

**Determinants of attitudes and beliefs towards Human papillomavirus infection, cervical cancer and HPV vaccine among parents of adolescent girls in Mysore, India**

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**Running Head**

**HPV, cervical cancer and HPV vaccine**

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## ABSTRACT

**Aim:** This study examined the determinants of attitudes and beliefs about HPV infection, cervical cancer and HPV vaccine among parents of adolescent girls in Mysore, India.

**Methods:** A random sample of 800 parents who had at least one adolescent-aged daughter attending school were recruited for a survey.

**Results:** Most parents (n:778; 97.3%) completed the survey. Compared to Hindus, Muslims were more likely to perceive that their daughters are susceptible to HPV infection (aOR 4.94; 95%CI 2.87, 8.49) or cervical cancer (aOR 2.73; 95%CI 1.55, 4.80). However, the likelihood of perceiving that daughters are susceptible to HPV infection (aOR 0.94; 95%CI 0.90, 0.98) or cervical cancer (aOR 0.95; 95%CI 0.92, 0.99) decreased with an increase in the age of the parents. Perceived severity of HPV infection (aOR 0.36; 95%CI 0.14, 0.97) and cervical cancer (aOR 0.33; 95% CI 0.15, 0.74) was lower among Muslims than Hindus. Muslims had lower odds of believing that HPV vaccine is safe (aOR 0.47; 95%CI 0.25,0.89) or could protect against cervical cancer (aOR 0.27; 95%CI 0.16, 0.48), but were more likely to feel that HPV vaccination may cause girls to become more sexually active (aOR 1.92; 95%CI 1.09, 3.39). The odds of believing that HPV vaccine is effective increased with an increase in the age of the parents (aOR 1.03; 95%CI 1.003,1.06).

**Conclusions:** Among Indian parents, age and religion of parents are associated with parental attitudes and beliefs about the threat of HPV and cervical cancer as well as the risks and benefits of HPV vaccine.

**Key words:** HPV; attitudes; cervical cancer; vaccine

## Introduction

Globally, more than 500,000 women are diagnosed with cervical cancer and 275,000 die each year.<sup>1</sup> About 80% of cases, and 88% of deaths occur in the developing world.<sup>2,3</sup> With 27 women per 100,000 diagnosed each year, India has the highest age standardized incidence of cervical cancer in South Asia.<sup>4</sup> This compares to an average of incidence of 15.7 and 9.9 per 100,000 for developing and developed countries, respectively.<sup>5</sup> HPV vaccines were first licensed in India by the Drug Controller General of India in 2008–2009. The Indian Academy of Pediatrics has recommended inclusion of HPV in its immunization schedule but current vaccine coverage is negligible at national level.<sup>6</sup>

It is estimated that about three quarters of all sexually active individuals acquire HPV during their lifetime.<sup>7</sup> Persistent infection with high-risk HPV strains (16, 18, 31, 33, 45, 52, 58) may cause cervical dysplasia, which can progress to cancer.<sup>8,9</sup> HPV types 16 and 18 cause most cervical and anal cancers, while type 6 and 11 cause 90% of genital warts.<sup>8</sup> Three vaccines are currently approved to prevent HPV infection: Gardasil, Gardasil 9, and Cervarix.<sup>10</sup> All prevent infections with HPV types 16 and 18. Gardasil also prevents infection with HPV types 6, 11 and Gardasil 9 prevents infection with HPV types 6, 11, 31, 33, 45, 52, and 58.<sup>10</sup>

Although studies have shown that HPV vaccines are safe and effective; research suggests that beliefs about HPV infection, cervical cancer, and HPV vaccination have been a major obstacle to increasing vaccination coverage.<sup>10-12</sup> Understanding the determinants of these beliefs would help inform current efforts to increase immunization rates.<sup>7</sup> Health behavior theories suggest that sociodemographic factors may influence attitudes and beliefs toward health conditions.<sup>13,14</sup> There is little research in this area in India however. This paper examines the

relationship between sociodemographic factors/awareness of HPV and i) perceived threat of HPV and cervical cancer ii) beliefs about HPV vaccine in Mysore, India.

## **Methods**

### **Study Population**

Between February, 2010 and January, 2011, a cross-sectional study was conducted among a random sample of parents of adolescent female school children enrolled in 12 schools located in Mysore city, India. Mysore has a population of approximately 887,446 and is the second largest city in the state of Karnataka. It is located 146 kilometers southwest of the capital city, Bangalore. Girls aged 11 to 15 years attending grade 7<sup>th</sup> to 10<sup>th</sup> in twelve schools (five government, four private and three religious) in Mysore city were selected based on probability proportionate-to-size following systematic random sampling technique. Out of 43 schools in Mysore city with grades 7<sup>th</sup> to 10<sup>th</sup>, 12, which assumed to represent the 43 schools, were selected randomly. The names (along with assigned number) of all girls aged 11 to 15 years attending grade 7<sup>th</sup> to 10<sup>th</sup> in the selected 12 schools were enumerated separately for each school. Then the number of students to participate in the study from each school was determined based on proportionate-to-size sampling and, a computer program selected the assigned number of students from each school using a simple random sampling technique. All girls selected were provided with a questionnaire to take home to their parents. The questionnaire was completed by one parent per household and returned within seven days along with the signed consent form.

