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### ORIGINAL ARTICLE

#### FACTORS INFLUENCING HPV VACCINE UPTAKE AMONG GRADE FOUR GIRLS: A CAREGIVER-BASED STUDY IN GAUTENG, SOUTH AFRICA

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#### Keywords

Awareness,  
Caregivers'  
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#### Abstract

**Background:** Cervical cancer is the second most frequent cancer in South Africa despite the availability of the HPV vaccination. The success of the HPV vaccine lies with the caregiver's acceptance, as their daughters cannot be vaccinated without their consent. This study aimed to determine the perception, acceptability, and uptake of the HPV vaccination among caregivers of girls aged 9-13 in the Tshwane sub-district of South Africa.

**Methods:** This was a cross-sectional study conducted among 368 caregivers who were selected using a stratified random sampling technique. Data were collected using a self-administered, anonymised questionnaire between March and April 2020. Stepwise logistic regression was used to determine predictors for HPV vaccine uptake using STATA version 12. Ethical approval was obtained from the Sefako Makgatho Health Sciences University Ethics Committee.

**Results:** The mean age of caregivers was 38 years (SD = 7.11). Most respondents were female (88%), black (94%), single (52%), and 45% had a secondary education. About half (48%) reported that their daughters had received the HPV vaccine, yet 68% were uncertain about the number of doses administered. The majority (74%) were vaccinated because of disease severity, followed by 8% citing effectiveness. Factors such as awareness of HPV vaccination, clarity of procedures, and understanding of the effects of the HPV vaccine were identified as being associated with the acceptance of vaccination ( $p < 0.05$ ).

**Conclusion:** The study found that caregivers have limited knowledge about the HPV virus and HPV vaccination. Therefore, it is advisable to develop HPV vaccine programs specifically for caregivers with less education, focusing on vaccination schedules, recommended doses, and cervical cancer prevention.

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## INTRODUCTION

Cervical cancer, despite being largely preventable, remains the second leading cause of death globally after breast cancer in women aged 15 to 44, with 604,127 cases reported in 2020 resulting in 341,831 fatalities.<sup>1</sup> Cervical cancer incidence is expected to increase by 26.7% to 47.6% between 2030 and 2040, respectively.<sup>2</sup> This condition has a severe impact on low- and middle-income countries, with occurrences and fatalities ranging between 84% and 88%, respectively.<sup>3</sup> The global prevalence of cervical cancer is higher in Sub-Saharan Africa, with 21.6% and 17.7% of fatalities and incidents, compared to European countries with incidences of 8.2, 6.8, and 3.6 per 100,000 women, respectively.<sup>4</sup> In South Africa 10 702 women are diagnosed with cervical cancer, and over half (5,870) die from the disease annually.<sup>2</sup> It is the second most common cancer among South African women, particularly among those aged 15 to 44. With a population of 21.3 million, the incidence rate is between 22.8 and 27 per 100,000 women, significantly higher than the global average of 15.8.<sup>5</sup> HPV vaccine is the world's and South Africa's most effective protection against cervical cancer.<sup>2</sup> Unfortunately, uptake has been declining since rollout in 2014 despite being offered free to government primary schools. Vaccine coverage for the first dose decreased from 86.6% in 2015 to 82.6% in 2018, and second-dose coverage declined from 63.6% to 61.3%.<sup>6,7</sup> Uptake continued to decline in 2020, falling to 69% for the first dose and to 43% for the second dose.<sup>2</sup> Low uptake of the second dose continues to be a cause for concern because two doses are needed for effective HPV protection and for the development of herd immunity.<sup>2,6</sup> Currently, there are limited studies on the perception and acceptability of the HPV two-dose vaccination program among caregivers, who play a crucial role in the HPV vaccination program as stakeholders.<sup>6,8</sup> This study sought to assess the uptake, acceptability, and perceptions about a Human Papillomavirus (HPV)

vaccination program among caregivers of fourth-grade girls in Gauteng Province, South Africa.

