about vaccine benefits for themselves and patients is needed to dispel common misconceptions and mitigate safety concerns. We propose offering vaccinations on nights and weekends, requiring healthcare workers who decline vaccination to wear surgical masks, and strengthening mobile vaccine teams within healthcare facilities, which will have lists of healthcare workers who should be vaccinated including students and volunteers, and whether they accepted or rejected vaccination. Individuals who decline vaccination should be referred to vaccine champions who support vaccination for more information. Strategic alliances between key healthcare actors, especially specialized and general hospitals, would facilitate dissemination of information regarding vaccine benefits.

Enhancing surveillance systems and improving laboratory capacity for detection of influenza would allow optimization of timing of vaccination campaigns.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data availability

Data will be made available on request.

Abbreviations:

CCSS	Costa Rican Social Security Fund
KAP	knowledge, attitudes, and practices
PCA	principal components analysis
UVG	Universidad del Valle de Guatemala

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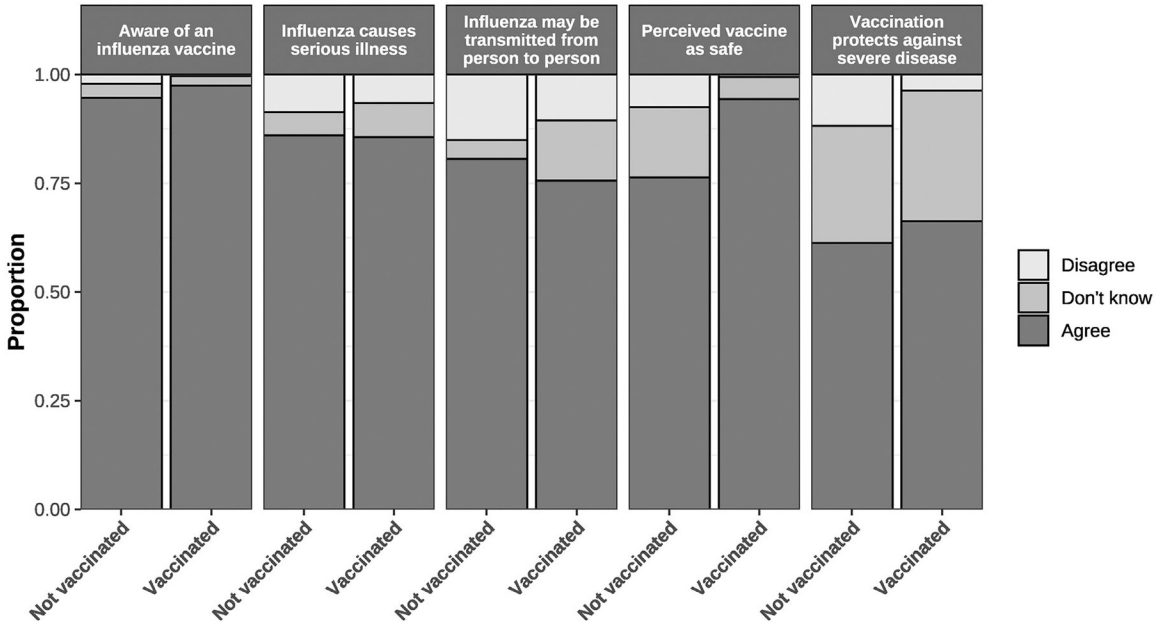

Fig. 1.

Knowledge of seasonal influenza vaccination among vaccinated (N = 549) and unvaccinated (N = 93) postpartum women, Costa Rica, July-August 2017.

Table 1

Demographics, prenatal care, and influenza vaccination coverage of 642 postpartum women, Costa Rica, July-August 2017.

	Observed data (n = 642)		Imputed (N = 642)
Characteristic	**N**	**%**	**%**
Age (in years)			
<18	37	5.8	5.8
18–34	531	82.7	82.7
≥35	74	11.5	11.5
Province of residence			
San José	340	53.0	53.0
Heredia	96	15.0	15.0
Limón	96	15.0	15.0
Alajuela	47	7.3	7.3
Puntarenas	40	6.2	6.2
Other	23	3.5	3.5
Race (N = 619)			
Mestiza	414	66.9	66.9
White	129	20.8	20.7
Mulata	66	10.7	10.8
Other	10	1.6	1.6
Education			
No formal education/primary school	141	22.0	22.0
Secondary school	286	44.5	44.5
Bachillerato	73	11.4	11.4
University	142	22.1	22.1
Occupation			
Housewife	377	58.7	58.7
Student	46	7.2	7.2
Technical services	146	22.7	22.7
Professional services	67	10.4	10.4
Other	6	1.0	1.0
Concurrent chronic disease[a] (N = 638)	101	15.8	15.8
Gestational age (N = 640)			
<37 weeks	55	8.6	8.6
≥37 weeks	585	91.4	91.4
Number of other children in household			
≥3	82	12.8	12.8
2	137	21.3	21.3
1	145	22.6	22.6
0	278	43.6	43.6
Average age of other children in household (years)			

