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A community-based survey on influenza and vaccination knowledge, perceptions and practices in Peru

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ABSTRACT

Background: Although Peru provides safe and effective influenza vaccines free-of-charge, coverage among vaccine target groups like pregnant women and older adults remains low. To improve risk communication messages and vaccine uptake, we explored knowledge, perceptions and practices about influenza illness and vaccination.

Methods: A cross-sectional, community-based survey with a three-stage cluster sampling design was conducted in three cities in Peru. We included mothers of young children, pregnant women and persons ≥65 years. Participants completed a questionnaire about knowledge, perceptions and practices about influenza illness and vaccination against influenza during the past year. Generalized linear models were used to explore factors associated with vaccination in the past year.

Results: 624/645 (97%) mothers, 54/55 (98%) pregnant women and 622/673 (92%) older adults approached provided informed consent and were surveyed. While most mothers, pregnant women and older adults (94%, 96% and 91%, respectively) perceived influenza as a potentially serious illness, few pregnant women (13%) and older adults (34%) self-identified themselves as a target group for influenza vaccination. Only 28% of mothers, 19% pregnant women, and 27% older adults were vaccinated against influenza during the previous year. Among the participants that did not get vaccinated against influenza in the previous year, "being afraid of vaccination and its effects" was the most commonly cited barrier. Knowledge of the recommendation for annual vaccination was significantly associated with vaccination status among pregnant women ($p = 0.048$) and older adults ($p = 0.004$).

Conclusion: Despite a government subsidized vaccine program, vaccine utilization remained low among pregnant women and older adults, who seemed typically unaware of their status as high-risk groups targeted for vaccination. Those aware of the recommendations for annual vaccination were more likely to be vaccinated. Information campaigns addressing fears and highlighting populations at risk for severe influenza illness that are targeted for vaccination might increase vaccine coverage in Peru.

1. Introduction

Seasonal influenza viruses cause approximately 300,000–645,000 respiratory deaths throughout the world annually [1]. This burden is generally highest among young children and older adults in low and middle-income countries. In Peru, epidemics occur annually, typically from May through October [2,3]. Each year, approximately 1 in 10 Peruvians become ill with influenza and 44% of those ill seek medical care [3]. While influenza hospitalization rates are highest among young children, mortality rates are highest among adults aged ≥75 years. An estimated 2,235 persons of all ages subsequently die from influenza each year in Peru [4]. Influenza also causes a substantial economic burden. During 2010, the total median cost of treatment of laboratory-confirmed influenza was US$17 in children <5 years and US$36 in people >65 years, generating an annual burden of US$ 85 million in direct and indirect treatment costs for Peru [5].

In Peru, vaccination for influenza is provided for free by the Peruvian government through public health establishments to pregnant women, children aged 7–23 months, health care workers, persons ≥65 years and people with co-morbidities [6]. During the "Vaccination week of the Americas", temporary immunization

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tents offering free vaccination at plazas and markets are also established [7]. Additionally, vaccines are offered for a fee in the private sector, mainly through private clinics.

There has been considerable uptake of seasonal influenza vaccines in the Americas compared to other regions [8,9]. Peru, for example, has increased the number of seasonal flu vaccines procured from 9.87 doses per 1,000 population in 2008 to 121.45 doses per 1,000 population in 2013 and in 2014, reported influenza vaccination coverage for the elderly of 47%, 23% for children and 30% for pregnant women [10]. Prompt antiviral treatment is also recommended, especially among patients with severe or progressive clinical illness because it can decrease mortality [11]. However, antivirals are seldomly used and are typically not part of a hospital's formulary in Peru. Although underutilized, influenza vaccination remains the best way to protect populations at risk.

Low vaccine coverage could be associated with insufficient awareness among target groups about the risk of influenza illness or failure of health care providers to recommend vaccination [12]. Information about Peruvians' knowledge and perceptions of influenza illness risk and benefit of vaccination is currently unavailable. We conducted a survey among mothers of young children, pregnant women, and older adults to understand the knowledge, perceptions and practices about influenza illness and vaccination to guide health promotion messages for these target groups.

2. Methods

2.1. Study setting

We conducted the study from July through August 2016 in three geographically and ecologically distinct cities in Peru: (1) Lima, Peru's capital, located in a coastal desert; (2) Cuzco, located in the Andes highlands and (3) Iquitos, located in Peru's Amazon Basin. The survey targeted communities near large hospitals where we assumed persons targeted for vaccination would be exposed to influenza-related public health messages as part of the Ministry of Health national campaign to promote influenza vaccines. We selected one large public hospital in each of the three cities: Maria Auxiliadora Hospital in Lima, Regional Hospital in Cusco and César Garayar García Hospital in Iquitos.