## METHODS

This study was conducted in Tshwane Sub-District 4, located in the southwestern part of the City of Tshwane municipality, Pretoria, Gauteng, where about 68.6% of the population is economically active, and 25% come from families with incomes less than R2,000 per month. Grade 4 girls aged 9–13 years in public schools were selected for the study because they met the criteria for receiving the HPV vaccine.

### Study Design

This was a descriptive, cross-sectional survey conducted to assess the uptake, acceptability, and perceptions of the HPV vaccination program among 374 parents and caregivers. Public schools were selected using a stratified random sampling technique based on the government school quintile system (Q1-Q5), with schools from various affluence levels included. The target population consisted of caregivers of grade 4 girls, including parents, grandparents, or guardians aged 18 and above. Using a 95% confidence level and a 5% margin of error, we calculated the minimum sample size for the study is 325. The sample size was increased to 374, representing a 15% increase, to cater for non-response or incomplete responses. The schools were randomly assigned by allocating a distinctive integer to each school, followed by the random allocation of numbers to select the schools in each of the quintiles. Research questionnaires, consent forms, and informational letters were distributed to Grade 4 girls, who then forwarded them to their caregivers for completion, either in physical format or electronically via a Google Form link. The data were imported into STATA 12 for cleaning, coding, and analysis. Categorical data were analysed by frequency distributions and shown as relative frequencies; numerical data were used to describe descriptive statistics, presented as means and SDs and factors related to HPV vaccine

**Table 1: Sample Breakdown**

| Quintile       | Total No. of Schools | School Proportions | No. of sampled schools | Population size | Sample proportions | size | Targeted size   | Sample |
|----------------|----------------------|--------------------|------------------------|-----------------|--------------------|------|-----------------|--------|
| 1              | 4                    | 13%                | 1                      | 330             | 330/2122*100= 16%  |      | 16% x 325 = 52  |        |
| 2              | 4                    | 13%                | 1                      | 289             | 289/2122*100= 14%  |      | 14% x 325 = 45  |        |
| 4              | 11                   | 35.4%              | 4                      | 662             | 662/2122*100 = 31% |      | 31% x 325 = 101 |        |
| 5              | 11                   | 35.4%              | 4                      | 811             | 811/2122*100 = 38% |      | 38% x 325 = 124 |        |
| Special school | 1                    | 3.2%               | 1                      | 15              | 15/2122*100 = 1%   |      | 1% x 325 = 3    |        |
| 15% Buffer     |                      |                    |                        |                 |                    |      | 49              |        |
| Total          | 31                   | 100%               | 11                     | 2122            | 100%               |      | 374             |        |

acceptability were examined using multivariate analysis at  $p < 0.05$ .

#### ETHICAL APPROVAL

Ethical clearance was granted by the Sefako Makgatho Health Sciences University Research Ethics Committee, and approval was obtained from the Department of Education and the school principals. Participation was voluntary, with the right to withdraw at any time without repercussions. Confidentiality and anonymity were assured, as no personal identifiers were collected.

#### RESULTS

A total of 374 questionnaires were distributed, with 368 returned, resulting in a response rate of 98.4%. Table 2 presents the demographics of the caregivers. The mean age of caregivers was 38 years ( $\pm$ SD 7.11), with a range of 20 to 64 years. Most respondents were female (88.0%), Black (94.3%), and single (51.7%). In terms of education, about two-thirds (61.4%) of the respondents had completed their secondary education. More than three-quarters (74.2%) of the caregivers were the mothers of the girls, while 14.4% indicated that they were the fathers of the girls. Approximately half (51.6%) of the respondents reported being unemployed (Table 2). Almost half of the caregivers (48.0%) reported that their daughters had received the HPV vaccine. It was found that two-thirds of the caregivers (67.7%) were unaware of the number of doses of the HPV vaccine their children had received (Table 3). Most caregivers (74.5%) indicated that the reason for vaccinating