Characteristic	Observed data (n = 642)		Imputed (N = 642)
	N	%	%
<5	132	20.6	20.6
5–10	157	24.4	24.4
>10	75	11.7	11.7
No other children	278	43.3	43.3
Vaccination status of other children (N = 627)			
Vaccinated	257	41.0	42.2
Not vaccinated	92	14.7	15.0
No other children	278	44.3	42.8
Number of prenatal visits (N = 631)			
<6	70	10.9	11.1
6–8	267	41.6	42.2
>8	294	45.8	46.7
Received iron, folic acid, multivitamin, or calcium supplements during pregnancy	631	98.3	98.3
Vaccinated for tetanus during pregnancy (N = 641)	557	86.9	86.9
Received vaccination recommendation by clinician during prenatal check-up (N = 641)	478	74.6	74.5
Vaccinated for seasonal influenza (self-reported)	549	85.5	85.5
Vaccinated for seasonal influenza (verified)[b] (N = 599)	506	84.5	–

N = 642 unless stated otherwise due to non-response.

[b] Verified with vaccination cards or medical records.

[a] 72 had asthma, 13 had heart disease, 11 had diabetes mellitus, 9 had cystic fibrosis, 3 had bronchitis, 3 had immunodeficiency, 2 had chronic renal disease, and 2 had cancer.

Table 2

Demographics and influenza vaccination coverage of 146 prenatal care physicians, Costa Rica, July-August 2017.

	Observed data (n = 146)		Imputed (N = 146)
Characteristic	**N**	**%**	**%**
Age (in years)			
24–34	72	49.3	49.3
≥35	74	50.7	50.7
Female Sex	81	55.5	55.5
Profession			
General physician	94	64.4	64.4
Obstetric physician	52	35.6	35.6
Years in profession (N = 145)			
≤10	89	61.4	61.6
>10	56	38.6	38.4
Works in multiple healthcare facilities (N = 143)	35	24.5	24.8
Health facility province			
San José	88	60.3	60.3
Heredia	24	16.4	16.4
Limón	20	13.7	13.7
Alajuela	9	6.2	6.2
Puntarenas	5	3.4	3.4
Service network			
East	43	29.4	29.4
Northeast	68	46.6	46.6
South	35	24.0	24.0
Treated patients with influenza (N = 145)	94	64.8	65.0
Vaccinated for seasonal influenza (self-reported) (N = 140)	81	57.9	–

N = 642 unless stated otherwise due to non-response.

[a] 72 had asthma, 13 had heart disease, 11 had diabetes mellitus, 9 had cystic fibrosis, 3 had bronchitis, 3 had immunodeficiency, 2 had chronic renal disease, and 2 had cancer.

[b] Verified with vaccination cards.

Table 3

Knowledge and attitudes of seasonal influenza vaccination, prenatal care physicians (N = 146), Costa Rica, July-August 2017.

	Observed data (n = 146)			Imputed (N = 146)
Knowledge/attitude	**Participants N**	**Agree N**	**Agree% (95 % CI)**	**Agree% (95 % CI)**
Influenza may be transmitted from person to person	146	146	100 (97.4–100)	100 (97.4–100)
Influenza may be transmitted from birds or pigs to people	143	102	71.3 (63.4–78.1)	71.5 (63.7–78.2)
People may contract influenza even if they have previously contracted influenza	145	142	97.9 (94.1–99.3)	97.9 (94.1–99.3)
Influenza may be transmitted via droplets from coughs or sneezes	146	146	100 (97.4–100)	100 (97.4–100)
Influenza may be transmitted if people touch their mouths or noses with contaminated hands	145	120	82.8 (75.8–88.0)	82.9 (75.9–88.1)
Every-one has the same risk of being infected with influenza virus	146	30	20.7 (14.9–28.0)	20.7 (14.9–28.0)
Every-one has the same risk of being hospitalized from influenza virus	146	11	7.6 (4.3–13.1)	7.6 (4.3–13.1)
Influenza can be prevented by vaccination	145	140	95.9 (91.3–98.1)	95.9 (91.3–98.1)
Pregnant women are a priority group for vaccination	146	134	91.8 (86.2–95.2)	91.8 (86.2–95.2)
The vaccine causes flu-like symptoms	138	128	92.8 (87.2–96.0)	92.9 (87.6–96.1)
The vaccine can cause harm	138	30	21.7 (15.7–29.3)	24.0 (17.8–31.6)
Healthcare workers should get vaccinated for influenza every year	140	138	98.6 (94.9–99.6)	98.6 (95.0–99.6)
Recommends the influenza vaccine to pregnant women	136	129	94.9 (89.8–97.5)	92.4 (86.9–95.7)

CI: confidence interval.