2.2. Participant selection and study design

We recruited (1) mothers 18 years and older with infants aged ≥6–59 months, (2) pregnant women 18 years and older and (3) men and women aged 65 years or older, because these groups or their children are or have been targeted for influenza vaccination. We sought to obtain a random sample of participants to minimize selection bias. We conducted a cross-sectional, community-based survey and selected participants using multistage cluster sampling with three stages. First, all residential blocks within a radius of 1 km from the selected hospitals were identified and numbered sequentially. We used computer-generated random numbers to select residential blocks until we reached our target sample of 500 households per city. Then, we conducted a census of households to identify households with members that met eligibility criteria for participation as described above. In a second stage, a random sample of 10 eligible households was selected from each residential block. Interviewers received tables that determined the households to enrol based on the number of eligible households identified and the date when the census was performed. In a third stage, all eligible members of selected households were identified, and one of them was selected randomly. The interviewers also received tables that would determine the person to enroll based on the number of eligible persons in the household and the date of the visit to the household. The sample of elders was independent of that of mothers or pregnant women. Additional inclusion criteria for both samples were: (1) providing informed consent, (2) being a resident of the selected city for at least 6 months, (3) living within the city for more than 3 of the 6 months before interview, (4) having slept in the selected household for at least 4 of the 7 nights prior to the interview, and (5) being mentally capable of responding to the questionnaire. We constructed a sampling frame using maps from the Peruvian National Institute of Statistics and Informatics [13] and satellite images from Google Earth© [14].

2.3. Data collection

Trained field staff visited the selected household and invited the selected household member to participate in the study. If interested, informed consent was obtained and smartphones were used to administer an electronic version of the questionnaire running on an Open Data Kit platform [15]. Data quality control was performed in real time through consistency checks implemented in the electronic data collection forms and daily by the study data manager.

2.4. Questionnaire design

Our 54-item questionnaire was based on work by Ditsungnoen et al. [16] and contained six sections eliciting information about: (1) sociodemographic data, (2) knowledge about influenza illness, (3) perceptions about vaccines in general, (4) knowledge about influenza vaccines, (5) perceived susceptibility, severity, barriers and benefits for pregnant women and their babies, and (6) media use and acceptance of text messages as reminders to seek vaccination. We asked participants about vaccines they have received in their lifetime. If receipt of influenza vaccine was reported, that was considered spontaneous self-reported influenza vaccination. We also asked specifically about influenza vaccination at least once in their life and in the past year. The main outcome for the study was self-reported (elicited) vaccination against influenza in the past year. We asked two open-ended questions to assess the principal reasons for influenza vaccination: "What do you think are the reasons people get vaccinated against influenza?" and "What do you think are the reasons people do not get vaccinated against influenza?" We constructed these questions in reference to a generic person to avoid desirability bias. We assessed knowledge of influenza illness by asking eleven questions about signs and symptoms, routes of infection, seasonality, preventive measures, treatment, and outcomes (Appendix 1). We assessed knowledge about influenza vaccination through two questions about the recommended frequency of vaccination and Peru's target groups. Pregnant women were asked an additional 14 questions about influenza illness and vaccination.

2.5. Grouping

Questions about the reasons for and against vaccination were grouped and presented according to the Health Belief Model (HBM). The HBM postulates that perceptions about susceptibility to infection and severe of illness, benefits and barriers of vaccination, and cues to action determine whether a person chooses to be vaccinated or not [17,18].

2.6. Data analysis

To quantify excess prevalence of vaccination we present prevalence ratios (PR) with their corresponding 95% confidence intervals (CI), calculated using generalized linear modeling with adjustment

for clustering within city. Variables related to knowledge or patient characteristics that were associated with the outcome at the 0.1 significance level in the bivariate analysis were tested in the multivariable model. All statistical analyses were performed with Stata v. 15.1 (StataCorp, College Station, TX).

2.7. Ethics considerations

The U.S. Naval Medical Research Unit No. 6 (NAMRU-6) (NAMRU6.2016.0005) and Cayetano University Ethics Committees approved this study. Informed written consent was obtained from each adult participant at the time of enrollment. No personal identifiers were recorded in the databases.