### **Questionnaire**

The self-administered questionnaire was available in English and *Kannada*, It contained 126 questions arranged in six sections to assess (1) socio-demographic characteristics; (2) completion

of recommended childhood vaccinations and attitudes towards vaccinations in general; (3) beliefs and attitudes about cervical cancer; (4) beliefs and attitude about HPV infection and the HPV vaccine; (5) reasons parents would choose to have their daughter vaccinated against HPV; and (6) reasons parents might choose not to have their daughter vaccinated against HPV. This was part of a larger study conducted to assess factors affecting intention-to-accept HPV vaccine among parents of adolescent girls in Mysore, India.<sup>15,16</sup> The current study focuses on examining the association between sociodemographic factors and i) awareness of HPV affected the attitudes and beliefs of parents towards HPV infection, cervical cancer and HPV vaccine based on the health belief model.<sup>13</sup> Some of the parents living in the study area were illiterate and may have lacked knowledge about HPV, cervical cancer and HPV vaccine. Thus, we included basic information about HPV, cervical cancer and HPV vaccine in the questionnaire to enable parents to answer some questions related to attitudes and beliefs about HPV infection, cervical cancer and HPV vaccine.

### **Socio demographic factors and awareness about HPV/cancer**

Six demographic items were analyzed (age, sex, marital status, employment status, education status and religion). Awareness about HPV was assessed by the question (Have you ever heard of HPV?) with 'yes' or 'no' responses.

### **Beliefs about the threat of cervical cancer**

Parental attitudes about susceptibility of their daughter getting cervical cancer were assessed using two statements: '*It is possible that my daughter will get cervical cancer in the future*' and '*It is likely that my daughter will get cervical cancer someday*'. Parental beliefs towards severity of cervical cancer was similarly assessed also using two statements: '*I believe that cervical*

*cancer can be extremely harmful* and *I believe that cervical cancer is serious disease*.

Responses for the four items were recorded on a 3-point scale (1='disagree', 2='do not know', 3='agree'). Items were validated in previous studies.<sup>17,18</sup>

### **Beliefs about the threat of HPV infection**

Parental attitudes towards susceptibility of their daughter getting HPV infection was assessed using two items presented as statements. These include: *it is likely that my daughter will get HPV in the future* and *my daughter may be at risk of getting HPV infection someday*. Parents beliefs towards the severity of HPV infection was similarly assessed using two similar items; *I believe that HPV infection can be harmful* and *I believe that HPV infection can cause serious health problems*. Possible responses included: 'disagree', 'do not know' and 'agree'. Items were validated in previous studies.<sup>17,18</sup>

### **Beliefs about HPV vaccine**

There were four questionnaire items about parental beliefs related with HPV vaccine that were derived from previous similar studies.<sup>18,19</sup> These included the *belief that the HPV vaccine is safe*, *belief that HPV vaccination is effective*, *belief that HPV vaccine will prevent cervical cancer*, and *belief that daughter receiving HPV vaccine may become sexually active*.

Responses included: 1= very important, 2= important, 3= not important at all.

### **Ethical Considerations**

The protocol for this study was reviewed and approved by the Institutional Review Boards of Florida International University (IRB-13-0022) and Public Health Research Institute of India (Protocol # 2009-04-19-04). Additional permissions were also sought from the Block Education

officer and school administrators to carry out the study in local schools. Only parents completing the informed consent were included in the study.

### **Data analysis**

Data were entered in MS Access, checked for completeness, cleaned and analyzed using STATA software (Version 11, Texas, USA). The outcome variables assessed were: 1) parental attitudes about susceptibility of their daughter getting HPV infection and cervical cancer; 2) parental perception that HPV infection and cervical cancer are severe; 3) belief that HPV vaccine is safe, effective, and prevents cervical cancer; and 4) belief that HPV vaccine may cause adolescents to become sexually active.

The calculated Cronbach's  $\alpha$  for the items used for assessing parental perceptions about susceptibility of their daughter to HPV infection ( $\alpha=0.75$ ) and cervical cancer ( $\alpha=0.75$ ) as well as severity of HPV infection ( $\alpha=0.66$ ) and cervical cancer ( $\alpha=0.61$ ) were substantial or moderate. While parental responses assessing their beliefs about HPV vaccine was originally recorded in three categories (very important, important, not important at all), the three categories were merged into two during data analysis as 'yes' (very important and important) and 'no' (not important at all). The explanatory variables included in the analyses were sex (0=male, 1=female), age in years (continuous), marital status (0=unmarried, 1= married), religion (0=Hindus, 1=Muslims, 3=Christians and others), employment status (0= unemployed, 1= employed), educational status (0= no formal education, 1= grade 1 to 10<sup>th</sup>, 2= high school completed or above) and awareness about HPV/have you ever heard of HPV? (0=no, 1=yes). We assumed that the beliefs of parents about HPV, cervical cancer and HPV vaccine may show correlation within school. Thus, school was used as a cluster variable.