their children was the seriousness of the disease, followed by the effectiveness of the vaccine (8.4%). Table 4 shows that 61.7% of the caregivers had not heard of the HPV virus, while 60.0% have not heard of the HPV vaccine. However, 70.1% of the respondents indicated that they had heard of cervical cancer. Health providers were cited as the primary source of information for HPV (18.7%), HPV vaccine (18.7%), and cervical cancer (43.2%), respectively. More than a quarter reported that they heard about cervical cancer through the media (27.5%). Most caregivers recognize cervical cancer as a major health issue for women, with 87.6% emphasizing its significance and 58.0% acknowledging women's risk. While 80.8% did not believe the vaccine causes severe side effects, concerns persisted: 17.6% thought it might lead to early sexual activity, and 51.6% believed young women are not at risk of HPV (Table 5). About 65.0% supported school-based vaccination, over half thought parents should endorse it, and 59.4% found the programme useful. As depicted in Figure 1, 83.0% of caregivers agreed to have their daughters receive the HPV vaccine. Among those who declined, 62.0% planned to vaccinate their children within the next 12 months, 7.0% had no plans to vaccinate in that period, and 31.0% remained undecided about HPV vaccination. The multivariate logistic regression analysis showed that those who signed the consent form were eight times more likely to accept the HPV vaccination (AOR = 7.9,  $p$ -value  $< 0.05$ ).

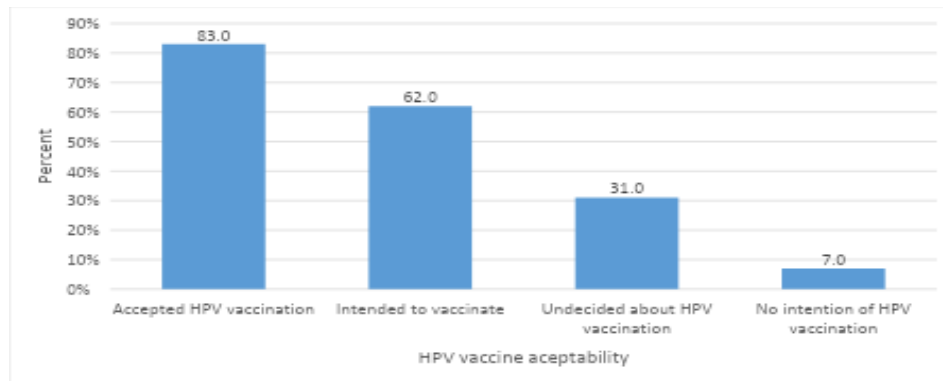


**Figure 1: HPV Vaccination Acceptance**

Caregivers who were aware of cervical cancer were three times more likely to accept the HPV vaccination compared to those who were not aware of cervical cancer (AOR = 2.9, p-value = 0.003) (Table 6).

## DISCUSSION

This study assessed perception, acceptability, and uptake of the HPV vaccine among caregivers of fourth-grade female students in Tshwane Sub-District 4, Gauteng Province, South Africa. The findings highlighted enabling factors and challenges faced during the vaccine administration, with special emphasis on caregivers' perception and acceptability as direct predictors. While a high percentage of caregivers indicated high acceptability, the observed uptake was significantly lower, thus demonstrating widespread knowledge gaps and operational challenges. The present study found a 48% uptake of HPV vaccine among Girls of Grade Four, a rate similar to those in KwaZulu-Natal and Mpumalanga studies, where uptake had been 40% and 43%, respectively. On a regional level, a meta-analysis of data from sub-Saharan African nations estimated a combined uptake of only 28.5%. However, country-level uptake ranged considerably, from 62.5% in Kenya to 3.8% in Nigeria.<sup>9</sup> This provides an idea of the extent to which program implementation and awareness significantly affect patterns of uptake. Our research study uncovered knowledge gaps, as most