3. Results

3.1. Participants' characteristics

During July and August 2016, field staff enrolled and surveyed 624 (97%) of 645 non-pregnant mothers, 54 (98%) of 55 pregnant women, and 622 (92%) of 673 older adults approached. The mean age of mothers and pregnant women was 30.9 and 29.2 years, respectively (Table 1). Half (50%) of the mothers and 59% of pregnant women had technical college or university degrees. Half of mothers and pregnant women were employed and most live with a partner or were married. Ten percent of mothers and 9% of pregnant women reported at least one pre-existing medical condition, most commonly asthma (2%) for the mothers and gastritis (4%) for pregnant women. The mean age of older adults was 74.2 years and 21% had a college or university degree. More than half of older adults surveyed (58%) reported at least one medical condition, most commonly hypertension (17%), diabetes and heart disease (each 10%). Age and employment status of mothers and pregnant women are comparable to national data from the 2018 Peruvian Demographic Health Survey. Education level in our study sample was higher compared to national data. (Supplemental Material Table 1).

3.2. Self-reported influenza vaccination status

Fewer people spontaneously reported influenza vaccination at least once in their life (i.e., 59% of mothers, 65% pregnant women, and 41% older adults) than when asked (64%, 72% and 50% respectively). (Table 1) The percent reporting influenza vaccination in the previous year was low and very similar in the three groups: 28% for mothers (95%CI: 25–32%), 19% for pregnant women (95%CI: 10–32%) and 27% among older adults (95%CI: 24–31%).

3.3. Knowledge about influenza illness

In general, fever, muscle and joint pain, runny nose and headache were the most commonly reported symptoms associated with influenza among participants. (Table 2) Less than a third of the participants (27% of mothers [95%CI: 23–30], 22% of pregnant women [95%CI: 13–36], 24% of older adults [95%CI: 21–28]) recalled all three main routes of influenza transmission. Most of the mothers (94%, 95%CI: 92–96), pregnant women (96%, 95%CI: 86–99) and older adults (91%, 95%CI: 88–93) agreed that influenza could cause serious illness and that treatment exists (89% of mothers [95%CI: 86–91%], 94% of pregnant women [95%CI: 94–98], and 87% of older adults [95%CI: 84–89]). Frequent hand washing and good coughing etiquette were considered by most participants as "very effective" in preventing influenza infection and 69% of mothers, 82% pregnant women and 73% older adults recognized winter as the time of the year where people typically get sick with influenza.

Table 1
Participants' characteristics and self-report of influenza vaccination, three cities in Peru, July-August 2016.

	Mothers (n = 624)	Pregnant women (n = 54)	Adults ≥ 65y (n = 622)
	n (%)	n (%)	n (%)
City			
Lima	170 (27)	11 (20)	241 (39)
Cusco	222 (36)	21(39)	197 (32)
Iquitos	232 (37)	22 (41)	184 (30)
Gender, female	624 (1 0 0)	54 (1 0 0)	390 (63)
Age in years, mean (SD)	30.9 (7.2)	29.2 (6.9)	74.2 (6.6)
Education level			
Primary or less	59 (9)	5 (9)	342 (55)
High School	256 (41)	17 (31)	151 (24)
Technical	172 (28)	18 (33)	47 (8)
University	137 (22)	14 (26)	78 (13)
Unknown	0 (0)	0 (0)	4 (1)
Marital status			
Cohabitating	343 (55)	34 (63)	33 (5)
Married	154 (25)	17 (32)	318 (51)
Single	127 (20)	3 (6)	68 (11)
Widowed	0 (0)	0 (0)	203 (33)
Working status[1]			
Employed	313 (50)	27 (50)	168 (27)
Studying	40 (6)	2 (4)	0 (0)
Housework	387 (62)	32 (59)	448 (72)
Unemployed	0 (0)	0 (0)	50 (8)
No response	0 (0)	0 (0)	1 (0)
One or more medical condition[2]	63 (10)	5 (9)	361 (58)
Self-reported Influenza vaccination status			
At least once in life, spontaneous	368 (59)	35 (65)	257 (41)
At least once in life, elicited	399 (64)	39 (72)	310 (50)
Last year, elicited	176 (28)	10 (19)	167 (27)

[1] Categories are not mutually exclusive.
[2] Most frequent for mothers: asthma (2%), diabetes (2%), hypertension, lung problems, heart problems (each 1%). Most frequent for pregnant women: gastritis (4%), problems with the heart (2%), allergy (2%), hypothyroidism (2%). Most frequent for older people: hypertension (17%), diabetes (10%), heart disease (10%), arthrosis (8%), asthma and renal problems (each 2%).