Multinomial regression analysis was used to test the hypothesis that sociodemographic characteristics of the parents are associated with their attitudes towards susceptibility and severity of HPV infection and cervical cancer. Multiple logistic regression was used to test the hypothesis that sociodemographic characteristics of the parents is associated with their belief towards HPV vaccine. As there were missing data for the four items used for assessing belief towards HPV vaccine: *belief that the HPV vaccine is safe* (n=5), *belief that HPV vaccination is effective* (n=13), *belief that HPV vaccine will prevent cervical cancer* (n=12) and *belief that daughter receiving HPV vaccine may become sexually active* (n=12), a multiple imputation method based on 20 iterations was used to estimate the missing values. Then results based on the data set after estimating the missing values (n=778) were compared with results based on the complete data set after removing the missing values (n=765-773). Odds ratios using logistic regression and regression coefficients using linear regression were calculated along with the corresponding 95% confidence intervals (CI). Values were considered significant when  $p < 0.05$ .

### **3. Results**

Of the 800 parents recruited for the study, 778 (97.3%) returned completed questionnaires along with signed consent forms and were included in the final analysis. Another 19 parents returned the completed questionnaires without signing the consent form and three parents did not return the questionnaires. The mean age of the study participants was 39.6 years (standard deviation  $\pm$  6.2). Most of the study participants were mothers (69%), married (94.7%), non-Muslims (81.2%), >35 years of age (68.9%), with a primary education (50.6%) who were employed (52.6%) (Table 1).

### **Beliefs about the threat of cervical cancer**

Of the 778 parents, 16% agreed that their daughter might get cervical cancer in the future, 22.6% disagreed and 61% did not know ( $p < 0.001$ ) (Table 1). A large majority (78.7%) believed that cervical cancer was a serious disease, 5.3% felt it was not, and 16% didn't know ( $p < 0.001$ ).

Age, religion and educational status of parents were associated with their attitudes about susceptibility of their daughter to cervical cancer (Table 1). The odds ratio of agreeing that daughter will get cervical cancer in the future decreased with an increase in the age of the parents (aOR: 0.95; 95% CI: 0.92, 0.99). Parents with grade 1 to 10<sup>th</sup> (aOR: 0.52; 95% CI: 0.31, 0.88) or high school/diploma or degree education level (aOR: 0.55; 95% CI: 0.31, 0.97) were less likely to agree that their daughter would get cervical cancer in the future compared to parents who lack formal education. The likelihood that parents would agree that their daughter would get cervical cancer in the future was significantly higher among Muslim parents compared to Hindus (aOR: aOR: 2.73; 95% CI: 1.55, 4.80). However, Muslim parents were less likely to believe that cervical cancer is a serious disease as compared to Hindus (aOR: 0.33; 95% CI: 0.15, 0.74). Parental gender, employment status, marital status, religion, and awareness about HPV were not associated with their beliefs about susceptibility of daughter for cervical cancer and severity of the disease (Table 1).

Insert Table 1

### **Beliefs about the threat of HPV infection**

Of the 778 parents, the proportion of parents who did not know if their daughters could be at-risk of getting HPV infection was 53.2%, a higher percentage than those who agreed (16.5%) or disagreed (30.3%) ( $p < 0.001$ ) (Table 2). Three-fourths (74.2%) of the sample believed that HPV

infection could cause serious health problem while, 4% did not, and 21.9% didn't know ( $p < 0.001$ ). There was a moderate level of correlation of responses of the susceptibility items for HPV and cervical cancer ( $r = 0.63$ ). Similarly, response of the severity items for HPV were moderately correlated with responses of the severity items for cervical cancer ( $r = 0.51$ )

Age, religion, and educational status were associated with perceptions about susceptibility to HPV infection (Table 2). Gender and religion was associated with perceptions about severity of HPV infection (Table 2). Parental perception that their daughters are at risk of getting HPV infection decreased with an increase in the age of the parents (aOR: 0.94; 95% CI: 0.90, 0.98). The perception that daughter may get HPV infection in the future was also lower among parents who were Grade 1 to 10<sup>th</sup> than those who had no formal education (aOR: 0.48; 95% CI: 0.29, 0.77). Parental perception that their daughters are at risk of getting HPV infection was significantly higher among Muslim parents compared to Hindus (aOR: 4.94; 95% CI: 2.87, 8.49). However, parental perception that HPV infection can cause serious health problem was lower among Muslim parents compared to Hindus (aOR: 0.36; 95% CI: 0.14, 0.97). Compared to fathers, mothers had lower odds of believing that HPV infection can be extremely harmful (aOR: 0.45, 95% CI: 0.20, 0.99). Parental employment status, marital status, religion, and awareness about HPV were not associated with their beliefs about susceptibility of daughter for HPV and severity of the infection (Table 2).

Insert Table 2

### **Beliefs about HPV vaccine**

Out of 778 parents, a large majority (92.2%) believed that the HPV vaccine was safe and 90% believed that HPV vaccination could protect against cervical cancer (Table 3). Muslim parents

had lower odds of believing that HPV vaccine was safe (adjusted odds ratio [aOR]: 0.47, 95% CI: 0.25, 0.89) or could protect against cervical cancer (aOR: 0.27, 95% CI: 0.16, 0.48), but were more likely to feel that HPV vaccination may cause girls to become more sexually active (aOR: 1.92, 95% CI: 1.09, 3.39) compared to Hindus parents. Compared to parents with no formal education, parents with high school, diploma or degree level of education had lower odds of believing that HPV vaccine is effective (aOR: 0.60; 95% CI: 0.37, 0.98). The odds of believing that HPV vaccine is effective increased with an increase in the age of the parents (aOR: 1.03; 95% CI: 1.003, 1.06). The likelihood of parents agreeing that HPV vaccination will make girls more sexually active was not associated with age, sex, education, occupation and marital status of parents.

