

Social and behavioral determinants of vulnerability to HPV in rural populations of Samaipata

Determinantes sociales y comportamentales de la vulnerabilidad al VPH en poblaciones rurales de Samaipata

Katherine Orellana  • Ruth Koria  • Nataly Duran*  

Facultad de Ciencias de la Salud, Universidad Privada Domingo Savio, Bolivia.

**Corresponding author*

Reception: 20-04-2026

Acceptance: 05-07-2026

Publication: 31-07-2026

ABSTRACT

Human papillomavirus (HPV) infection constitutes a major public health problem due to its association with cervical cancer and other diseases. This study evaluated social and behavioral vulnerability to HPV among individuals over 18 years of age in the municipality of Samaipata, Bolivia, during 2024. A quantitative, cross-sectional, descriptive, and analytical study was conducted with 181 participants selected through convenience sampling. A validated questionnaire was applied, and statistical analysis included frequencies, odds ratios, and Chi-square tests using Epi Info 7.2. The results showed a low level of knowledge about HPV, limited preventive information, and poor recognition of the vaccine. In addition, a significant association was identified between the lack of health guidance and the absence of preventive examinations. It is concluded that strengthening sexual health education, vaccination, and community-based prevention strategies in rural populations is necessary.

Keywords: human papillomavirus, social vulnerability, prevention, rural health.

RESUMEN

La infección por el virus del papiloma humano (VPH) constituye un importante problema de salud pública por su relación con el cáncer cervicouterino y otras patologías. El presente estudio evaluó la vulnerabilidad social y comportamental frente al VPH en personas mayores de 18 años del municipio de Samaipata, Bolivia, durante 2024. Se realizó una investigación cuantitativa, transversal, descriptiva y analítica con 181 participantes seleccionados mediante muestreo por conveniencia. Se aplicó un cuestionario validado y el análisis estadístico incluyó frecuencias, odds ratio y prueba de chi-cuadrado utilizando Epi Info 7.2. Los resultados evidenciaron bajo nivel de conocimiento sobre el VPH, limitada información preventiva y escaso reconocimiento de la vacuna. Además, se identificó asociación significativa entre la falta de orientación en salud y la ausencia de exámenes preventivos. Se concluye que es necesario fortalecer la educación sexual, vacunación y estrategias comunitarias de prevención en poblaciones rurales.

Palabras clave: virus del papiloma humano, vulnerabilidad social, prevención, salud rural.

Cite as: Orellana, K., Koria, R., & Duran, N. (2026). Social and behavioral determinants of vulnerability to HPV in rural populations of Samaipata. *Revista Gregoriana de Ciencias de la Salud*, 3(2), 52-62. <https://doi.org/10.36097/rgcs.v3i2.3228>

© Author(s) 2026

INTRODUCTION

The human papillomavirus (HPV) belongs to the family of DNA viruses and infects the genital areas, mouth, and throat. It is the most common sexually transmitted infection worldwide (Bahi et al., 2023), particularly affecting low- and middle-income countries, especially rural areas with limited access to healthcare services. According to the World Health Organization (WHO), HPV is responsible for more than 95% of cervical cancer cases worldwide, with the majority of deaths occurring in countries with fragmented healthcare systems or limited coverage of screening and vaccination programs (World Health Organization [WHO], 2026). Emerging evidence suggests that the gut microbiome and its modulation through probiotics may influence systemic immunity and inflammatory responses (Barcia et al., 2024), potentially affecting the host's ability to manage persistent viral infections such as HPV.

Social factors, including poverty, low educational attainment, ethnicity, and rural living conditions, directly influence increased HPV exposure and reduced access to preventive measures, resulting in a higher epidemiological burden in these communities (Kombe et al., 2021). Moreover, dietary habits and food choices, particularly the consumption of ultra-processed foods with low nutritional quality, have been identified as modifiable behavioral factors that can affect immune function and overall health status, indirectly influencing vulnerability to infections such as HPV (Gallardo & García, 2024). This situation has been confirmed by recent studies conducted in Andean countries, particularly in rural communities of La Paz, where a 27% prevalence of high-risk HPV infection was reported among adult women, with HPV types 56, 39, and 31 being predominant in settings with limited access to preventive healthcare services (Patz-Churqui et al., 2020).

Furthermore, significant disparities exist in HPV vaccination implementation in rural areas due to multiple factors, including insufficient health education, misinformation, cultural barriers, lack of healthcare professional recommendations, and restricted access to vaccination services. Recent studies in Latin America have identified these factors as the main contributors to low vaccination uptake, even though HPV vaccines are safe, effective, and included in national immunization programs (Nogueira-Rodrigues et al., 2022; Roberti et al., 2024).