3.4. General perception about vaccines

Most participants perceived that vaccines are good for health (mothers 582 [93.3%], pregnant women 54 [100%], and older adults 559 [89.9%]), and that vaccines protect people from diseases (mothers 616 [98.7%], pregnant women 53 [98%], and older adults 596 [95.8%], data not displayed). A great majority also agreed that there are vaccines that adults should receive (mothers 566 [90.7%], pregnant women 48 [88.9%], and older adults 567 [90.9%]). Nevertheless, at least 91% of mothers, 88.9% of pregnant women and 87.6% of older adults perceived that people are afraid of vaccines.

3.5. Knowledge about influenza vaccination

Most mothers (70%, 95%CI: 66–74), pregnant women (74%, 95% CI: 60–84), and older adults (64%, 95%CI: 60–67) reported that influenza vaccination should be received every year (Table 2). Only 33% (95%CI: 30–37) of mothers and 30% (95%CI: 19–43) of pregnant women, however, recognized young children as a vaccination target group. Only 13% (95%CI: 6–25) of pregnant women and 34% (95%CI: 31–38%) of older adults recognized themselves as a vaccination target group.

3.6. Reasons for vaccination, barriers, and cues to action

Ninety-eight percent of mothers, 90% of pregnant women and almost all (99%) older adults who reported receiving the influenza

Table 2
Knowledge about influenza illness and vaccination, three cities in Peru, July-August 2016.

	Mothers (n = 624) n (%)	Pregnant women (n = 54) n (%)	Adults ≥ 65y (n = 622) n (%)
What are the signs and symptoms of influenza (spontaneous recall)?			
Fever	414 (66)	35 (65)	280 (45)
Muscle and joint pain	290(46)	18 (33)	258 (41)
Running nose	274 (44)	23 (43)	348 (56)
Headache	259 (41)	29 (54)	173 (28)
Sore throat	192 (31)	15 (28)	262 (42)
Cough	226 (36)	15 (28)	299 (48)
Dyspnea	14 (2)	0 (0)	37 (6)
Diarrhea and vomiting	22 (4)	2 (4)	6 (1)
What are the possible ways to be infected with influenza?			
Close contact with persons that sneeze and cough	577 (92)	46 (85)	550 (88)
Direct contact with persons with influenza	320 (51)	30 (56)	301 (48)
Touch mouth/nose after in contact with surface contaminated with influenza virus	253 (41)	20 (37)	222 (36)
Mention all 3 ways of influenza transmission	167 (27)	12 (22)	151 (24)
Knowledge about Influenza and Influenza Prevention			
Influenza *can be severe (agree)*	586 (94)	52 (96)	564 (91)
Influenza can be lethal (*agree*)	424 (68)	36 (67)	470 (76)
Treatment for influenza exists (*agree)*	553 (89)	51 (94)	541 (87)
People recover from influenza with or without treatment (*agree*)	393 (63)	28 (52)	355 (57)
Likelihood for infection is the same for everyone *(agree)*	322 (52)	22 (41)	283 (46)
Likelihood for severe infection is the same for everyone *(agree)*	228 (37)	16 (30)	226 (36)
Frequent hand washing to prevent influenza is very effective	541 (87)	38 (70)	549 (88)
Good coughing etiquette to prevent *influenza is very effective*	549 (88)	46 (85)	524 (84)
What time of the year are people getting sick with influenza?			
All year	155 (25)	8 (15)	131 (21)
In summer	31 (5)	2 (4)	32 (5)
In winter	433 (69)	44 (81)	452 (73)
How often should people get vaccinated against influenza?			
Every year	437 (70)	40 (74)	395 (64)
Never/Don't know/others	86 (14)	6 (11)	121 (19)
Twice in your life	80 (13)	6 (11)	54 (9)
Once in your life	21 (3)	2 (4)	52 (8)
Who should receive the vaccination against influenza?			
Everyone	425 (68)	38 (70)	354 (57)
Young children	207 (33)	16 (30)	224 (36)
Adults ≥ 65yo	190 (30)	16 (30)	213 (34)
Pregnant women	45 (7)	7 (13)	9 (1)
People with chronic diseases[1]	8 (1)	0 (0)	5 (1)
Healthcare workers	1 (0)	0 (0)	8 (1)

[1] People with asthma, lung, renal or heart disease, diabetes, or cancer.

vaccine during the previous year stated people get the vaccine mainly "to protect themselves" against influenza illness (Table 3) Conversely, protecting others was rarely (<10%) cited as a reason for vaccination, and issues of effectiveness or safety were rarely mentioned. Few mothers (≤2%) and none of the pregnant women reported that reading or hearing about influenza vaccines in the media or getting a physician recommendation was a reason to be vaccinated. The media and physician recommendations seldom were cues to action among older adults (6%, 95%CI: 3–11 and 4%, 95%CI: 2–9, respectively).