Insert Table 3

The odds ratio and the corresponding 95% CI estimates of the association between age, sex, education, religion, occupation and marital status of parents and belief of parents about HPV vaccine based on the complete data set after removing the missing values (Table 1 & 2) were very similar with the results obtained after estimating the missing values using a multiple imputation method (additional file: table).

## **Discussion**

This study assessed the sociodemographic determinates of beliefs toward HPV infection, cervical cancer, and HPV vaccine among parents of school-going girls living in Mysore City, India. Findings suggest that religion, age and level of education were significantly associated with beliefs about HPV, cervical cancer, and the HPV vaccine. Interestingly, Muslim parents were more likely to perceive that their daughters are susceptible to HPV infection and cervical cancer.

Muslims were also more likely to believe that HPV vaccination may cause girls to become more sexually active, but less likely to believe that HPV vaccination is safe and protect against cervical cancer, compared to Hindus. Older parents and those with grade 1 to 10 education level had lower perception that their daughters are susceptible to HPV infection or cervical cancer.

Research shows that religion can be influential in shaping vaccine attitudes and beliefs.<sup>20</sup> There are examples of opposition to vaccination among Muslim populations based on beliefs about vaccination being an attempt to avert the will of Allah.<sup>21</sup> Other Islamic leaders have expressed contrasting attitudes arguing that immunization is consistent with Islamic principles.<sup>22</sup> This study is the first to show, however, that religion may also plays a role in the beliefs of Indian parents toward HPV vaccine. These findings however, should be interpreted with caution since India's Muslim population is highly concentrated in urban areas and faces significant socioeconomic disparities with regard to socioeconomic status, parental literacy, gender equality, health access, and health literacy—all of which are determinants of vaccine attitudes and coverage.<sup>23</sup> More research is needed to better understand how sociodemographic differences may be impacting beliefs about the HPV vaccine among Muslim parents.

Our study also found that age is significantly associated with attitudes about susceptibility to HPV and cervical cancer among parents. Older age parents were less likely to perceive that their daughters to be susceptible to HPV infection and cervical cancer. Due to age related changes in sexual norms and behavior, older age parents might be less interested in health information about sexually transmitted infection. Hence, older parents may have less access to information about transmission mechanisms of HPV infection, which could affect their attitude related to susceptibility of their daughter to HPV infection. More research is needed to determine whether these findings reflect differences in general attitudes about immunization, use of

different media or information sources, or contrasting cohort experiences with vaccines in general.<sup>24</sup> It also suggests the need for more tailored communication strategies to improve vaccine coverage.

Although majority of surveyed parents believed that HPV infection and cervical cancer could cause serious health problems, about 71.6% of the participants had never heard about HPV. Perhaps that people assumed HPV and cervical cancer must be serious because we are asking. Alternatively, this could just be because of the response options and the coding used. There were only three response options (disagree', 'do not know', 'agree) for the items used to assess perceived threat of parents about HPV and cervical cancer. There is a need for health education about the epidemiology of HPV infection and cervical cancer. While the majority ( $\geq 90\%$ ) of study participants believed that HPV vaccine was safe and protected against cervical cancer; a surprising 32.8% of parents felt the HPV vaccine was not effective. Making people aware of research demonstrating high HPV vaccine efficacy may be important to vaccine acceptance in India.

The findings in this study has important implications that can be useful for designing strategies to increase HPV vaccination among adolescents in urban area, Mysore India. Hindus and older parents were less likely to perceive that their daughters are susceptible to HPV infection and cervical cancer. Although Muslim parents were more likely to perceive that their daughters are susceptible to HPV infection and cervical cancer, they were less likely to believe that HPV vaccination is safe and protect against cervical cancer but were more likely to believe that HPV vaccination may cause girls to become more sexually active. Thus, Hindus and Muslim parents in Mysore, India might be reluctant to recommend HPV vaccination for their daughter. Hence, educational programs that can create awareness about sexual transmission mechanisms of

HPV infection<sup>7</sup>, and thus increased susceptibility of adolescents to HPV infections<sup>7</sup>, and the fact that HPV infection causes cervical cancer<sup>8</sup> are important for parents-particularly to the Hindus and older ones in Mysore, India. In addition, informing parents-particularly Muslims about research findings, which showed lack of relationship between HPV vaccination and sexual activity,<sup>25-27</sup> and the fact that HPV vaccine is safe and effective<sup>27</sup> is important to increase their trust on HPV vaccine. Moreover, educational programs to inform parents about different kinds of cancer that can be protected by HPV vaccine are necessary for both Muslim and Hindus in Mysore, India. Furthermore, it might be useful to include a specific content about transmission mechanism of HPV and its relationship with cervical cancer in the sexuality education program when the gov't includes it in the school curriculum.