Table 4

Associations between demographics and prenatal care, and self-reported influenza vaccination, postpartum women (n = 642), Costa Rica, July-August 2017.

Variable	OR (95 % CI)	P-value	aOR[a] (95 % CI)	P-value
Age group (Ref: 18–34 years)		0.367		–
<18 years	0.67 (0.30–1.72)		–	
≥35 years	0.67 (0.37–1.31)		–	
Province (Ref: San José)		0.002		0.045
Heredia	0.87 (0.49–1.60)		0.70 (0.37–1.34)	
Limón	3.67 (1.56–10.75)		3.29 (1.19–9.06)	
Alajuela	4.53 (1.35–28.25)		2.91 (0.66–12.81)	
Puntarenas	1.14 (0.49–3.13)		0.62 (0.23–1.67)	
Other	0.73 (0.28–2.27)		0.92 (0.30–2.82)	
Race (Ref: Mestiza)		0.509		–
White	0.89 (0.51–1.53)		–	
Mulata	1.65 (0.69–3.96)		–	
Other	0.69 (0.14–3.31)		–	
Education (Ref: no formal education/primary school)		<0.001		<0.001
Secondary school	0.32 (0.12–0.72)		0.31 (0.12–0.78)	
Bachillerato	0.17 (0.06–0.45)		0.25 (0.08–0.72)	
University	0.13 (0.05–0.29)		0.15 (0.05–0.38)	
Concurrent chronic disease (Ref: no)	1.28 (0.67–2.44)	0.419	–	–
≥37 weeks gestational age (Ref: <37 weeks)	1.00 (0.46–2.20)	0.970	–	–
Number of other children in household (Ref: 0)		0.320		–
1	1.30 (0.75–2.34)		–	
2	1.58 (0.88–2.97)		–	
≥3	1.69 (0.83–3.84)		–	
Average age of other children in household (Ref: no other children)		0.349		–
<5	1.41 (0.79–2.63)		–	
5–10	1.43 (0.83–2.56)		–	
>10	1.75 (0.83–4.15)		–	

Variable	OR (95 % CI)	P-value	aOR[a] (95 % CI)	P-value
Vaccination status of other children in household (Ref: not vaccinated)		0.011		0.041
Vaccinated	2.25 (1.17–4.35)		2.25 (1.08–4.68)	
No other children in household	1.25 (0.69–2.28)		1.50 (0.76–2.96)	
Number of prenatal visits (Ref: <6)		0.059		–
>8	0.90 (0.44–1.83)		–	
6–8	1.57 (0.73–3.38)		–	
Received iron, folic acid, multivitamin, or calcium supplements during pregnancy (Ref: no)	1.32 (0.20–5.22)	0.734	–	–
Vaccinated for tetanus during pregnancy (Ref: no)	2.43 (1.38–4.15)	0.002	3.62 (1.89–6.92)	<0.001
Received vaccination recommendation by clinician during prenatal check-up (Ref: no)	3.69 (2.34–5.84)	<0.001	3.39 (2.06–5.59)	<0.001
Vaccination protects against severe disease (Ref: disagree)	1.24 (0.78–1.95)	0.350	–	–

Ref: reference; OR: odds ratio; aOR: adjusted odds ratio; CI: confidence interval.

[a]Adjusted for the other variables listed in the model.

Table 5

Reasons for receiving (N = 506) and not receiving (N = 83) influenza vaccination, postpartum women, Costa Rica, July-August 2017.

Reasons for vaccination (N = 506)	**N**	**% (95 % CI)**
To protect her children	287	56.7 (52.4–61.0)
To protect herself	199	39.3 (35.2–43.6)
Urged to get vaccinated at health center	99	19.6 (16.3–23.2)
Urged to get vaccinated by friends or family	6	1.2 (0.5–2.6)
Aware of vaccine benefits from media	4	0.8 (0.3–2.0)
Reasons for non-vaccination (N = 83)		
Limited access	46	55.4 (44.7–65.6)
Vaccine was not offered during pregnancy	41	49.4 (38.9–59.9)
Inconvenient hours for vaccination	6	7.2 (3.4–14.9)
Did not know where to go for vaccine	4	4.8 (1.9–11.7)
Vaccine is too expensive	2	2.4 (0.7–8.4)
Vaccination center was too far away	1	1.2 (0.2–6.5)
Vaccination center located in dangerous area	1	1.2 (0.2–6.5)
Rejection	27	32.5 (23.4–43.2)
Vaccination is harmful	18	21.7 (14.2–31.7)
Fear of contracting influenza	11	13.3 (7.6–22.2)
Fear of harm to infant	9	10.8 (5.8–19.3)
Fear of needles	4	4.8 (1.9–11.7)
Does not like vaccination	4	4.8 (1.9–11.7)

CI: confidence interval.

Composite subheadings (e.g., limited access) included at least one positive response for one of the listed reasons.