

RESEARCH ARTICLE

Open Access



# Implementation of a national school-based Human Papillomavirus (HPV) vaccine campaign in Fiji: knowledge, vaccine acceptability and information needs of parents

S. F. La Vincente<sup>1,2\*</sup>, D. Mielnik<sup>1,3</sup>, K. Jenkins<sup>4</sup>, F. Bingwor<sup>5</sup>, L. Volavola<sup>5</sup>, H. Marshall<sup>6,7,8</sup>, P. Druavesi<sup>5</sup>, F. M. Russell<sup>1,2</sup>, K. Lokuge<sup>3</sup> and E. K. Mulholland<sup>1,9</sup>

## Abstract

**Background:** In 2008 Fiji implemented a nationwide Human Papillomavirus (HPV) vaccine campaign targeting all girls aged 9–12 years through the existing school-based immunisation program. Parents of vaccine-eligible girls were asked to provide written consent for vaccination. The purpose of this study was to describe parents' knowledge, experiences and satisfaction with the campaign, the extent to which information needs for vaccine decision-making were met, and what factors were associated with vaccine consent.

**Methods:** Following vaccine introduction, a cross-sectional telephone survey was conducted with parents of vaccine-eligible girls from randomly selected schools, stratified by educational district. Factors related to vaccine consent were explored using Generalised Estimating Equations.

**Results:** There were 560 vaccine-eligible girls attending the participating 19 schools at the time of the campaign. Among these, 313 parents could be contacted, with 293 agreeing to participate (93.6 %). Almost 80 % of participants reported having consented to HPV vaccination (230/293, 78.5 %). Reported knowledge of cervical cancer and HPV prior to the campaign was very low. Most respondents reported that they were satisfied with their access to information to make an informed decision about HPV vaccination (196/293, 66.9 %), and this was very strongly associated with provision of consent. Despite their young age, the vaccine-eligible girls were often involved in the discussion and decision-making. Most consenting parents were satisfied with the campaign and their decision to vaccinate, with almost 90 % indicating they would consent to future HPV vaccination. However, negative media reports about the vaccine campaign created confusion and concern. Local health staff were cited as a trusted source of information to guide decision-making. Just over half of the participants who withheld consent cited vaccine safety fears as the primary reason (23/44, 52.3 %).

(Continued on next page)

\* Correspondence: [sophie.lavincente@rch.org.au](mailto:sophie.lavincente@rch.org.au)

<sup>1</sup>Centre for International Child Health, Murdoch Childrens Research Institute, Royal Children's Hospital, Flemington Road, Parkville, VIC 3052, Australia

<sup>2</sup>Department of Paediatrics, University of Melbourne, Royal Children's Hospital, Flemington Road, Parkville, VIC, Australia

Full list of author information is available at the end of the article



(Continued from previous page)

**Conclusion:** This is the first reported experience of HPV introduction in a Pacific Island nation. In a challenging environment with limited community knowledge of HPV and cervical cancer, media controversy and a short lead-time for community education, Fiji has implemented an HPV vaccine campaign that was largely acceptable to the community and achieved a high level of participation. Community sensitisation and education is critical and should include a focus on the local health workforce and the vaccine target group.

**Keywords:** HPV vaccination, Fiji, Vaccine acceptance, Vaccine decision-making

## Background

Cervical cancer is the third most common cancer in women worldwide, and a leading cause of mortality amongst women [1]. The greatest cervical cancer burden is in low-resource settings, with 85 % of new cases and almost 90 % of mortality occurring in low and middle income countries [1] where access to cancer screening and treatment is often very limited. The Human Papillomavirus (HPV) causes almost all cases of cervical cancer [2]. The development of a vaccine that provides protection against the most common, and most cancer-causing, types of HPV is a major step towards reducing cervical cancer rates. Infection with HPV is also recognised to cause a number of other cancers [3], as well as genital warts, a condition around which there is substantial stigma and negative impact on quality of life [4, 5]. Thus there is potential for a much broader health impact of HPV vaccine use beyond reduction of cervical cancer.

The potential for vaccine introduction to reduce disease burden relies on community acceptance and uptake of the vaccine. Effective community education and awareness-raising is a key component of any new vaccine introduction [6]. Such activities may be particularly important in the case of HPV vaccine for a number of reasons. Studies across a range of settings have revealed there is typically limited knowledge about HPV among the general population [7–12]. Further, the virus is sexually transmissible. To ensure women are protected, the vaccine is ideally delivered prior to sexual contact, thus a key target population for vaccination is young adolescents. As such there may be strong cultural and social factors influencing community acceptance of the vaccine [7, 13].

Early experience with HPV vaccine, and in particular the implementation of a nation-wide campaign, was restricted to high-income countries. Recognising the high burden of cervical cancer and with increasing access to the vaccine through the GAVI Alliance's support of HPV vaccine implementation [14], the last decade has seen a substantial expansion of HPV vaccine introduction in low and middle income countries (LMIC). These experiences are generating a growing body of literature on the acceptability of the vaccine in these varied settings, what

factors have been important for successful implementation, and what lessons have been learnt in each country. Such experiences are critical to strengthen vaccine programs in those countries, and to inform introduction elsewhere.

The burden of cervical cancer in the Pacific region is very high, with rates in Melanesian islands among the highest reported worldwide [1, 15–17]. A 2015 report noted that senior Pacific country health officials ranked public perception about the HPV vaccine and its safety as one of the leading barriers to effective introduction of the vaccine [17]. To date there has been no information on community acceptability of the vaccine, or of the experience of vaccine introduction in this region.

The Republic of the Fiji Islands is an archipelago of several hundred islands in the South Pacific. With a population of just under 850,000 it is one of the most populous of the South Pacific Island nations. While Fiji made steady progress across many development goals during the 1990s, progress has more recently slowed and it is unlikely that poverty targets and several key health goals will be met [18]. Fiji has a very high burden of cervical cancer, with an estimated age-standardised incidence of 27.6 cases per 100,000 women (2003–2009) [19]. Data indicate the available HPV vaccines could reduce cervical cancer in Fiji by up to 80 % [20]. Cytology-based cervical cancer screening was included in Fiji's overall Cancer Control Programme in 1995; however as in many LMICs, coverage of Papanicolaou (Pap) smear testing remains very low, reaching only 10 % of eligible women [21]. Resource constraints limit the scope of the screening program (for example, a lack of human resource caps the number of tests that can be performed each year, and there is very limited program advocacy and mobilisation), and this is likely an important barrier to broader uptake [21].