The study has a number of important strengths; it had a relatively large randomly selected sample. In addition, more than 97% of the parents who were contacted agreed to participate in the study. This increases the generalizability of the study. This study also has some limitations. It was conducted among parents of school going girls living in urban Mysore so findings may not be generalizable to parents of girls not attending school or living in rural areas. The results were also based on data collected using a self-administered questionnaire. This might have affected the validity of responses to sensitive questions, overestimating positive beliefs and attitudes of parents toward the vaccine. Moreover, we acknowledge the possible impact of the time delay on collection of the data and presentation of the current result on the beliefs and attitudes of parents regarding HPV infection, cervical cancer and HPV vaccine. However, as the beliefs and attitudes of parents in the community changes slowly, we believe the current finding will still be valid to inform policy related HPV vaccination. Furthermore, there were missing data for four items that measure beliefs about HPV vaccine (range 0.6% to 1.4%), thus might have overestimated the

observed association between sociodemographic factors and parental beliefs about HPV vaccine. However, the odds ratio and the corresponding 95% CI estimates of the association between sociodemographic factors and belief of parents about HPV vaccine obtained after estimating the missing values using a multiple imputation method were found very similar with the results based on the complete data set without the missing values.

In conclusion, the current results suggest the need for health education and interventions that promote awareness of HPV and cervical cancer, and the need for promoting that HPV vaccine is both safe and efficacious particularly among older parents and some religious minorities in India.

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### **Disclosure**

None

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Table 1: Association of sociodemographic factors with beliefs and attitudes about cervical cancer among parents of adolescent girls in Mysore City, India, 2010/2011 (n=778)

| Sociodemographic characteristics | N   | It is possible that my daughter will get cervical cancer in the future |                          | It is likely that my daughter may get cervical cancer someday |                          | I believe that cervical cancer is a serious disease |                          | I believe that cervical cancer can be extremely harmful |                          |
|----------------------------------|-----|--|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|
|                                  |     | Agree (vs. disagree) (%)   | aOR (95% CI)             | Agree (vs. disagree) (%)                                      | aOR (95% CI)             | Agree (vs. disagree) (%)                            | aOR (95% CI)             | Agree (vs. disagree) (%)                                | aOR (95% CI)             |
| <b>Age</b>                       | 778 | 16.1(22.7)   | <b>0.95 (0.92, 0.99)</b> | 15.2 (25.5)   | 0.97 (0.91, 1.02)        | 78.7 (5.3)  | 0.98 (0.95, 1.01)        | 79.3 (4.5)  | 1.01 (0.98, 1.03)        |
| <b>Sex</b>                       |     |  |                          |   |                          |   |                          |   |                          |
| Male                             | 241 | 12.0 (24.5)  | ----                     | 12.9 (24.1)   | ----                     | 78.0 (3.7)  | ----                     | 75.9 (2.1)  | ----                     |
| Female                           | 537 | 17.9 (21.8)  | 0.86 (0.39, 1.88)        | 16.2 (26.1)   | 0.75 (0.44, 1.31)        | 79.0 (6.0)  | 0.69 (0.18, 2.64)        | 80.8 (6.0)  | 0.40 (0.15, 1.06)        |
| <b>Education</b>                 |     |  |                          |   |                          |   |                          |   |                          |
| No education                     | 116 | 19.8 (14.7)  | ----                     | 20.7 (19.8)   | ----                     | 69.0 (6.9)  | ----                     | 76.7 (3.5)  | ----                     |
| Grade 1 to 10 <sup>th</sup>      | 394 | 17.5 (24.4)  | <b>0.52 (0.31, 0.88)</b> | 15.8 (26.5)   | <b>0.54 (0.29, 0.99)</b> | 79.4 (5.3)  | 1.56 (0.60, 4.03)        | 80.7 (5.3)  | 0.67 (0.30, 1.48)        |
| ≥High school                     | 268 | 12.3 (23.5)  | <b>0.55 (0.31, 0.97)</b> | 11.9 (26.5)   | 0.54 (0.29, 1.02)        | 81.7 (4.5)  | 1.66 (0.76, 3.63)        | 78.4 (4.5)  | 0.54 (0.22, 1.34)        |
| <b>Employment</b>                |     |  |                          |   |                          |   |                          |   |                          |
| Unemployed                       | 369 | 18.4 (20.1)  | ----                     | 16.3 (26.1)   | ----                     | 77.5 (6.0)  | ----                     | 80.0 (6.0)  | ----                     |
| Employed                         | 409 | 13.9 (24.9)  | 0.76 (0.41, 1.44)        | 14.2 (24.9)   | 1.13 (0.73, 1.69)        | 79.7 (4.4)  | 1.24 (0.39, 3.95)        | 78.7 (3.7)  | 0.94 (0.54, 1.66)        |
| <b>Marital Status</b>            |     |  |                          |   |                          |   |                          |   |                          |
| Unmarried <sup>±</sup>           | 41  | 17.1 (17.1)  | ----                     | 14.6 (26.8)   | ----                     | 78.1 (4.9)  | ----                     | 82.9 (0.0)  | ----                     |
| Married                          | 737 | 16.0 (22.9)  | 0.70 (0.23, 2.10)        | 15.2 (25.4)   | 1.13 (0.41, 3.11)        | 78.7 (5.3)  | 1.02 (0.22, 4.76)        | 79.1 (5.3)  | 6.35 (2.11, 1.91e)       |
| <b>Religion</b>                  |     |  |                          |   |                          |   |                          |   |                          |
| Hindus                           | 607 | 12.5 (23.1)  | ----                     | 11.2 (26.8)   | ----                     | 16.3 (4.3)  | ----                     | 79.1 (3.3)  | ----                     |
| Muslim                           | 146 | 31.7 (20.7)  | <b>2.73 (1.55, 4.80)</b> | 31.7 (20.0)   | <b>4.13 (2.92, 5.82)</b> | 75.3 (8.2)  | <b>0.57 (0.33, 1.00)</b> | 80.1 (11.0)   | <b>0.33 (0.15, 0.74)</b> |
| Christians                       | 25  | 12.0 (24.0)  | 1.67 (0.39, 3.43)        | 16.0 (24.0)   | 1.81 (0.91, 3.61)        | 30.0 (12.0)   | 0.34 (0.09, 1.21)        | 80.0 (4.0)  | 0.90 (0.22, 3.66)        |
| <b>Ever heard of HPV</b>         |     |  |                          |   |                          |   |                          |   |                          |
| No                               | 557 | 15.5 (21.6)  | ----                     | 14.2 (25.0)   | ----                     | 75.4 (5.6)  | ----                     | 76.3 (5.0)  | ----                     |
| Yes                              | 221 | 17.6 (25.3)  | 1.13 (0.86, 1.48)        | 17.6 (26.7)   | 1.43 (0.81, 2.52)        | 86.9 (4.5)  | 1.34 (0.74, 2.43)        | 86.9 (4.1)  | 1.22 (0.60, 2.49)        |