caregivers had a basic understanding of cervical cancer but lacked in-depth knowledge about HPV and the vaccine. This is similar to a study conducted among postgraduate students in KwaZulu-Natal, wherein 74.0% possessed knowledge concerning cervical cancer; however, only 26.2% were aware of HPV. These findings are a reminder of the historic gap between knowledge about cervical cancer and its viral cause, and therefore, educational campaigns must explicitly draw the link between HPV and cervical cancer prevention.<sup>10</sup> Health workers were the first and most reliable sources of HPV information, as in earlier research in South Africa. Meanwhile, lower uptake following lower media coverage is consistent with findings that high-frequency, multi-channel communication campaigns—i.e. schools, mass media, and community outreach—are successful at sustaining high awareness and coverage.<sup>11,12</sup> This suggests that, although caregivers are generally favourably inclined towards the HPV vaccine, their decision also depends on the quality of information provided and the clarity of the programme's communication. The overall high acceptance of the HPV vaccine among parents in this study (83.0%) was higher than that of Ethiopian parents (60%).<sup>13</sup> High acceptance does translate into uptake, where information and logistical barriers often persist. Acceptance and uptake predictors in our research include knowledge of the HPV vaccine, the severity

**Table 2: Caregivers Demographic Characteristics**

| Variable                       | Category            | Frequency       | Percentage |
|--------------------------------|---------------------|-----------------|------------|
| <b>Age in years</b>            | 20-30 years         | 52              | 14.1       |
|                                | 31-40 years         | 188             | 51.1       |
|                                | 41-50 years         | 111             | 30.2       |
|                                | 50 years+           | 17              | 4.6        |
|                                | Mean age            | 37.9 (SD = 7.1) |            |
| <b>Gender</b>                  | Female              | 324             | 88.0       |
|                                | Males               | 44              | 12.0       |
| <b>Race</b>                    | Black               | 347             | 94.3       |
|                                | Indian              | 16              | 4.3        |
|                                | Coloured            | 5               | 1.4        |
| <b>Marital status</b>          | Single              | 186             | 51.7       |
|                                | Married             | 117             | 32.6       |
|                                | Living with partner | 43              | 11.9       |
|                                | Divorced            | 7               | 1.9        |
|                                | Widowed             | 7               | 1.9        |
| <b>Education</b>               | No formal Education | 8               | 2.2        |
|                                | Primary School      | 44              | 12.2       |
|                                | Secondary School    | 221             | 61.4       |
|                                | Diploma             | 58              | 16.1       |
|                                | Degree              | 17              | 4.7        |
|                                | Postgraduate degree | 12              | 3.4        |
| <b>Relationship to learner</b> | Mother              | 273             | 74.2       |
|                                | Father              | 53              | 14.4       |
|                                | Grand Parent        | 14              | 3.8        |
|                                | Other               | 28              | 7.6        |
| <b>Employment Status</b>       | Unemployed          | 190             | 51.6       |
|                                | Employed            | 178             | 48.4       |
| <b>Religious group</b>         | Christian           | 318             | 87.8       |
|                                | Muslim              | 15              | 4.1        |
|                                | None                | 29              | 8.1        |

of cervical cancer, and clarity of consent procedures parameters that are consistent with those found in Ethiopia, South Africa, and Hong Kong.<sup>13-15</sup> A systematic review among Ethiopian parents identified positive vaccine attitude, higher maternal education, and adequate knowledge about HPV and its vaccine as statistically significant predictors of acceptance of the HPV vaccine.<sup>13</sup> Likewise, a systematic review conducted among sub-Saharan Africans revealed that stakeholders' perceptions regarding cervical cancer, HPV, and HPV vaccine were influenced by correct knowledge to an equal

or possibly greater extent than by misinformation and that such influences were mediated by social factors or relationships. Overall, these interactions serve either as obstacles or enablers of vaccine uptake.<sup>14</sup> A parental opinion survey in Hong Kong revealed that, for both girls and boys, the main motivations for accepting the HPV vaccine included cancer prevention (girls: 68.8%; boys: 68.7%), STI prevention (girls: 67.3%; boys: 68.3%), and early vaccination before sexual activity (girls: 62.8%; boys: 59.8%).<sup>15</sup>