Among participants that did not get vaccinated against influenza in the previous year "being afraid of vaccination and its effects" was the most commonly cited barrier for getting vaccinated against influenza (53% of mothers [95%CI 49–58]; 52% of pregnant women [95%CI: 37–67]; and 52% of older adults [95%CI: 47–57], Table 3). The second most common reason cited was not knowing the vaccine was necessary (mothers 39% [95%CI: 35–45], pregnant women 55% [95%CI: 39–69], and older adults 38% [95%CI: 33–44%]). Nineteen percent (95%CI: 16–23) of mothers, 11% of pregnant women (95%CI: 5–25) and 17% of older adults (95%CI: 14–21) stated that they did not get vaccinated because "the vaccine does not protect people".

3.7. Pregnant women, influenza and vaccine

Most pregnant women reported willigness to receive vaccination during pregnancy even if they have to pay for it (87.4%, 95%: CI 74.9–94.2) and believed influenza illness could hurt their baby during pregnancy (70%, 95%CI: 54–82). However almost half of them (47.4%,95%CI: 30.7–64.8) perceived that is unlikely that they will get influenza during pregnancy and 41% perceived that vaccination can have bad effects during pregnancy (41.7%, 95%CI: 24.8–60.8). Interestingly, most pregnant women (86%, 95%CI 74–93) believed influenza vaccines could prevent disease during pregnancy and the majority (93%, 95%CI 81.5–97.6) trusted the recommendation to get vaccinate if it was done by their doctor and to a lesser extent by their family (47.5%, 95%CI: 30.6–64.9) (see Supplementary Table 2).

3.8. Factors related to influenza vaccination in the previous year

In the bivariate analysis for the group of mothers we did not find any factor associated with vaccination in the previous year. Two variables with p values between 0.05 and 0.1 were tested in a subsequent multivariate model, but the p values for both remained > 0.05. For pregnant women, participants with technical education were less likely vaccinated (prevalence ratio [PR] 0.57, 95% CI: 0.35–0.91), while those with pre-existing medical conditions were 4.20 times more likely to be vaccinated in the previous year (95% CI: 2.03–8.70) (Table 4). All pregnant women who knew about the required frequency of vaccination were vaccinated (p = 0.048). The small number of pregnant women included in this study precluded multivariate analysis.

Among older adults, the most educated were less likely to be vaccinated against influenza in the previous year (PR [95%CI]: 0.70 [0.57–0.85], 0.69 [0.51–0.95] and 0.79 [0.52–1.20] for high school, technical and university education respectively) than those with primary education or less (Table 4). Those employed were less likely to be vaccinated (0.74 [0.62–0.88]), while those with preexisting medical conditions (1.50 [1.29–1.74]) and those who knew the recommended vaccination frequency (2.43[1.27–4.66]) were more likely to be vaccinated. Only education, pre-existing medical conditions, and knowledge of vaccination frequency were independently associated with vaccination during the previous 12 months in multivariate analyses (Table 4).

3.9. Perspective on means of communication

Most mothers and pregnant women stated television (69 and 72%, respectively) as their primary source of information about their community; followed by radio (44 and 32%, respectively) and neighbors/ friends (39 and 28%, respectively). Older adults stated that television (59%), neighbors/ friends (50%) and radio (48%) were their most important sources of information. Internet or social networks had low importance for mothers and pregnant women (≤13%) and no importance for older persons (0%) seeking

Table 3
Spontaneously mentioned reasons for and against influenza vaccination, three cities in Peru, July-August 2016.