Given the high burden of cervical cancer in Fiji and the existence of a well-functioning school-based immunisation programme, the Ministry of Health (MoH) implemented a one-off national HPV vaccine campaign in 2008 following the donation of 110,000 doses of quadrivalent HPV vaccine. This was one of the first experiences of HPV vaccine introduction in a low- or middle-income Pacific nation.

The HPV vaccine campaign in Fiji commenced in late-2008, with administration of the 3-dose HPV vaccine primarily through the existing school-based immunisation program. There was enough vaccine available to vaccinate four birth cohorts (30,338 girls aged 9–12 years) with a 3-dose schedule. Due to the limited shelf-life of the donated vaccine and the approaching school holidays, less than two months were available for community sensitisation prior to vaccine introduction. To capture the target age group of 9 to 12 year olds, all girls in classes 4 to 7 were eligible for vaccination. The vaccine was also offered free-of-charge at health centres to age-eligible girls who had missed school-based administration. A concerted awareness-raising strategy was undertaken to educate the population about HPV and promote vaccine uptake by the target group, both in the short period of time prior to vaccine introduction and during campaign roll-out. This communication was directed at parents of school-aged children, with written parental consent being required for vaccination. An information pamphlet for parents outlined key issues about cervical cancer, HPV and reasons for vaccination, side-effects and safety of the vaccine, as well as details of the vaccine campaign including eligibility and timing. The Ministry of Health also worked closely with the Ministry of Education to engage schools and teachers in the communication strategy. The Ministry of Education was involved in the planning and timing of the campaign. Nurses involved in implementing the program met with teachers to explain the program. Teachers organised for the information pamphlet and consent forms to be taken home by eligible students. An awareness-raising campaign was also run through the media, including advertisements and information presented on the radio, television and in newspapers. A number of negative reports appeared in the media questioning the safety of the vaccine and the motivation of the government and vaccine manufacturer. A vigorous media debate ensued, which created significant hype and controversy around the vaccine campaign. The MoH and other supporting agencies responded swiftly to counter the concerns generated by the negative press.

Understanding the information needs and attitudes of parents in relation to HPV vaccine delivery is critical to ensure vaccination programs achieve a high level of uptake [22]. The aim of this study was to describe parents' knowledge, experiences and satisfaction with the campaign in Fiji, the extent to which information needs for vaccine decision-making were met, and to identify factors that were associated with vaccine consent.

## Methods

A list of primary schools in each of the nine educational districts was provided by the Ministry of Education.

From this list of 724, 25 schools were randomly selected, stratified by educational district. We aimed to interview all parents of vaccine-eligible girls attending the selected schools. The research team first contacted each school to request their assistance. Schools provided contact details for the parents of all girls in eligible classes at the time of the vaccination program and notified parents of these students about the upcoming survey.

A telephone-based questionnaire was developed and initially pilot tested with parents from two schools. A combination of open and closed questions focused on knowledge and attitudes about HPV, cervical cancer and HPV vaccine prior to and after the vaccine campaign; HPV vaccine decision-making, including information sources and satisfaction with available information; participation in the campaign; concerns about the vaccine or the campaign and, among non-consenting parents, reasons for withholding consent. Demographic information was also collected. Interviews were conducted by two Fijian research assistants trained in the administration of the questionnaire, including the use of standard prompts. Using the contact lists provided by the schools, parents were contacted by telephone and invited to participate in the survey. Three attempts of contact at different times of day and on different days were made for each contact number provided by the school. Verbal informed consent was obtained from participants prior to interview. Responses were coded and entered by research team members in Fiji.

Data were transferred to Stata13 for analysis. Test of proportions was used to assess the change in self-reported awareness of HPV and cervical cancer before and after the vaccine campaign. We assessed the relationship between vaccine acceptance (self-reported provision of consent) and potential explanatory variables using logistic regression, employing the method of marginal models estimated using Generalised Estimating Equations (GEE) with information sandwich estimates of variance. GEE was used given the potential for clustering by school. These analyses were performed in Stata using the `xtgee` command. Simple (univariate) GEE was initially performed to examine the relationship between vaccine acceptance and each explanatory variable of interest, followed by multivariate GEE including explanatory variables found to be significant associated with consent in univariate analysis or considered to be potential confounders.

The survey was undertaken from November 2009 to March 2010, following scheduled delivery of the third dose of the HPV vaccine. The study was approved by the Fiji National Research Ethics Review Committee, and the Human Research Ethics committee of the University of Melbourne, Australia.

## Results

### Survey participation and sample characteristics

Of the 25 schools randomly selected for participation, three schools were excluded as they were subsequently identified to be schools for boys only. A further three schools from a remote northern region were excluded due to communication difficulties following a cyclone. All of the 19 remaining randomly selected schools agreed to assist.

Class lists provided by the schools indicated that a total of 560 vaccine-eligible girls attended the participating 19 schools at the time of the campaign. Among these 560, 247 parents could not be reached by the research team due to incorrect or missing phone number. Among the 313 parents who were contacted and invited to participate, a total of 293 agreed (93.6 %).

Most participants identified as the mother of the vaccine-eligible girl (235/293, 80.2 %) and had a median age of 40 years (IQR 36, 43) (Table 1). The distribution of participants across the three main geographic regions of Fiji was largely consistent with the broader population distribution [23]. The large majority of respondents reported that their daughter received the routine immunisations provided through the school-based program (270/293, 92.2 %).

### Awareness and knowledge of cervical cancer and HPV

Participants reported very little knowledge of cervical cancer or HPV prior to the campaign (Table 1). Only 30 participants (10.2 %) reported having heard of HPV before the vaccine campaign. Sixty-two respondents (21.2 %) reported having heard of cervical cancer before the campaign, and the majority of these knew someone who had the disease (47/62, 75.8 %). Most had heard of pap smear (219, 74.7 %) and almost all of those respondents considered it somewhat (6/219) or very (211/219) important for women in Fiji to have pap smear screening.

The information campaign significantly increased self-reported awareness of cervical cancer ( $p < 0.001$ ). Over 80 % (239/293, 81.6 %) of respondents reported knowledge of cervical cancer at the time of survey, and most (177/293, 60.4 %) reported having only become aware of cervical cancer through the vaccine campaign. Many participants believed cervical cancer to be common among women in Fiji (193/293, 65.9 %). Awareness of HPV also significantly increased, with just under a third (87/293) of participants reporting knowledge of HPV at the time of survey ( $p < 0.001$ ).