In this context, the most effective public health strategies include the implementation of free HPV vaccination programs in educational institutions, targeted health education campaigns, community empowerment, and active involvement of healthcare professionals. Well-structured programs have achieved vaccination coverage rates exceeding 90% in similar settings, highlighting that the absence of these structural components in rural areas such as Samaipata may contribute to increased vulnerability to HPV infection (Nogueira-Rodrigues et al., 2022; Díaz et al., 2025).

METHODOLOGY

A quantitative, observational, cross-sectional, descriptive, and analytical study was conducted to determine the factors associated with an increased risk of human papillomavirus (HPV) transmission in the studied population. The quantitative approach allowed the objective measurement of the variables of interest and the statistical analysis of possible associations between sociocultural, behavioral, and HPV-related knowledge and perception factors. The cross-sectional design enabled the simultaneous assessment of exposure to specific risk factors and the condition of interest during a defined period, while the descriptive component allowed the characterization of participants' sociodemographic and behavioral conditions. Additionally, the analytical component made it possible to establish relationships between the independent variables and the increased risk of HPV transmission.

The target population consisted of individuals over 18 years of age residing in the municipality of Samaipata, Bolivia. Participants were selected through non-probabilistic convenience sampling, considering their accessibility and availability during the study period. The final sample included 181 participants, who voluntarily agreed to participate and provided informed consent before the application of the research instrument.

The dependent variable was defined as the increased risk of human papillomavirus (HPV) transmission. The independent variables included several sociocultural and behavioral factors potentially associated with this risk. Social factors included age, sex, marital status, educational level, income level, and place of residence (urban or rural). Behavioral factors included the number of sexual partners, use of contraceptive methods—particularly condoms—, tobacco consumption, alcohol consumption, and drug use. In addition, factors related to HPV knowledge and perception

were evaluated, including the level of knowledge about HPV and its consequences, risk perception, attitudes toward vaccination, and access to health counseling and healthcare services.

A structured questionnaire previously validated by Sepúlveda et al. (2014) through the Mexican College of Nurses was used for data collection. The instrument was applied without modifications because its methodological characteristics were considered appropriate for assessing the variables established in the study. No pilot test was conducted before the final application of the questionnaire.

Data processing and statistical analysis were performed using Epi Info version 7.2 software. Descriptive analysis was conducted using absolute and relative frequencies to characterize the studied variables. To determine the association between sociocultural and behavioral factors and the increased risk of HPV transmission, association measures were calculated using odds ratios (OR) with their respective 95% confidence intervals. Additionally, the Chi-square test was applied to evaluate the statistical significance of the associations identified, establishing a significance level of $p < 0.05$.

The research considered the fundamental ethical principles applicable to studies involving human participants. The protocol was approved by the Ethics Committee of Universidad Privada Domingo Savio through Resolution No. 0007/2024, issued on March 15, 2024. All procedures were conducted in accordance with the principles established in the Declaration of Helsinki, ensuring respect for participants' autonomy, dignity, and rights. Before enrollment, each participant received clear information about the study objectives, procedures, potential benefits, and possible risks, and voluntarily provided informed consent. Likewise, confidentiality of the collected information, anonymity of personal data, and exclusive use of the information for scientific purposes were ensured, preventing any form of discrimination or harm resulting from participation in the research.

RESULTS AND DISCUSSION

The study sample consisted of 181 individuals over 18 years of age who signed informed consent forms to participate voluntarily. The sociodemographic profile showed a mean age of 33.15 years, with an age range of 18 to 87 years. The highest concentration of participants was

observed among individuals aged 23 to 41 years; a group considered particularly relevant for HPV prevention strategies.

Regarding sex distribution, 55.80% of participants were female, and 44.20% were male. Concerning marital status, 74.59% were single, 18.23% were married, and 7.18% were in a consensual union. This distribution may reflect lower marital stability and potentially greater exposure to sexual risk behaviors. Additionally, 56.35% of participants reported having children, whereas 43.65% did not, which may influence risk perception and interest in preventive strategies.

The analysis of behavioral factors showed that alcohol consumption during sexual intercourse was not significantly associated with HPV infection risk ($p < 0.05$), although the odds ratio ($OR > 1$) suggested a possible trend toward increased risk. Drug use showed a relevant association with HPV vulnerability, with an OR of 3.5 and a p-value close to statistical significance ($p = 0.0583$), indicating a potential relationship that requires further investigation (Figure 1).