Health Belief Model Construct	Item/Response Option	Mothers n (%)	Pregnant women n (%)	Adults ≥ 65y n (%)
What do you think are the reasons people are vaccinated against influenza? (Restricted to those with self-reported vaccination during the last year)				
		176	10	167
Perceived benefits	To protect themselves	173 (98)	9 (90)	165 (99)
	To protect others	14 (8)	1 (10)	13 (8)
	Because it's effective	4 (2)	0 (0)	6 (4)
	Because it's safe	3 (2)	1 (10)	7 (4)
	Because it's free	0 (0)	0 (0)	2 (1)
Cues to Action	Because read or heard it in media	4 (2)	0 (0)	10 (6)
	Because of the doctor's recommendation	3 (2)	0 (0)	7 (4)
	Because it's mandatory	1 (1)	0 (0)	2 (1)
What do you think are the reasons people do not get vaccinated against influenza? (Restricted to those reporting no influenza vaccines in the last year*)				
		448	44	455
Perceived barriers	Being afraid of vaccination and its effects	239 (53)	23 (52)	238 (52)
	Don't know it's necessary	175 (39)	24 (55)	174 (38)
	Does not protect	85 (19)	5 (11)	79 (17)
	Don't have time to get it	46 (10)	6 (14)	37 (8)
	Inconvenient working hours at health centers	25 (6)	0 (0)	16 (4)
	Media talks bad about it	22 (5)	4 (9)	28 (6)
	Don't know where to get it	18 (4)	1 (2)	22 (5)
	Can't get vaccination at health center	25 (6)	2 (5)	8 (2)
	Carelessness	18 (4)	1 (2)	27 (6)
Perceived severity	Influenza is not serious	22 (5)	0 (0)	33 (7)

Multiple responses allowed.
*"No" and "don't know" responses included.

Table 4
Bivariate and multivariable analyses for association with vaccination in previous year, three cities in Peru, July-August 2016.

Variable	Mothers (n = 624)		Pregnant women (n = 54)		Adults ≥ 65 yo (n = 622)	
	PR (95% CI)	P value	PR (95% CI)	P value	PR (95% CI)	P value
Bivariate Analyses						
Sociodemographic Variables						
Female	–	–	–	–	0.96 (0.90–1.03)	0.278
Age (years)	0.99 (0.96–1.01)	0.333	1.01 (0.93–1.10)	0.756	1.01 (0.98–1.04)	0.659
Education level						
Primary or less	(Ref.)		–		(Ref.)	
High School	1.38 (0.96–1.99)	0.082	(Ref.)		0.70 (0.57–0.85)	**<0.001**
Technical	1.10 (0.59–2.06)	0.764	0.57 (0.35–0.91)	**0.020**	0.69 (0.51–0.95)	**0.024**
University	1.49 (0.70–3.18)	0.302	0.49 (0.14–1.73)	0.266	0.79 (0.52–1.20)	0.263
Marital status						
Cohabitating	(Ref.)		(Ref.)		(Ref.)	
Married	1.07 (0.88–1.30)	0.492	0.57 (0.17–1.97)	0.376	1.03 (0.56–1.89)	0.928
Single	0.75 (0.44–1.28)	0.289	1.62 (0.52–5.04)	0.405	0.94 (0.48–1.83)	0.858
Widowed	–	–	–	–	1.28 (0.91–1.81)	0.163
Working status						
Employed	0.96 (0.68–1.35)	0.796	1.50 (0.66–3.39)	0.330	0.74 (0.62–0.88)	**0.001**
Studying	0.80 (0.44–1.46)	0.467	–	0.661†	–	–
Housework	0.91 (0.71–1.15)	0.428	0.69 (0.46–1.03)	0.068	1.00 (0.67–1.49)	0.987
Unemployed	–	–	–	–	1.79 (1.42–2.25)	**<0.001**
Pre-existing medical condition	1.02 (0.83–1.25)	0.850	4.20 (2.03–8.70)	**<0.001**	1.50 (1.29–1.74)	**<0.001**
Influenza Vaccination Knowledge						
Vaccination Frequency *(every year)*	1.44 (0.96–2.16)	0.075	–*	**0.048**	2.43 (1.27–4.66	**0.008**
Knowledge of being part of a risk group**	–	–	0.75 (0.05–10.43)	0.828	1.36 (0.98–1.89)	0.068
Multivariate analyses						
Education level	–	–	–	–		
Primary or less	–	–	–	–	(Ref.)	
High School	–	–	–	–	0.64 (0.49–0.83)	**0.001**
Technical	–	–	–	–	0.58 (0.43–0.79)	**0.001**
University	–	–	–	–	0.79 (0.50–1.21)	0.269
Pre-existing medical condition	–	–	–	–	1.46 (1.17–1.82)	**0.001**
Vaccination Frequency *(every year)*	–	–	–	–	2.37 (1.35–5.13)	**0.004**

†Fisher's exact test, not adjusted for clustering within city.
*PR cannot be calculated as zero unexposed received vaccination.
** Mothers were not considered a risk group according to previous guidelines

information (Fig. 1). Authorities were not cited as a source of information by any of the participants.