### Information and decision-making

Over half of the respondents reported feeling that they had sufficient information to make a decision to accept or decline vaccination for their daughter

(Table 1) (196/293, 66.9 %). The majority reported that their primary source of information about cervical cancer, HPV and the vaccination campaign was the information pamphlet provided to parents of eligible girls (219, 75 %). While most respondents reported that the source of health information they trust most is their local nurse or family physician (259/293, 88.4 %), few reported having obtained further information or advice about the vaccine campaign from a health provider or other community member (48, 16.4 %). By contrast, most respondents reported having discussed the decision with a family member (182, 62.1 %), and the majority also reported having involved their daughter in the decision about vaccination (213, 72.7 %).

Additional information needs focused on the long-term safety, potential side-effects, and the relative advantages and disadvantages of vaccination. Several respondents also wanted more information about why girls were being vaccinated at such a young age, and how sexual intercourse could lead to cancer. Negative media reports were described as having created confusion, with some participants noting that they would have liked more information to clarify the claims made by those reports.

Some schools had been vocally opposed to the campaign and had resisted the nurses' attendance on the scheduled vaccination days. Most respondents perceived their daughter's school had been supportive of the campaign (180/293, 61.4 %). Seven respondents (2.4 %) reported the school had been openly opposed to the HPV vaccine program, representing four different schools; however, all but one of these families reported consenting to vaccination notwithstanding the school's position.

### Vaccine acceptance

Almost 80 % of participants reported that they had consented to their daughter receiving the HPV vaccine (230/293, 78.5 %) (Table 1, Fig. 1). Over half reported that their daughter had received all three doses (170/293, 58.0 %), which is consistent with broader population figures of 55 % coverage for the third dose [24]. Among the 39 consented children who did not receive all three doses, absence from school during vaccination was the most common reason given (16/39, 41.0 %). The large majority of consenting parents were happy with their decision, with few parents reporting any subsequent concern about their decision to consent to vaccination (14/230, 6.1 %).

In univariate GEE analysis, respondents who reported feeling that they had sufficient information to make an informed decision about vaccination were significantly more likely to consent to vaccination (OR 180.38, 95 % CI 18.26, 1781.92,  $p < 0.001$ ) (Table 2). Almost all who

**Table 1** Participant characteristics (*n* = 293)

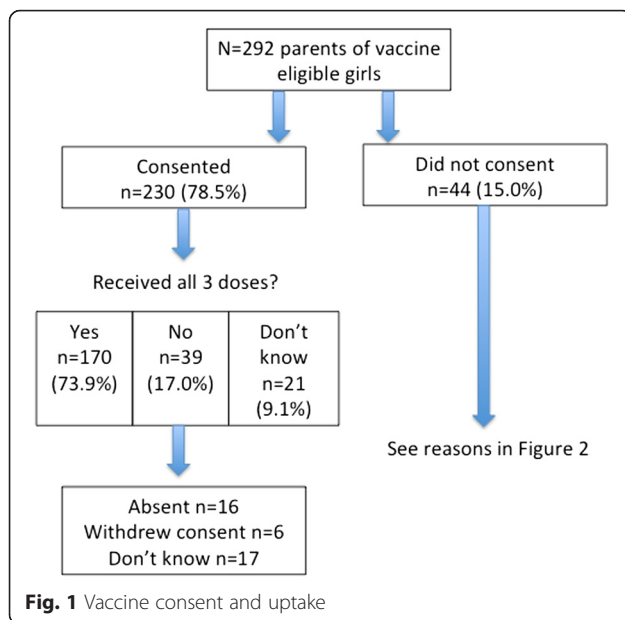
	N (%)
Demographics	
Age of respondent (years) ( <i>med,IQR</i> )	40 (36,43)
Relationship of respondent to eligible girl	
Mother	235 (80.2 %)
Father	39 (13.3 %)
Other guardian	14 (4.8 %)
Region	
Central/Eastern Division	177 (60.4 %)
Western Division	90 (30.7 %)
Northern Division	26 (8.9 %)
Education of respondent	
Primary school only	40 (13.7 %)
Secondary school or higher	233 (79.5 %)
Household weekly income, \$FJ	
<100	86 (29.4 %)
100-199	129 (44.0 %)
200+	78 (26.6 %)
Vaccine uptake	
Consent given for HPV vaccination	
Yes	230 (78.5 %)
No	44 (15.0 %)
Don't know	19 (6.5 %)
Eligible girl reported to have received all three doses	
Yes	170 (73.9 %)
No	39 (17.0 %)
Don't know	21 (9.1 %)
Eligible girl reported to receive other routine school vaccines	
Yes	270 (92.2 %)
No	1 (0.3 %)
Don't know	19 (6.5 %)
Awareness and knowledge	
Heard of HPV before campaign	
Yes	30 (10.2 %)
No	242 (82.6 %)
Don't know	17 (5.8 %)
Heard of cervical cancer before campaign	
Yes	62 (21.2 %)
No	222 (75.8 %)
Don't know	8 (2.7 %)
Consider cervical cancer common in Fiji	
Yes	193 (65.9 %)
No	39 (13.3 %)
Don't know	60 (20.5 %)

**Table 1** Participant characteristics (*n* = 293) (*Continued*)

Consider women in Fiji at risk of HPV	
Yes	190 (64.9 %)
No	73 (24.9 %)
Don't know	26 (8.9 %)
Heard of pap smear	
Yes	219 (74.7 %)
No	51 (17.4 %)
Don't know	22 (7.5 %)
How important for women in Fiji to have pap smear ( <i>among those who have heard of pap smear</i> )	
Very important	211/219 (96.4 %)
Somewhat important	6/219 (2.7 %)
Don't know	2/219 (0.9 %)
Vaccine information and decision-making	
Satisfied with access to information for decision-making	
Yes	196 (66.9 %)
No	38 (13.0 %)
Don't know	54 (18.4 %)
Discussed decision with family member	
Yes	182 (62.1 %)
No	104 (35.5 %)
Don't know	0
Involved daughter in decision	
Yes	213 (72.7 %)
No	62 (21.2 %)
Don't know	14 (4.8 %)
Obtained advice from health provider or other community member	
Yes	48 (16.4 %)
No	202 (68.9 %)
Don't know	37 (12.6 %)
Main source of HPV vaccine information	
Campaign information pamphlet	219 (74.7 %)
Consent letter	11 (3.8 %)
Newspaper	40 (13.7 %)
Radio	10 (3.4 %)
Magazine article	1 (0.3 %)