aOR= (adjusted odds ratio) after controlling for age, gender, religion, education, employment status, marital status and awareness about HPV based on multinomial regression analysis; Reference category: 'Disagree' Unmarried±=Divorced/separated/ widowed; Percent agree and disagree do not sum up to 100% as some of the participants in each group responded "do not know"

Table 2: Sociodemographic factors and its association with beliefs and attitudes about HPV infection among parents of adolescent girls in Mysore City, India, 2010 (n=778)

| Sociodemographic characteristics | N   | My daughter may be at risk of getting HPV infection |                          | It is likely that my daughter may get HPV infection in the future |                          | I believe that HPV infection can cause serious health problem |                          | I believe that HPV infection can be extremely harmful |                          |
|----------------------------------|-----|---|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|
|                                  |     | Agree (vs. disagree) (%)                            | aOR (95% CI)             | Agree (vs. disagree) (%)  | aOR (95% CI)             | Agree (vs. disagree) (%)                                      | aOR (95% CI)             | Agree (vs. disagree) (%)                              | aOR (95% CI)             |
| <b>Age</b>                       | 778 | 16.5 (30.3)   | <b>0.94 (0.90, 0.98)</b> | 15.8 (23.7)   | 0.96 (0.92, 1.01)        | 74.2 (4.0)  | 1.03 (0.99, 1.08)        | 75.3 (6.0)  | 0.97 (0.89, 1.06)        |
| <b>Sex</b>                       |     |   |                          |   |                          |   |                          |   |                          |
| Male                             | 241 | 12.1 (30.7)   | ----                     | 15.3 (22.8)   | ----                     | 71.8 (2.9)  | ----                     | 74.3 (4.2)  | ----                     |
| Female                           | 537 | 18.4 (30.2)   | 0.72 (0.45, 1.17)        | 16.0 (24.0)   | 0.58 (0.26, 1.27)        | 75.2 (4.5)  | 0.96 (0.46, 2.01)        | 75.8 (6.9)  | <b>0.45 (0.20, 0.99)</b> |
| <b>Education</b>                 |     |   |                          |   |                          |   |                          |   |                          |
| No education                     | 116 | 15.5 (25.9)   | ----                     | 19.0 (16.4)   | ----                     | 74.1 (3.5)  | ----                     | 71.6 (5.2)  | ----                     |
| Grade 1 to 10 <sup>th</sup>      | 394 | 18.0 (32.2)   | 0.90 (0.66, 1.24)        | 15.5 (25.9)   | <b>0.48 (0.29, 0.77)</b> | 74.9 (4.1)  | 0.93 (0.26, 3.25)        | 74.4 (5.8)  | 0.94 (0.49, 1.81)        |
| ≥High school                     | 268 | 14.6 (29.5)   | 1.30 (0.65, 2.61)        | 14.9 (23.5)   | 0.69 (0.34, 1.40)        | 73.1 (4.1)  | 0.66 (0.24, 1.79)        | 78.4 (6.7)  | 0.88 (0.43, 1.77)        |
| <b>Employment</b>                |     |   |                          |   |                          |   |                          |   |                          |
| Unemployed                       | 369 | 20.1 (30.4)   | ----                     | 17.1 (23.6)   | ----                     | 75.1 (4.6)  | ----                     | 75.6 (6.5)  | ----                     |
| Employed                         | 409 | 13.2 (30.3)   | 0.80 (0.39, 1.63)        | 14.7 (23.7)   | 0.85 (0.49, 1.47)        | 73.4 (3.4)  | 1.09 (0.38, 3.10)        | 75.1 (5.6)  | 0.93 (0.40, 2.19)        |
| <b>Marital Status</b>            | 369 |   |                          |   |                          |   |                          |   |                          |
| Unmarried <sup>±</sup>           | 41  | 16.4 (30.4)   | ----                     | 11.9 (25.0)   | ----                     | 80.5 (2.4)  | ----                     | 90.2 (4.9)  | ----                     |
| Married                          | 737 | 17.7 (29.3)   | 0.89 (0.35, 2.24)        | 15.7 (23.2)   | 1.13 (.38, 3.29)         | 73.8 (4.1)  | 0.55 (0.14, 2.15)        | 74.5 (6.1)  | 0.58 (0.18, 1.95)        |
| <b>Religion</b>                  |     |   |                          |   |                          |   |                          |   |                          |
| Hindus                           | 607 | 11.5 (32.3)   | ----                     | 11.9 (25.0)   | ----                     | 74.0 (3.0)  | ----                     | 76.3 (6.1)  | ----                     |
| Muslim                           | 146 | 37.7 (24.0)   | <b>4.94 (2.87, 8.49)</b> | 32.2 (19.2)   | <b>4.19 (2.71, 6.47)</b> | 75.3 (7.5)  | <b>0.36 (0.14, 0.97)</b> | 72.6 (5.5)  | 1.14 (0.42, 3.08)        |
| Christians                       | 25  | 12.0 (20.0)   | 2.10 (0.89, 4.96)        | 16.0 (16.0)   | 2.57 (0.62, 10.61)       | 72.0 (8.0)  | 0.33 (0.08, 1.37)        | 68.0 (8.0)  | 0.76 (0.17, 3.33)        |
| <b>Ever heard of HPV</b>         |     |   |                          |   |                          |   |                          |   |                          |
| No                               | 557 | 15.4 (30.3)   | ----                     | 14.0 (22.6)   | ----                     | 71.3 (3.4)  | ----                     | 71.3 (5.6)  | ----                     |
| Yes                              | 221 | 19.0 (30.3)   | 1.54 (0.85, 2.77)        | 20.4 (26.2)   | 1.56 (0.94, 2.57)        | 81.4 (5.4)  | 0.63 (0.27, 1.47)        | 85.5 (7.2)  | 0.95 (0.43, 2.11)        |