**Table 3: HPV Vaccine Uptake and Number of Doses Received**

| Variable                                                | Category                                                            | Frequency | Percent |
|---------------------------------------------------------|---------------------------------------------------------------------|-----------|---------|
| <b>Child vaccinated</b>                                 | Yes                                                                 | 177       | 48.0    |
| <b>Number of doses of HPV vaccine received by child</b> | One dose                                                            | 46        | 12.5    |
|                                                         | Two doses                                                           | 73        | 19.8    |
|                                                         | Don't know                                                          | 204       | 67.7    |
| <b>Reasons for vaccinating the child</b>                | The seriousness of the disease that the vaccine prevents            | 239       | 74.5    |
|                                                         | The effectiveness of the vaccine                                    | 27        | 8.4     |
|                                                         | The side effects of the vaccine                                     | 9         | 2.8     |
|                                                         | The extent to which adequate care was taken to preserve the vaccine | 6         | 1.9     |
|                                                         | Price of the vaccine                                                | 3         | 0.9     |
|                                                         | None                                                                | 37        | 11.5    |

## CONCLUSION

The study found high acceptance of the HPV vaccine among caregivers in Tshwane Sub-District 4, but uptake among Grade Four girls was low. Caregivers knew more about cervical cancer than the vaccine or HPV, which is a critical gap. Knowledge of cervical cancer, clear consent forms, and understanding the vaccination process strongly predicted vaccine uptake. These results underscore the need to improve communication, increase caregiver knowledge, and implement initiatives to translate positive attitudes into increased coverage. Expanding awareness activities and consistent messaging from healthcare providers, schools, and media are vital to boosting HPV vaccination and reducing cervical cancer in South Africa.

## STRENGTHS AND LIMITATIONS OF THE STUDY

This research is among the few to examine vaccine perception, uptake, and acceptability from Gauteng Province's Tshwane Sub-District 4. The study adopted a cross-sectional design, which precludes establishing causality. There is a potential for recall bias and social desirability bias in the self-reported data. Furthermore, the study was limited to a single sub-district, which may restrict the generalizability

of the findings to other provinces within South Africa.

## IMPLICATIONS FOR POLICY AND FUTURE RESEARCH

The results highlight the need for targeted health campaigns to bridge the gap from HPV to cervical cancer and improve vaccine uptake through policy, education, and media strategies. Long-term studies are necessary to evaluate the causal effects and long-term consequences. Studies using qualitative methods among caregivers and healthcare providers may complement a better understanding of cultural and practical issues and barriers.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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**Table 4: Caregivers' Awareness and Source of Information Regarding HPV, HPV Vaccine, and Cervical Cancer**

| Variable                           | Category                                         | Frequency | Percentage |
|------------------------------------|--------------------------------------------------|-----------|------------|
| Ever heard of the HPV virus        | Yes                                              | 141       | 38.3       |
|                                    | No                                               | 227       | 61.7       |
| Ever heard of the HPV vaccine      | Yes                                              | 149       | 40.5       |
|                                    | No                                               | 219       | 59.5       |
| Ever heard of cervical cancer      | Yes                                              | 258       | 70.1       |
|                                    | No                                               | 110       | 29.9       |
| HPV Virus Information sources      | Healthcare providers (Clinic, GP, Hospital)      | 69        | 18.7       |
|                                    | Brochure from daughters' school                  | 64        | 17.4       |
|                                    | Mass media (TV, radio, print)                    | 37        | 10.1       |
|                                    | Internet                                         | 33        | 9.1        |
|                                    | Information from meeting at daughters' school    | 25        | 6.8        |
|                                    | Family/Relatives                                 | 16        | 4.4        |
|                                    | Friends                                          | 15        | 4.1        |
| HPV Vaccine information source     | Healthcare Providers                             | 69        | 18.7       |
|                                    | Brochure from daughters' school                  | 64        | 17.4       |
|                                    | Mass Media (tv, radio, print)                    | 37        | 10.1       |
|                                    | Internet                                         | 33        | 9.0        |
|                                    | Information received from child's school meeting | 25        | 6.8        |
|                                    | Healthcare Providers                             | 33        | 9.0        |
|                                    | Family and relatives                             | 16        | 4.4        |
|                                    | Friends                                          | 15        | 4.1        |
| Cervical Cancer information source | Healthcare Provider                              | 159       | 43.2       |
|                                    | Broadcast media                                  | 101       | 27.5       |
|                                    | Word of mouth                                    | 84        | 22.8       |
|                                    | Daughters' school meeting                        | 64        | 17.4       |
|                                    | Internet                                         | 58        | 15.7       |
|                                    | Print Media                                      | 37        | 10.1       |