*NB Percentages for each variable may not equal 100 due to missing data*

reported having access to sufficient information gave consent for vaccination (192/193, 99.5 %). Among non-consenting parents, almost all (43/44) either said they didn't have (*n* = 17), or weren't sure if they had (*n* = 26), sufficient information to make a decision. Believing that women in Fiji are at risk of HPV and that cervical cancer is common in Fiji were also significantly associated with



consent. The odds of giving consent was almost 7 times greater among respondents who perceived that women in Fiji are at risk of HPV compared to those who did not (OR 6.81, 95 % CI 2.64, 17.56,  $p < 0.001$ ), and 6 times greater among respondents who believed that cervical cancer is common in Fiji compared to those who did not think it is common (95 % CI 2.1, 17.2,  $p = 0.001$ ). The odds of consent was 30 times greater among parents who involved the vaccine-eligible girl in the decision (OR 30.66, 95 % CI 11.8, 79.9,  $p < 0.001$ ). Having discussed the decision with family members was also significantly associated with consent (OR 5.66, 95 % CI 2.5, 12.8,  $p < 0.001$ ). By contrast, those who obtained additional advice from a health provider or other community member were not statistically more likely to consent (OR 3.6, 95 % CI 0.07, 195.7,  $p = 0.529$ ).

Household income was significantly associated with consent, with the odds of consent among those in the middle-income bracket (\$FJ100-\$FJ199) 5 times greater than the odds of consent in the lowest income category (<\$FJ100) (OR 5.36, 95 % CI 1.9, 15.4,  $p = 0.002$ ). By contrast, parent's age ( $p = 0.736$ ) and education level ( $p = 0.085$ ) were not significantly related to consent.

A multivariate model exploring factors associated with consent was constructed including the following explanatory variables: household income, education of respondent, believing that women in Fiji are at risk of HPV, satisfaction with access to information for decision-making, discussing the decision with a family member and involving the daughter in the decision. Believing that cervical cancer is common in Fiji was not included as this is considered to measure a closely related construct to believing that women in Fiji are at risk of

HPV. The outcome of the model was not different according to which of these two risk perception variables were included, thus we included the variable with the strongest association in univariate analysis. Satisfaction with access to information for decision-making remained highly predictive of consent in the multivariate model (OR 272.10, 95 % CI 12.7, 5822.6,  $p < 0.001$ ). No other variables were significantly associated with consent in the multivariate model (Table 3).

#### Attitude towards future HPV vaccination

The large majority of consenting parents said they would again consent to HPV vaccination for other eligible family members if the vaccine were offered in the future (199/228, 87 %). Some were unsure if they would consent again (26/228, 11 %) and only 1 % said they would not consent in the future (3/228, 1 %). Among non-consenting parents, over a third were unsure whether they would consent if the vaccine became available again (17/44, 38.6 %), and several reported they would consent in the future (5/44, 11.3 %).

Parents' attitudes were fairly consistent regarding the age they considered appropriate for girls to receive the HPV vaccine, with most respondents suggesting between 9 and 11 years of age (188/293, 64.2 %). Most respondents said they would also consent to a son receiving the HPV vaccine if it were offered to boys in the future (203/293, 69.3 %).

#### Reasons for vaccine refusal

Forty-four participants (44/293, 15.0 %) reported that they had not consented to their daughter receiving the HPV vaccine, and a further 19 were unsure whether consent had been given (19/293, 6.4 %). Among non-consenting parents, approximately half (23/44, 52.3 %) cited concerns about HPV vaccine safety to be the primary reason for withholding consent (Fig. 2). Many of these parents commented that the vaccine was new in Fiji, that they had heard negative information about the vaccine from friends and in the media, and were frightened for their daughter to receive it. None of the parents who refused HPV vaccination reported withholding other vaccinations.

#### Discussion

Experience with HPV vaccine implementation in LMICs has been variable [25–29]. In Fiji there was broad acceptance and uptake of HPV vaccine, with almost 80 % of survey respondents having consented to vaccination, and over half reporting their daughter had received all three doses (58 %). This is consistent with the coverage recorded by the vaccine campaign, of 62 %, 56 %, and 55 % for doses 1, 2, and 3 respectively [24]. The high level of vaccine acceptance and uptake in Fiji was an

**Table 2** Factors associated with consent: univariate analysis (Generalised estimating equations)

Factors associated with consent: univariate analysis				
	Consented n (%)	Did not consent n (%)	OR	p value
Demographics				
Age ( <i>med./QR</i> )	40 (37.42)	40 (36.46)	0.99 (0.94,10.5)	0.736
Education				
Primary only	27 (71.1)	11 (28.9)	2.59 (0.88, 7.66)	0.085
Secondary or higher	193 (87.3)	28 (12.7)		
Household income				
<100\$FJ	60 (72.3)	23 (27.7)		
100-199 \$FJ	113 (91.9)	10 (8.1)	5.36 (1.87, 15.36)	0.002
200+ \$FJ	57 (83.8)	11 (16.2)	2.30 (0.80, 6.58)	
Region				
Central/Eastern	141 (83.9)	27 (16.1)		
Western	70 (87.5)	10 (12.5)	1.61 (0.35, 7.47)	0.510
Northern	19 (73.1)	7 (16.1)	0.51 (0.06, 4.49)	
Awareness and knowledge				
Heard of HPV prior				
Yes	26 (11.9)	3 (8.6)	1.56 (0.40, 6.10)	0.519
No	193 (88.1)	32 (91.4)		
Heard of CC prior				
Yes	52 (23.0)	9 (21.4)	0.85 (0.25, 2.88)	0.800
No	174 (77.0)	33 (78.6)		
CC common in Fiji				
Yes	171 (90.0)	16 (61.5)	5.99 (2.08, 17.24)	0.001
No	19 (10.0)	10 (38.5)		
Women in Fiji at risk of HPV				
Yes	170 (82.1)	15 (40.5)	6.81 (2.64, 17.56)	<0.001
No	37 (17.9)	22 (59.5)		
Information and decision-making				
Satisfied with access to information				
Yes	192 (91.4)	1 (5.6)	180.38 (18.26, 1781.92)	<0.001
No	18 (8.6)	17 (94.4)		
Discussed decision with family member				
Yes	165 (73.7)	15 (34.1)	5.66 (2.50, 12.83)	<0.001
No	59 (26.3)	29 (65.9)		
Involved daughter in decision				
Yes	203 (89.8)	9 (23.1)	30.66 (11.77, 79.90)	<0.001
No	23 (10.2)	30 (76.9)		
Obtained advice from health provider or other community member				
Yes	45 (20.6)	2 (8.0)	3.60 (0.07, 195.69)	0.529
No	173 (79.4)	23 (92.0)		

impressive achievement in the context of very limited baseline public awareness, as demonstrated by the low reported knowledge of HPV and cervical cancer and further supported by the absence of an existing public

health campaign around cervical cancer; limited time for community education; and a vigorous media debate.