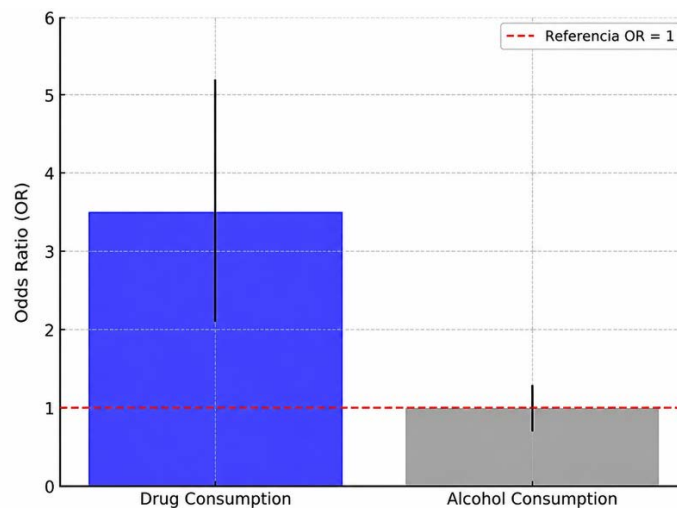


Figure 1. Association of substance use (alcohol and drug consumption) with HPV vulnerability based on odds ratios (ORs) and 95% confidence intervals (95% CI). The reference line at $OR = 1$ indicates the null association.

Regarding contraceptive use, no statistically significant association with HPV infection risk was identified. Concerning HPV-related knowledge, a low level of general information was observed among the surveyed population: 65.75% of participants did not know what HPV was,

69.61% had not received information about the virus, and only 37.02% were aware of the existence of the HPV vaccine. Although 83.43% of respondents reported knowledge of sexual protection methods, critical gaps remain regarding specific knowledge about HPV (Table 1).

Table 1. Level of knowledge about Human Papillomavirus (HPV) among the surveyed population (n = 181)

Category	Frequency	Percentage
Knowledge about human papillomavirus		
No	119	65.75
Yes	62	34.25
Total	181	100.00
Receipt of information about HPV		
No	126	69.61
Yes	55	30.39
Total	181	100.00
Knowledge of protection methods		
Knows	151	83.43
Does not know	30	16.57
Total	181	100.00
Knowledge of the HPV prevention vaccine		
No	114	62.98
Yes	67	37.02
Total	181	100.00

The association between sociodemographic variables and the performance of preventive medical examinations was also evaluated. No significant associations were found with marital status or with perceptions about the vaccine. However, receiving health guidance was statistically significantly associated with undergoing diagnostic examinations, with an OR of 4.86 and $p < 0.001$ (Table 2).

Table 2. Association between sociodemographic variables and performance of HPV diagnostic tests

Variable	OR	χ^2	p-value
Perception of HPV vaccination and test performance	1.71	1.099	0.246
Marital status and test performance	NS	0.7337	0.6929
Health guidance and test performance	4.86	21.2959	3.956×10^{-6}

NS = not significant; OR = odds ratio; χ^2 = chi-square statistic.

The high level of ignorance about HPV ($\approx 66\%$) and the vaccine ($\approx 37\%$) among rural residents of Samaipata is consistent with previous findings in Bolivia and other rural contexts in Latin America. An observational study showed that the prevalence of high-risk HPV in rural Bolivia was similar to that of urban areas ($\sim 11\%$), and that restricted access to diagnostic tests perpetuated information and screening gaps (Carozzi et al., 2024).

Additionally, a qualitative analysis conducted in rural communities in the Hernando Siles area of Bolivia identified persistent information barriers, distrust in health services, and communication breakdowns between doctors and patients as key factors hindering the implementation of preventive screening for cervical cancer (Basagoitia et al., 2023). These findings corroborate the significant association (OR 4.86; $p < 0.001$) we found between health guidelines and the implementation of diagnostic tests.

Drug use, with an OR of 3.50 and a p-value approaching significance, indicates risk behaviors that increase HPV exposure, although the association was not statistically conclusive. In Latin America, similar connections exist between risk behaviors, limited education, and greater susceptibility to HPV, particularly in rural areas (Zhetpisbayeva et al., 2023). Likewise, recent studies have linked behavioral factors such as alcohol, tobacco, and drug use with greater progression of HPV infection in vulnerable populations (Roman et al., 2023).