Most mothers and pregnant women owned a mobile phone (84 and 85%, respectively), most stated they receive text messages (75 and 83%, respectively) and about two thirds (73 and 80%, respectively) were interested in receiving information about influenza vaccination via text message. In contrast, only 47% of older adults had mobile phones, 18% stated to receive text messages and only 16% were willing to receive text messages about influenza vaccination.

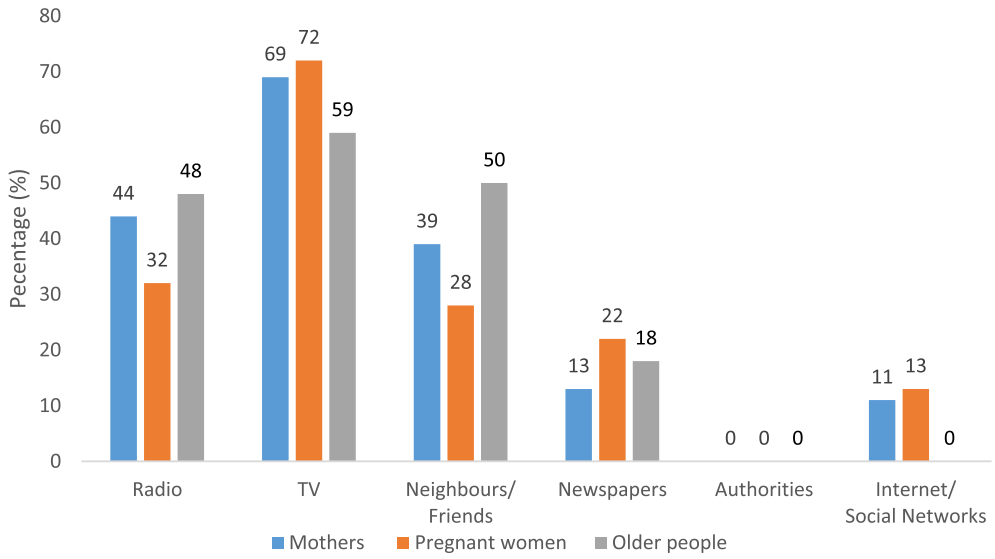

Fig. 1. Sources of information on community-related matters, three cities in Peru, July-August 2016.

4. Discussion

Our results suggest that despite Peru's efforts to distribute influenza vaccine free-of-charge to target groups, vaccine coverage remained low. The vaccination coverage among older adults in the current study (28%) was similar to the coverage reported in a Peru population-based cohort (26%) [3]. Our findings differed from the coverage reported by PAHO in 2014 (47% among adults in Peru aged ≥65 years) [10] and differs substantially from the coverage, published also by PAHO in 2016 (i.e., 89% for adults in Peru aged ≥60 years in 2014) [8]. Differences between our survey and PAHO findings might be due to the methodology used to ascertain vaccine coverage. While survey data uses nominal self-reporting to estimate coverage, PAHO uses coverage data reported by ministries of health [10,19]. Reported vaccine coverage in Peru is calculated using the number of individuals vaccinated over the number of individuals planned to target, and usually this number is an estimation of the individuals in the catchment areas of health facilities. Accurate denominator information, however, is often lacking.

While most participants considered vaccines protective and good for health, a great majority also believed people were "afraid "of vaccines. This last finding could explain, in part, the low coverage among pregnant women and older adults who are targeted for vaccination. Their vaccination coverage was similar to those of mothers who are not a target group but who care for children targeted for vaccination.

Like other studies [20], our participants were more likely to get vaccinated if they understood that influenza could lead to severe illness. We did not assess whether participants believed that they were individually at high risk of severe influenza illness and perhaps those who knew of the possibility of severe influenza illness judged such an event unlikely. A systematic review suggests that perceptions of low risk of acquiring influenza illness is a barrier to influenza vaccine uptake [21]. Only 13% of surveyed pregnant women and approximately one third of older adults self-identified as an influenza vaccine target group. This highlights the need to strengthen risk communication messages to promote vaccination and the value of targeting those at higher risk of influenza illness complications such as children [22], pregnant women [20], and older adults [23].