The low reported knowledge of HPV and cervical cancer among participants prior to the vaccine campaign in

**Table 3** Factors associated with consent: multivariate analysis (Generalised estimating equation)

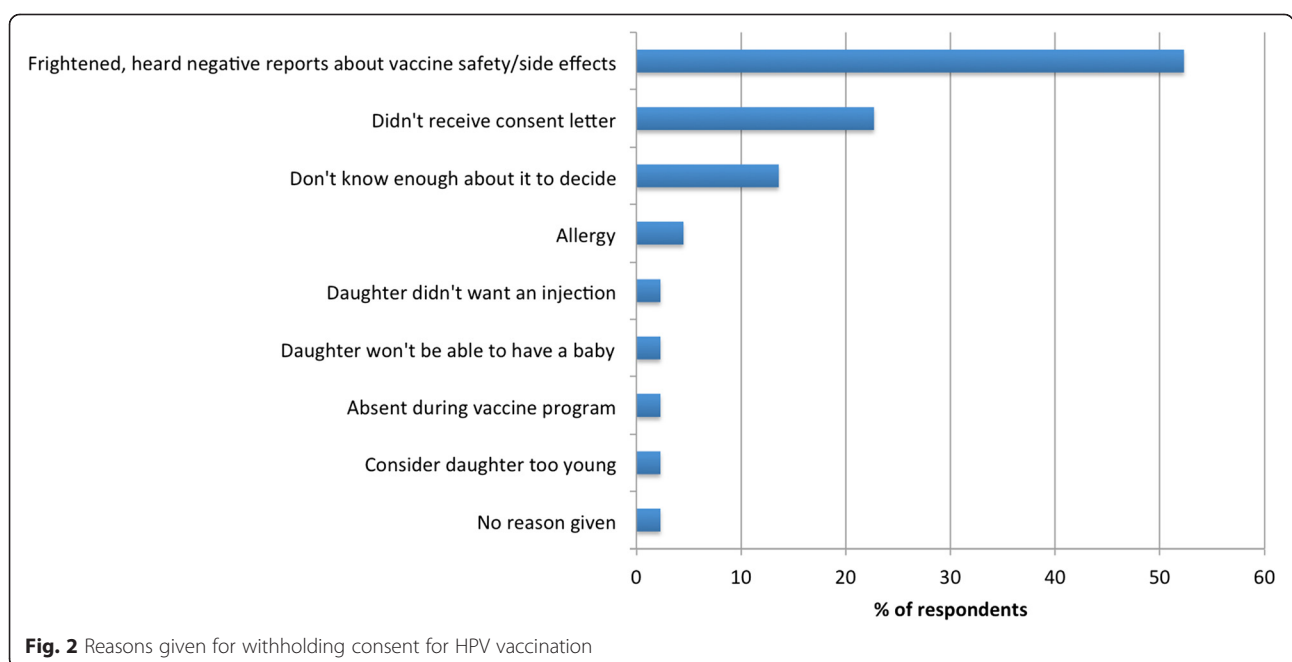
Factors associated with consent: multivariate analysis	OR (95 % CI)	p value
Household income		
100-199 \$FJ	6.92 (0.98, 48.5)	0.052
200+ \$FJ	0.47 (0.04, 5.82)	0.554
Education	4.33 (0.68, 27.64)	0.122
Women in Fiji at risk of cervical cancer	3.31 (0.39, 27.7)	0.270
Satisfied with access to information	272.10 (12.72, 5822.56)	<0.001
Discussed decision with family member	0.94 (0.21,4.23)	0.935
Involved daughter in decision	1.8 (0.47, 7.07)	0.384

Fiji is consistent with findings from other low and middle-income settings [7]. This, together with the very strong association identified between parents' satisfaction with their access to information and vaccine consent, highlights the critical role of community education and awareness-raising in HPV vaccine introduction. Among the variables measured in Fiji, the single most important factor explaining vaccine consent was satisfaction with access to information for decision-making. Almost universally, and irrespective of household income and other socio-demographic factors, parents who reported having access to sufficient information gave consent for vaccination. Among parents who did not consent, almost all were not satisfied with their access to information to guide decision-making.

The overwhelming association identified between parents' satisfaction with their access to information and

vaccine uptake is positive for future HPV vaccination in Fiji as it suggests that, with sufficient credible and accurate information, parents are generally willing to accept HPV vaccination for their daughters. Findings from other LMICs have also highlighted the important role of access to information and vaccine uptake. Masika and colleagues recently reported from Kenya that insufficient information about the vaccine was one of the main barriers to teachers recommending the vaccine to parents, and that those with greater knowledge were more likely to recommend the vaccine [30]. Another recent report from Kenya describing participation in hospital-based HPV vaccine delivery reported a limited association between demographic factors and vaccine uptake, but a strong relationship between vaccine uptake and being well-informed about the vaccine program and cervical cancer [31]. A study in Peru also identified access to sufficient, trusted and credible information as critical to parental acceptance of the vaccine [32].

Recent years have seen an increasing focus on understanding not only the role of information in parental decision-making for HPV vaccination, but also the type and source of information most likely to support vaccine acceptance. Reporting on the experience from HPV vaccine introduction in Uganda and Vietnam, Galagan and colleagues found the people with whom parents discussed the decision to be a key factor in vaccine uptake [33]. In those settings, discussion with "community influencers" (eg teachers, health workers and other community members) regarding the decision was significantly associated with vaccine uptake, playing a more important role than exposure to materials such as



**Fig. 2** Reasons given for withholding consent for HPV vaccination



information leaflets, banners and radio announcements. In Fiji we found that, despite local health providers being cited as a trusted source of health information, few parents reported having obtained information about the campaign from health providers or other community members, and those who did were no more or less likely to consent. The short time period available in Fiji for community education and discussion ahead of vaccine roll-out may have limited parents' access to sufficient information and their ability to actively seek out further information in the community.