The low coverage and acceptance of the HPV vaccine in rural areas could be directly linked to certain social factors. A systematic review revealed that 84% of the vaccine was well received in Latin America; however, it also noted that acceptance decreased considerably in rural communities or those with low levels of education, particularly during the COVID-19 pandemic (Salazar-Valdivia et al., 2024; Han et al., 2025). From the perspective of implementing screening policies in Latin America, evidence shows that the introduction of serological or molecular HPV tests is feasible and promising in reducing cervical cancer mortality. Research conducted in the region determined that using HPV tests as a primary detection method is feasible and efficient, even in low-income countries (De Oliveira et al., 2022).

Finally, global reviews emphasize that low compliance with screening and vaccination in rural areas is due to geographical barriers, a shortage of well-trained personnel, a lack of guidance from healthcare workers, and a general lack of knowledge about HPV (Zhetpisbayeva et al., 2023).

This diagnosis is consistent with the results of this research in Samaipata and underscores the urgent need to develop holistic strategies that include health education, technical access, and improvement of community services.

CONCLUSIONS

A high vulnerability to HPV infection was observed in the rural population of Samaipata, primarily associated with gaps in knowledge about the infection, limited preventive information, and low recognition of vaccination as a protective strategy. These findings reflect deficiencies in comprehensive sexual and reproductive health education, as well as barriers that affect timely access to preventive measures and health services. The association between the lack of health guidance and the lack of diagnostic testing highlights the importance of health support and strengthening prevention programs. Therefore, comprehensive strategies based on sexual education, expanded HPV vaccination coverage, promotion of screening, and ongoing training for health personnel are needed, especially in rural communities.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conceptualization: Katherine Orellana, Ruth Koria, and Nataly Duran. **Data curation:** Katherine Orellana and Ruth Koria. **Formal analysis:** Katherine Orellana, Ruth Koria, and Nataly Duran. **Investigation:** Katherine Orellana, Ruth Koria, and Nataly Duran. **Methodology:** Katherine Orellana, Ruth Koria, and Nataly Duran. **Project administration:** Nataly Duran. **Resources:** Katherine Orellana and Nataly Duran. **Software:** Katherine Orellana. **Supervision:** Nataly Duran. **Validation:** Katherine Orellana and Nataly Duran. **Visualization:** Katherine Orellana and Ruth Koria. **Writing – original draft:** Katherine Orellana and Ruth Koria. **Writing – review & editing:** Nataly Duran.

REFERENCES

Bahi, M. C., Bahramand, S., Jan, R., Boulaaras, S., Ahmad, H., & Guefaifia, R. (2023). Fractional view analysis of sexual transmitted human papilloma virus infection for public health. *Scientific Reports*, 14, 3048. <https://doi.org/https://doi.org/10.1038/s41598-024-53696-8>

- Barcia, A. A., García, M. A., & Tejedor, R. (2024). Microbiota intestinal, probióticos y su relación con el trastorno depresivo mayor: una revisión bibliográfica. *Revista San Gregorio*, (58): 111-118. <https://doi.org/10.36097/rsan.v1i58.2756>
- Basagoitia, A., Burrowes, S., Solis-Soto, M. T., MacMillan, G., & Sullivan, S. (2023). Community and provider perceptions and experiences of cervical cancer screening in Rural Bolivia: a qualitative study. *BMC Women's Health* 23, 359. <https://doi.org/10.1186/s12905-023-02500-2>
- Carozzi, F. M., Yanez, R. R., Paganini, I., Sani, C., Cannistrà, S., Matucci, M., von Borries, S., & Traina, S. (2024). Cervical cancer prevention: Feasibility of self-sampling and HPV testing in rural and urban areas of Bolivia: An observational study. *Plos One*, 19(3). <https://doi.org/10.1371/journal.pone.0292605>
- De Oliveira, L. H., Janusz, C. B., Da Costa, M. T., El Omeiri, N., Bloem, P., Lewis, M., & Luciani, S. (2022). HPV vaccine introduction in the Americas: a decade of progress and lessons learned. *Expert Review of Vaccines*, 21(11), 1569-1580. <https://doi.org/10.1080/14760584.2022.2125383>
- Díaz, L. M., Martínez, D., Márquez, K., Scartascini, C. (2025). *Combating Vaccine Hesitancy: The Case of HPV Vaccination* (IDB-WP-1673). Inter-American Development Bank, Department of Research and Chief Economist. <https://doi.org/http://dx.doi.org/10.18235/0013410>
- Gallardo, W. D., & García, M. A. (2024). Junk food: analysis of risks, benefits, and social perception. *Journal of Food Science and Gastronomy*, 2(1), 26-34. <https://doi.org/10.5281/zenodo.13996283>
- Han, J., Zhang, L., Chen, Y., Zhang, Y., Wang, L., Cai, R., Li, M., Dai, Y., Dang, L., Chen, H., & Zhu, L. (2025). Global HPV vaccination programs and coverage rates: a systematic review. *eClinicalMedicine*, 84, 103290. <https://doi.org/10.1016/j.eclinm.2025.103290>
- Kombe, A. J., Li, B., Zahid, A., Mengist, H. M., Bounda, G.-A., Zhou, Y., & Jin, T. (2021). Epidemiology and burden of human papillomavirus and related diseases, molecular pathogenesis, and vaccine evaluation. *Frontiers in Public Health*, 8, 552028. <https://doi.org/10.3389/fpubh.2020.552028>
- Nogueira-Rodrigues, A., Flores, M. G., Macedo, A. O., Braga, L. A. C., Vieira, C. M., Sousa-Lima, R. M., de Andrade, D. A. P., Machado, K. K., & Guimarães, A. P. G. (2022). HPV