**Table 5: Caregivers' Perceptions of the HPV Vaccination**

| Variable                                                                                             | Agree | Disagree |
|------------------------------------------------------------------------------------------------------|-------|----------|
| Cervical cancer is not a big problem for women                                                       | 12.4  | 87.6     |
| HPV vaccine can cause terrible side effects for our children                                         | 19.2  | 80.8     |
| There is a risk for women to contract cervical cancer                                                | 58.4  | 41.6     |
| The programme may influence young girls to indulge in early sexual activities                        | 17.6  | 82.4     |
| The HPV vaccination is well-placed as a school-based programme                                       | 65.0  | 35.0     |
| Parents should support HPV the HPV vaccination programme                                             | 56.0  | 44.0     |
| HPV vaccination is useful                                                                            | 59.4  | 40.6     |
| The programme can help to initiate dialogues between parents and daughters about reproductive health | 51.9  | 48.1     |
| There is a risk for young women to contract HPV Virus                                                | 46.0  | 54.0     |

**Table 6: Factors Associated with HPV Vaccination Acceptability**

| Variables                                                             | Univariate Logistic Regression |          | Multivariate Logistic Regression |          |
|-----------------------------------------------------------------------|--------------------------------|----------|----------------------------------|----------|
|                                                                       | uOR (95% CI)                   | p-values | aOR (95% CI)                     | p-values |
| <b>Signed consent form</b>                                            |                                |          |                                  |          |
| Yes                                                                   | Ref                            |          | Ref                              |          |
| No                                                                    | 11.7 (6.2; 21.9)               | <0.05    | 7.9 (3.9; 15.7)                  | <0.05    |
| <b>Child experiencing side effects due to HPV vaccination</b>         |                                |          |                                  |          |
| Strongly Agree                                                        | Ref                            |          | Ref                              |          |
| Agree                                                                 | 1.8 (0.5;6.5)                  | 0.339    | 1.0 (0.2;4.6)                    | 0.972    |
| Neutral                                                               | 1.0 (0.4; 2.7)                 | 0.935    | 0.5 (0.1; 1.8)                   | 0.293    |
| Disagree                                                              | 0.9 (0.5; 1.8)                 | 0.825    | 1.0 (0.4; 2.9)                   | 0.919    |
| Strongly disagree                                                     | 1.7 (0.7;4.1)                  | 0.228    | 1.0 (0.2;5.1)                    | 0.954    |
| <b>Clear understanding of the HPV vaccination programme procedure</b> |                                |          |                                  |          |
| Strongly Agree                                                        | Ref                            |          | Ref                              |          |
| Agree                                                                 | 6.7 (2.4; 18.8)                | <0.05    | 1.8 (0.5; 6.1)                   | 0.320    |
| Neutral                                                               | 4.7 (2.1; 10.7)                | <0.05    | 2.7 (0.9;8.1)                    | 0.065    |
| Disagree                                                              | 1.9 (1.0; 3.9)                 | 0.063    | 1.3 (0.5; 3.7)                   | 0.587    |
| Strongly disagree                                                     | 1.6 (0.5;5.5)                  | 0.437    | 1.0 (0.2; 5.3)                   | 0.959    |
| <b>Cervical Cancer awareness</b>                                      |                                |          |                                  |          |
| Heard of cervical cancer                                              | Ref                            |          | Ref                              |          |
| Have not heard of cervical cancer                                     | 5.1 (2.9; 9.1)                 | <0.05    | 2.9 (1.4; 5.8)                   | 0.003    |
| <b>HPV Virus Awareness</b>                                            |                                |          |                                  |          |
| Heard of HPV virus                                                    | Ref                            |          | Ref                              |          |
| Have not head of HPV virus                                            | 4.5 (2.1; 9.5)                 | <0.05    | 5.1 (0.9; 5.2)                   | 0.095    |

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