Despite the absence in our study of an identified role for health worker or other community member consultation in parent decision-making in Fiji, in univariate analysis both discussion with family members and involvement of the vaccine-eligible girl in decision-making were strongly associated with consent. There is limited information from LMIC regarding the extent to which vaccine-eligible girls themselves are involved in HPV vaccine decision-making and the influence they may have on parental consent or refusal. A qualitative study of vaccine introduction in Peru revealed that the vaccine-eligible girls had an active role in decision-making, particularly in urban areas, citing cases of parents being convinced by daughters to either consent or refuse. This is consistent with findings from high-income countries that parent-daughter interaction regarding HPV vaccination decision-making plays an important role in vaccine uptake [34–36]. Given the potential then for vaccine-eligible girls themselves to be actively involved in decision-making, and also to foster awareness about HPV among future generations, community education and sensitisation should incorporate a strong focus on increasing understanding and acceptance among these young adolescents. This should also include adolescent boys, as potential future vaccine recipients, noting that a substantial proportion of respondents in Fiji indicated they would consent to HPV vaccination for their sons if it were offered.

In many settings limited knowledge about HPV and cervical cancer has been described among the health workforce [37–43]. Future HPV implementation in Fiji should include training and information targeting health professionals, as those identified by respondents to be a trusted source of health information, to ensure they are able to respond effectively to community queries and concerns. Galagan and colleagues also found in Uganda and Vietnam that teachers were important community influencers for parent decision-making [33]. We did not specifically enquire regarding the role of teachers in supporting vaccine decision making for parents; however as HPV vaccine has been primarily delivered in Fiji through the school-based immunisation program this is an important consideration for future delivery to ensure that

teachers are able to respond effectively and accurately to parents' concerns.

Respondents who did not consent to vaccination mainly attributed their refusal to safety concerns. This is consistent with reports from other settings describing vaccine acceptability and concerns post-introduction. For example, a study of vaccine acceptance and decision-making among parents of vaccine-eligible girls in Vietnam described similar safety concerns and suspicion that the vaccine was experimental [44]. A report from Romania attributed the very low HPV vaccine coverage achieved in their campaign (2.5 %) to community concerns about vaccine safety, which had been fuelled by rumours and negative media [26].

Despite the short time to sensitise the community, the HPV vaccine campaign in Fiji was largely successful in providing the information needed by parents to make a decision about HPV vaccination for their daughter. Future HPV vaccine implementation in Fiji will require a continued strong focus on information and education, particularly to ensure there is enough reliable information from trusted sources in the community to counter any negative media and rumours. Strategies to strengthen the cervical screening program should also be a priority, as participation rates in Fiji are very low, and it is important that vaccine introduction not be considered to replace the need for regular cervical screening [21].

A limitation of this study is the collection of data by telephone interview. This approach was taken in order to maximise participation from geographically diverse areas in the context of limited time and resources available for data collection. This approach naturally restricts participation to those individuals who have access to a functioning telephone, raising concerns of over-representation by higher socio-economic groups. However, in support of this approach, mobile telephone ownership and use in low and middle income settings has increased dramatically in recent years [45]. Data indicate that mobile phone ownership in Fiji is common, with 81 mobile phone subscriptions per 100 people in 2010 and 65 % of the population being covered by a cellular network [45]. Furthermore, while not an ideal measure of socio-economic status, the household income reported by participants is in line with population averages [46], and HPV vaccine-uptake in the survey sample is consistent with the broader population [24]. Notwithstanding, the use of telephone interviewing is likely to have reduced participation in the study, with a large number of parents of girls in participating classes not being contacted by the survey team to invite participation due to missing or incorrect phone number. As such we cannot rule out a potential bias in our study population and this should be considered in interpretation of findings.

A further potential limitation is the measurement of parents' satisfaction with access to information using a simple binary satisfied/not satisfied response. Given the important relationship that has been identified between satisfaction with access to information and vaccine consent, collection of more detailed information in relation to satisfaction would have enabled more precise measurement and greater insight into the relationship between this variable and vaccine uptake.

Finally, we focused our enquiry around vaccine consent, which may not always be a true indicator of vaccine acceptance. The large majority of parents reported no subsequent concern about their decision to permit vaccination, and a relatively small number of girls had been consented but not received all three doses. Notwithstanding, we may have missed the opportunity to document attitudes and concerns among parents who provided consent but ultimately did not permit vaccination. For example, absenteeism on scheduled vaccine days may reflect a deliberate desire among some parents to avoid vaccination for their daughter despite having previously given consent. Future activities exploring parental acceptance of vaccination should enquire not only around vaccine consent, but also actual receipt of vaccination among children of consenting parents.

## Conclusion

Despite the challenges of low baseline community awareness of HPV, a short lead-time and significant negative media reporting, Fiji successfully implemented an HPV vaccine campaign that was largely acceptable to parents. With a very strong relationship identified between vaccine consent and satisfaction with access to information for vaccine decision-making, the findings of this survey highlight the critical role of effective community education and ensuring that families have ready access to a trusted source of accurate information to address any questions or concerns about the vaccine.

This is one of the first experiences with HPV vaccine introduction in a resource-limited Pacific island nation. Guided by this experience, the Government of Fiji took the decision to include HPV vaccination in their national immunisation program in 2013. These findings have helped refine community education approaches to further strengthen community acceptance and support HPV vaccine uptake by the target population.

## Competing interests

Helen Marshall has been an investigator on studies of investigational vaccines funded by pharmaceutical companies including GSK. Travel support has been provided to her institution by GSK for her to present scientific data at international meetings. In addition institutional funding or serological testing has been provided by GSK for investigator led epidemiological and vaccine safety studies. Other authors declare no conflict of interest.

## Authors' contribution

SL participated in the conception and design of the study; collection, analysis and interpretation of data; and drafting of the manuscript. DM participated in the review and finalisation of the survey questionnaire; the collection, analysis and interpretation of data; and review of the manuscript. KJ participated in the conception and design of the study; the collection and interpretation of data; and review of the manuscript. FB participated in the conception and design of the study; collection of data; and review of the manuscript. LV participated in the conception and design of the study; collection of data; and review of the manuscript. HM participated in the conception and design of the study; interpretation of data; and review of the manuscript. PD participated in the conception and design of the study; collection of data; and review of the manuscript. FR - participated in the conception and design of the study; interpretation of data; and review of the manuscript. KL - participated in the analysis and interpretation of data; and review of manuscript. KM - participated in the conception and design of the study; interpretation of data; and review of the manuscript. All authors read and approved the final manuscript.

## Acknowledgments

Many thanks to Mere Gunaivalu and Tupou Ratu for their assistance with data collection, to Obioha Ukoumunne formerly of the Clinical Epidemiology and Biostatistics Unit, MCRI, for guidance on sampling, and to Catram Nguyen of MCRI for statistical review and advice. We are very grateful to the participating schools and families for their time and willingness to contribute to this research. This work was funded by the Australian Aid Program. Helen Marshall acknowledges support of the National Health and Medical Research Council of Australia: Career Development Fellowship (1084951).