Knowledge that influenza vaccination is recommended annually was associated with vaccination in our study among both pregnant women and older adults. In the group of older adults, it was surprising to find that the most educated and those employed were less likely to be vaccinated in the last year. It might be that, unless they have a medical condition, older adults do not necessarily identify themselves at high risk. When they feel healthy and are employed, they might not prioritize and make time available for preventive medical services. Information, vaccine recommendations, and vaccine availability at medical facilities and at workplaces can have a significant effect on vaccine uptake [23]. Most of pregnant women were willing to be vaccinated particularly if vaccines were recommended by physicians and, to a lesser extent, a family member. This finding highlights the importance of provider-recommended influenza vaccination among pregnant women [24,25]. Providing information in the health care setting on groups targeted for influenza vaccination and explanation of the risks of influenza disease and the potential benefits of vaccination might help improve vaccination coverage [26].

We identified several barriers to influenza vaccination. Less than a quarter of participants seemed knowledgeable about all the routes of influenza transmission. Insufficient knowledge about influenza illness, including its routes of transmission, was found as a barrier to vaccination especially among pregnant women [27]. Health promotion messages about the spread of influenza might promote preventive behaviours, including influenza vaccination. Insufficient information about the safety of influenza vaccines was also a barrier to vaccination [23]. More than half of those not vaccinated in the past year reported being afraid of vaccination and side effects as a barrier for vaccination. Fear of vaccine adverse effects is frequently identified as a barrier to vaccination among pregnant women and older adults [28–31]. Pregnant women can also be worried about birth defects erroneously attributed to vaccination [32]. Influenza vaccination campaigns in Peru have traditionally focused on distribution of pamphlets at health centers and dissemination of information regarding vaccine availability through newspapers, TV or radio. Providing, as part of the communication campaigns and at the point of care, information not only about vaccine availability but also about the disease itself, groups at higher risk for influenza and safety of influenza vaccines might be useful in Peru.

Our study has some limitations. We did not corroborate the status of influenza vaccination through a review of vaccination records and relied on self-reported vaccination status. While we

explored participants' knowledge of influenza illness, we did not assess participants' concerns about the cost and inconvenience of mild influenza illness or the likelihood of a severe influenza illness event. We also did not ask mothers about the vaccination status of their children. The study also has several strengths: a robust sampling methodology, high participation and the collection of information that could help improve risk communication messages during subsequent vaccination campaigns and ultimately influenza vaccination coverage.

The study findings highlight the need to target communication strategies to the broader community to increase knowledge about the route of influenza transmission, the potential for severe and/or fatal illness among all persons and especially among risk groups. Promotional messages should also address the safety of influenza vaccine for adults, children, pregnant women and their fetuses and the annually recommendation of the vaccine. Additionally, it is important to train and create awareness among health care providers through medical societies, continuing education, and policies on the protection influenza vaccines provide for themselves and for the community, the safety of vaccines, and the key role they have to facilitate vaccinate acceptance and coverage in target groups.

5. Conclusions

Despite a government-subsidized vaccine program, influenza vaccine uptake remained low among pregnant women and older adults. Participants seemed to have insufficient knowledge of influenza routes of transmission and risk. Risk communication is critical for community mobilization. Televised health promotion messages might reinforce influenza vaccine recommendations from providers and family especially among pregnant women. Radio messages might similarly reinforce messages among older adults. In addition, SMS messages could be used, because of the frequent use of cellular phones among younger participants. Peru might consider providing target groups and their health care providers with additional information about influenza transmission routes, who is at greatest risk of severe influenza illness, the benefits of protecting yourself against influenza through vaccination, and the safety of vaccination. The results of this study were used by the Ministry of Health of Peru in 2017 to strengthen and target the communication messages to increase the number of people vaccinated for influenza.

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.

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Authors contribution

PG conceived the study. CR, CC, GS, JN, PM and PG contributed to the study design. SR and CC performed analysis. SR and CR developed a first draft. SR, CR, CC, JN, YT, GS, EAB and PG interpreted the data. SR, YT, CR and PG conducted a literature search. CC, MV, SLR and PM implemented and supervised the study execution and acquisition of data. All authors critical reviewed and have given final approval to the manuscript.

Disclaimer

The views expressed in this manuscript are those of the authors and do not necessarily reflect the official policy or position of the Centers for Disease Control and Prevention, the Department of the Navy, Department of Defense, nor the U.S. Government.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2019.11.016.

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