- vaccination in Latin America: Coverage status, implementation challenges and strategies to overcome it. *Frontiers in Oncology*, 12, 984449. <https://doi.org/10.3389/fonc.2022.984449>
- Patzi-Churqui, M., Terrazas-Aranda, K., Liljeqvist, J.-Å., Lindh, M., & Eriksson, K. (2020). Prevalence of viral sexually transmitted infections and HPV high-risk genotypes in women in rural communities in the Department of La Paz, Bolivia. *BMC Infectious Diseases*, 20(1), 204. <https://doi.org/10.1186/s12879-020-4931-1>
- Roberti, J., Ini, N., Belizan, M., & Alonso, J. P. (2024). Barriers and facilitators to vaccination in Latin America: A thematic synthesis of qualitative studies. *Cadernos de Saúde Pública*, 40(6), e00165023. <https://doi.org/10.1590/0102-311XEN165023>
- Roman, C., Andrade, D., Hernández, Y., Salazar, Z. K., Espinosa, L., Campoverde, E., Guallaizaca, L., Merchán, M., Sarmiento, M., & Brenner, J. (2023). Biological, demographic, and health factors associated with HPV infection in Ecuadorian women. *Frontiers in Public Health*, 11, 1158270. <https://doi.org/10.3389/fpubh.2023.1158270>
- Salazar-Valdivia, F. E., Alarcon-Braga, E. A., Estrada-Grossmann, J. M., Valdez-Cornejo, V. A., Hernandez Randich, K., Chaponan-Lavalle, A., & Joya-Arista, V. (2024). HPV vaccine acceptance in Latin America and the Caribbean: A systematic review and meta-analysis. *Discover Public Health*, 21(22). <https://doi.org/10.1186/s12982-024-00146-5>
- Sepúlveda, G. J., Meneses, A. L., & Goldenberg, P. (2014). Validez de contenido: cuestionario de vulnerabilidad al papilomavirus humano. *Enfermería Global*, 13(35), 211-225. https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1695-61412014000300013
- World Health Organization (WHO). (2026). *Cervical cancer*. Retrieved July 28, 2026, from <https://www.who.int/news-room/fact-sheets/detail/cervical-cancer>
- Zhetpisbayeva, I., Kassymbekova, F., Sarmuldayeva, S., Semenova, Y., & Glushkova, N. (2023). Cervical cancer prevention in rural areas. *Annals of Global Health*, 89(1), 75. <https://doi.org/10.5334/aogh.4133>

Statement on the Use of Artificial Intelligence: The authors acknowledge the use of generative artificial intelligence (AI) and AI-assisted technologies solely to improve the readability, language quality, and clarity of this manuscript. AI tools may also have been used to create or edit non-scientific graphical content, such as graphical abstracts, icons, illustrations, diagrams, or

educational figures, provided that such use is transparently disclosed and does not misrepresent or fabricate research findings. AI tools were not used to generate, modify, enhance, interpret, or analyze scientific data, medical images (e.g., radiographs, computed tomography scans, magnetic resonance imaging, ultrasound images, histopathological images, microscopy images, or other diagnostic images), or any figures that constitute primary research data. The authors reviewed and edited all AI-assisted content as necessary and assume full responsibility for the accuracy, integrity, and originality of the final published work.

Disclaimer / Editor's Note: All publications' statements, opinions, and data are solely those of the individual authors and contributors, not *Revista Gregoriana de Ciencias de la Salud* or the editors. *Revista Gregoriana de Ciencias de la Salud* and/or the editors disclaim all responsibility for any injury to persons or property resulting from any ideas, methods, instructions, or products referred to in the content.