## Role of the funding source

The Australian Aid program provided support to this activity and approved submission of this manuscript for publication.

## Author details

<sup>1</sup>Centre for International Child Health, Murdoch Childrens Research Institute, Royal Children's Hospital, Flemington Road, Parkville, VIC 3052, Australia. <sup>2</sup>Department of Paediatrics, University of Melbourne, Royal Children's Hospital, Flemington Road, Parkville, VIC, Australia. <sup>3</sup>National Centre for Epidemiology and Population Health, Australian National University, Building 62, Cnr Eggleston and Mills Roads, Canberra, ACT, Australia. <sup>4</sup>Fiji Health Sector Support Programme, Namosi House, Amy St, Suva, Fiji. <sup>5</sup>Ministry of Health, Dinem House, 88 Amy St, Suva, Fiji. <sup>6</sup>Women's and Children's Hospital, 72 King William Rd, North Adelaide, SA, Australia. <sup>7</sup>School of Medicine and Robinson Research Institute, School of Paediatrics and Reproductive Health, University of Adelaide, 55 King William Road, North Adelaide, SA, Australia. <sup>8</sup>School of Population Health, University of Adelaide, 178 North Terrace, Adelaide, SA, Australia. <sup>9</sup>London School of Hygiene and Tropical Medicine, Keppel St, London, UK.

Received: 24 March 2015 Accepted: 8 December 2015

Published online: 18 December 2015

## References

1. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*. 2010; 127(12):2893–917. doi:10.1002/ijc.25516.
2. Walboomers JM, Jacobs MV, Manos MM, Bosch FX, Kummer JA, Shah KV, et al. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *J Pathol*. 1999;189(1):12–9. doi:10.1002/(SICI)1096-9896(199909)189:1<12::AID-PATH431>3.0.CO;2-F.
3. Forman D, de Martel C, Lacey CJ, Soerjomataram I, Lortet-Tieulent J, Bruni L, et al. Global burden of human papillomavirus and related diseases. *Vaccine*. 2012;30 Suppl 5:F12–23. doi:10.1016/j.vaccine.2012.07.055.
4. Mortensen GL, Larsen HK. The quality of life of patients with genital warts: a qualitative study. *BMC Public Health*. 2010;10:113. doi:10.1186/1471-2458-10-113.
5. Qi SZ, Wang SM, Shi JF, Wang QQ, Chen XS, Sun LJ, et al. Human papillomavirus-related psychosocial impact of patients with genital warts in China: a hospital-based cross-sectional study. *BMC Public Health*. 2014;14:739. doi:10.1186/1471-2458-14-739.
6. WHO. Vaccine Introduction Guidelines. Adding a vaccine to a national immunization program: decision and implementation. Geneva: WHO; 2005.