aOR= (adjusted odds ratio) after controlling for age, gender, religion, education, employment status, marital status and awareness about HPV based on multinomial regression analysis;

Reference category: 'Disagree'; Unmarried<sup>±</sup>=Divorced/separated/ widowed

Percent agree and disagree do not sum up to 100% as some of the participants in each group responded "do not know"

Table 3: Sociodemographic determinants of parents beliefs about HPV vaccine among parents of adolescent girls in Mysore City, India, 2010/2011

| Socio-demographic characteristics | Categories (n)                   | I believe that HPV vaccine is safe (n=773) |                          | I believe that HPV vaccine is effective (n=765) |                           | I believe that HPV vaccination protect cervical cancer (n=766) |                          |
|-----------------------------------|----------------------------------|--|--------------------------|---|---------------------------|--|--------------------------|
|                                   |                                  | Yes (%)                                    | aOR (95% CI)             | Yes (%)   | aOR (95% CI)              | Yes (%)  | aOR (95% CI)             |
| Gender                            | Male (241)                       | 90.0                                       | ----                     | 33.2  | ----                      | 89.6   | ----                     |
|                                   | Female (537)                     | 93.1                                       | 1.67 (0.76, 3.70)        | 32.6  | 1.02 (0.66, 1.59)         | 90.1   | 1.96 (0.88, 4.36)        |
| Age                               | Continuous                       | 92.1                                       | 0.97 (0.93, 1.02)        | 32.8  | <b>1.03 (1.003, 1.06)</b> | 89.9   | 1.00 (0.95, 1.05)        |
| Education                         | No formal education (116)        | 90.5                                       | ----                     | 36.2  | ----                      | 88.8   | ----                     |
|                                   | Grade1 to 10 <sup>th</sup> (394) | 91.6                                       | 1.25 (0.60, 2.60)        | 35.3  | 0.97 (0.62, 1.50)         | 88.3   | 1.16 (0.59, 2.30)        |
|                                   | High school or above (268)       | 93.7                                       | 1.95 (0.83, 4.55)        | 27.6  | <b>0.60 (0.37, 0.98)</b>  | 92.9   | 1.72 (0.76, 3.91)        |
| Employment Status                 | Unemployed (369)                 | 92.7                                       | ----                     | 34.7  | ----                      | 88.1   | ----                     |
|                                   | Employed (409)                   | 91.7                                       | 0.91 (0.46, 1.79)        | 31.1  | 0.80 (0.56, 1.16)         | 91.7   | 1.61 (0.83, 3.12)        |
| Marital Status                    | Unmarried <sup>b</sup> (41)      | 85.4                                       | ----                     | 29.3  | ----                      | 87.8   | ----                     |
|                                   | Married (737)                    | 92.5                                       | 2.11 (0.75, 5.89)        | 33.0  | 1.13 (0.55, 2.31)         | 90.1   | 1.48 (0.48, 4.55)        |
| Religion                          | Hindus (607)                     | 92.9                                       | ----                     | 32.3  | ----                      | 92.7   | ----                     |
|                                   | Muslims (146)                    | 87.7                                       | <b>0.47 (0.25, 0.89)</b> | 34.2  | 1.00 (0.67, 1.49)         | 77.4   | <b>0.27 (0.16, 0.48)</b> |
|                                   | Christians (25)                  | 100.0                                      | NA                       | 36.0  | 1.06 (0.45, 2.50)         | 96.0   | 1.46 (0.19, 11.24)       |
| Ever heard of HPV                 | No (557)                         | 93.0                                       | ----                     | 32.5  | ----                      | 89.1   | ----                     |
|                                   | Yes (221)                        | 91.4                                       | 0.83 (0.45, 1.53)        | 33.5  | 1.09 (0.78, 1.53)         | 92.3   | 1.19 (0.64, 2.20)        |