7. Bingham A, Drake JK, LaMontagne DS. Sociocultural issues in the introduction of human papillomavirus vaccine in low-resource settings. *Arch Pediatr Adolesc Med*. 2009;163(5):455–61. doi:10.1001/archpediatrics.2009.50.
8. Bowyer HL, Marlow LA, Hibbitts S, Pollock KG, Waller J. Knowledge and awareness of HPV and the HPV vaccine among young women in the first routinely vaccinated cohort in England. *Vaccine*. 2012. doi:10.1016/j.vaccine.2012.12.038.
9. Chan ZC, Chan TS, Ng KK, Wong ML. A systematic review of literature about women's knowledge and attitudes toward human papillomavirus (HPV) vaccination. *Public Health Nurs*. 2012;29(6):481–9. doi:10.1111/j.1525-1446.2012.01022.x.
10. Kobetz E, Menard J, Hazan G, Koru-Sengul T, Joseph T, Nissan J, et al. Perceptions of HPV and cervical cancer among Haitian immigrant women: implications for vaccine acceptability. *Educ Health (Abingdon)*. 2011;24(3):479. doi:479 [pii].
11. Paul P, LaMontagne DS, Le NT. Knowledge of cervical cancer and HPV vaccine post-vaccination among mothers and daughters in Vietnam. *Asian Pac J Cancer Prev*. 2012;13(6):2587–92.
12. Marshall H, Ryan P, Robertson D, Baghurst P. A cross-sectional survey to assess community attitudes to introduction of Human papillomavirus vaccine. *Aust N Z J Public Health*. 2007;31(3):235–42.
13. Agosti JM, Goldie SJ. Introducing HPV vaccine in developing countries—key challenges and issues. *N Engl J Med*. 2007;356(19):1908–10. doi:10.1056/NEJMp078053.
14. Adams P. Reaching teenagers with three-times jab is a first for most countries. *Bull World Health Organ*. 2012;90(12):874–5.
15. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer*. 2015;136(5):E359–86. doi:10.1002/ijc.29210.
16. Garland SM, Bhatla N, Ngan HY. Cervical cancer burden and prevention strategies: Asia Oceania perspective. *Cancer Epidemiol Biomarkers Prev*. 2012;21(9):1414–22. doi:10.1158/1055-9965.epi-12-0164.
17. Obel J, McKenzie J, Buenconsejo-Lum LE, Durand AM, Ekeroma A, Soares Y, et al. Mapping HPV Vaccination and Cervical Cancer Screening Practice in the Pacific Region—Strengthening National and Regional Cervical Cancer Prevention. *Asian Pac J Cancer Prev*. 2015;16(8):3435–42.
18. Ministry of National Planning. Millennium Development Goals, 2nd Report 1990-2009, Report for the Fiji Islands. 2010.
19. Kuehn R, Fong J, Taylor R, Gyaneshwar R, Carter K. Cervical cancer incidence and mortality in Fiji 2003-2009. *Aust N Z J Obstet Gynaecol*. 2012;52(4):380–6. doi:10.1111/j.1479-828X.2012.01461.x.
20. Tabrizi SN, Law I, Buadromo E, Stevens MP, Fong J, Samuela J, et al. Human papillomavirus genotype prevalence in cervical biopsies from women diagnosed with cervical intraepithelial neoplasia or cervical cancer in Fiji. *Sex Health*. 2011;8(3):338–42. doi:10.1071/sh10083.
21. Law I, Fong JJ, Buadromo EM, Samuela J, Patel MS, Garland SM, et al. The high burden of cervical cancer in Fiji: 2004-2007. *Sex Health*. 2013;10(2):171–8.
22. Ogilvie G, Anderson M, Marra F, McNeil S, Pielak K, Dawar M, et al. A population-based evaluation of a publicly funded, school-based HPV vaccine program in British Columbia, Canada: parental factors associated with HPV vaccine receipt. *PLoS Medicine*. 2010;7(5):e1000270. doi:10.1371/journal.pmed.1000270.
23. Fiji Bureau of Statistics. Census of Population and Housing. Suva: Fiji Bureau of Statistics, Ministry of Finance, Strategic Planning, National Development and Statistics. 2007.
24. Ministry of Health, Fiji. Personal communication. 2010. Suva, Fiji.
25. Binagwaho A, Wagner CM, Gatera M, Karema C, Nutt CT, Ngabo F. Achieving high coverage in Rwanda's national human papillomavirus vaccination programme. *Bull World Health Organ*. 2012;90(8):623–8. doi:10.2471/blt.11.097253.
26. Craciun C, Baban A. "Who will take the blame?": understanding the reasons why Romanian mothers decline HPV vaccination for their daughters. *Vaccine*. 2012;30(48):6789–93. doi:10.1016/j.vaccine.2012.09.016.
27. Ladner J, Besson MH, Hampshire R, Tapert L, Chirenje M, Saba J. Assessment of eight HPV vaccination programs implemented in lowest income countries. *BMC Public Health*. 2012;12:370. doi:10.1186/1471-2458-12-370.
28. Penny M, Bartolini R, Mosqueira NR, LaMontagne DS, Mendoza MA, Ramos I, et al. Strategies to vaccinate against cancer of the cervix: feasibility of a school-based HPV vaccination program in Peru. *Vaccine*. 2011;29(31):5022–30. doi:10.1016/j.vaccine.2011.04.078.
29. Singh Y, Shah A, Singh M, Verma S, Shrestha BM, Vaidya P, et al. Human papilloma virus vaccination in Nepal: an initial experience in Nepal. *Asian Pac J Cancer Prev*. 2010;11(3):615–7.
30. Masika MM, Ogembo JG, Chabeda SV, Wamai RG, Mugo N. Knowledge on HPV Vaccine and Cervical Cancer Facilitates Vaccine Acceptability among School Teachers in Kitui County, Kenya. *PLoS One*. 2015;10(8):e0135563. doi:10.1371/journal.pone.0135563.
31. Vermandere H, Naanyu V, Mabeya H, Vanden Broeck D, Michielsens K, Degomme O. Determinants of acceptance and subsequent uptake of the HPV vaccine in a cohort in Eldoret, Kenya. *PLoS One*. 2014;9(10):e109353. doi:10.1371/journal.pone.0109353.
32. Bartolini RM, Winkler JL, Penny ME, LaMontagne DS. Parental acceptance of HPV vaccine in Peru: a decision framework. *PLoS One*. 2012;7(10):e48017. doi:10.1371/journal.pone.0048017.
33. Galagan SR, Paul P, Menezes L, LaMontagne DS. Influences on parental acceptance of HPV vaccination in demonstration projects in Uganda and Vietnam. *Vaccine*. 2013;31(30):3072–8. doi:10.1016/j.vaccine.2013.04.056.
34. Gamble HL, Klosky JL, Parra GR, Randolph ME. Factors influencing familial decision-making regarding human papillomavirus vaccination. *Journal of Pediatric Psychology*. 2010;35(7):704–15. doi:10.1093/jpepsy/jsp108.
35. Kessels SJ, Marshall HS, Watson M, Braunack-Mayer AJ, Reuzel R, Toohar RL. Factors associated with HPV vaccine uptake in teenage girls: a systematic review. *Vaccine*. 2012;30(24):3546–56. doi:10.1016/j.vaccine.2012.03.063.
36. Rondy M, van Lier A, van de Kastele J, Rust L, de Melker H. Determinants for HPV vaccine uptake in the Netherlands: A multilevel study. *Vaccine*. 2010;28(9):2070–5. doi:10.1016/j.vaccine.2009.12.042.
37. Ali SF, Ayub S, Manzoor NF, Azim S, Afif M, Akhtar N, et al. Knowledge and awareness about cervical cancer and its prevention amongst interns and nursing staff in Tertiary Care Hospitals in Karachi, Pakistan. *PLoS One*. 2010;5(6):e11059. doi:10.1371/journal.pone.0011059.
38. Kwan TT, Lo SS, Tam KF, Chan KK, Ngan HY. Assessment of knowledge and stigmatized attitudes related to human papillomavirus among Hong Kong Chinese healthcare providers. *Int J Gynaecol Obstet*. 2012;116(1):52–6. doi:10.1016/j.ijgo.2011.07.035.
39. Makwe CC, Anorlu RI. Knowledge of and attitude toward human papillomavirus infection and vaccines among female nurses at a tertiary hospital in Nigeria. *Int J Womens Health*. 2011;3:313–7. doi:10.2147/ijwh.s22792.
40. McCarey C, Pirek D, Tebeu PM, Boulvain M, Doh AS, Petignat P. Awareness of HPV and cervical cancer prevention among Cameroonian healthcare workers. *BMC Womens Health*. 2011;11:45. doi:10.1186/1472-6874-11-45.
41. Nganwai P, Truadpon P, Inpa C, Sangpetngam B, Mekjarasnapa M, Apirakarn M, et al. Knowledge, attitudes and practices vis-a-vis cervical cancer among registered nurses at the Faculty of Medicine, Khon Kaen University, Thailand. *Asian Pac J Cancer Prev*. 2008;9(1):15–8.
42. Phianmongkhol Y, Suwan N, Srisomboon J, Kietpeerakool C. Knowledge about human papillomavirus infection and cervical cancer prevention among nurses in Chiang Mai University Hospital, Thailand. *Asian Pac J Cancer Prev*. 2011;12(3):823–5.
43. Urasa M, Darj E. Knowledge of cervical cancer and screening practices of nurses at a regional hospital in Tanzania. *Afr Health Sci*. 2011;11(1):48–57.
44. Cover JK, Nghi NQ, LaMontagne DS, Huyen DT, Hien NT, Nga le T. Acceptance patterns and decision-making for human papillomavirus vaccination among parents in Vietnam: an in-depth qualitative study post-vaccination. *BMC Public Health*. 2012;12:629. doi:10.1186/1471-2458-12-629.
45. World Bank. Information and Communications for Development 2012: Maximizing Mobile. Washington: World Bank; 2012. doi:10.1596/978-0-8213-8991-1. website: <http://www.worldbank.org/ict/IC4D2012>.
46. Narsey W, Raikoti T, Waqavonovono E. Preliminary report : poverty and household incomes in Fiji in 2008-09. Suva: Fiji Islands Bureau of Statistics; 2010.