aOR<sup>a</sup> (adjusted odds ratio) after controlling for age, gender, religion, education, employment status, marital status based and awareness about HPV based on logistic regression analysis; Unmarried<sup>b</sup>=Divorced/separated/ widowed

Supplementary Table: Sociodemographic determinants of parents beliefs about HPV vaccine among parents of adolescent girls in Mysore City, India, 2010/2011 based on data set after estimating missing values (n=778)

| Socio-demographic characteristics | Categories (n)                   | I believe that HPV vaccine is safe |                           | I believe that HPV vaccine is effective |                           | I believe that HPV vaccination protect cervical cancer |                          |
|-----------------------------------|----------------------------------|------------------------------------|---------------------------|---|---------------------------|--|--------------------------|
|                                   |                                  | Yes (%)                            | aOR <sup>a</sup> (95% CI) | Yes (%)                                 | aOR <sup>a</sup> (95% CI) | Yes (%)  | aOR* (95% CI)            |
| Gender                            | Male (241)                       | 90.0                               | ----                      | 33.2                                    | ----                      | 89.6   | ----                     |
|                                   | Female (537)                     | 93.1                               | 1.68 (0.76, 3.70)         | 32.6                                    | 1.04 (0.67, 1.60)         | 90.1   | 1.93 (0.87, 4.29)        |
| Age                               | Continuous                       | 92.1                               | 0.97 (0.93, 1.02)         | 32.8                                    | <b>1.03 (1.004, 1.07)</b> | 89.9   | 1.00 (0.95, 1.05)        |
| Education                         | No formal education (116)        | 90.5                               | ----                      | 36.2                                    | ----                      | 88.8   | ----                     |
|                                   | Grade1 to 10 <sup>th</sup> (394) | 91.6                               | 1.26 (0.61, 2.63)         | 35.3                                    | 1.00 (0.65, 1.54)         | 88.3   | 1.20 (0.61, 2.38)        |
|                                   | High school or above (268)       | 93.7                               | 1.97 (0.84, 4.59)         | 27.6                                    | <b>0.61 (0.38, 0.98)</b>  | 92.9   | 1.78 (0.78, 4.03)        |
| Employment Status                 | Unemployed (369)                 | 92.7                               | ----                      | 34.7                                    | ----                      | 88.1   | ----                     |
|                                   | Employed (409)                   | 91.7                               | 0.89 (0.45, 1.76)         | 31.1                                    | 0.81 (0.56, 1.16)         | 91.7   | 1.58 (0.82, 3.05)        |
| Marital Status                    | Unmarried <sup>b</sup> (41)      | 85.4                               | ----                      | 29.3                                    | ----                      | 87.8   | ----                     |
|                                   | Married (737)                    | 92.5                               | 2.08 (0.74, 5.81)         | 33.0                                    | 1.13 (0.56, 2.26)         | 90.1   | 1.49 (0.49, 4.56)        |
| Religion                          | Hindus (607)                     | 92.9                               | ----                      | 32.3                                    | ----                      | 92.7   | ----                     |
|                                   | Muslims (146)                    | 87.7                               | <b>0.47 (0.25, 0.90)</b>  | 34.2                                    | 1.00 (0.68, 1.49)         | 77.4   | <b>0.28 (0.16, 0.50)</b> |
|                                   | Christians (25)                  | 100.0                              | NA                        | 36.0                                    | 1.01 (0.43, 2.37)         | 96.0   | 1.43 (0.19, 11.06)       |
| Ever heard of HPV                 | No (557)                         | 93.0                               | ----                      | 32.5                                    | ----                      | 89.1   | ----                     |
|                                   | Yes (221)                        | 91.4                               | 0.83 (0.45, 1.53)         | 33.5                                    | 1.14 (0.82, 1.59)         | 92.3   | 1.17 (0.63, 2.17)        |

aOR<sup>a</sup> (adjusted odds ratio) after controlling for age, gender, religion, education, employment status, marital status based and awareness about HPV based on logistic regression analysis; Unmarried<sup>b</sup>=Divorced/separated/ widowed