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# Genomic and epidemiological profile of cervical cancer patients - identifying risk factors, pathways and novel variants through integrated survey and Whole Exome Sequencing strategies

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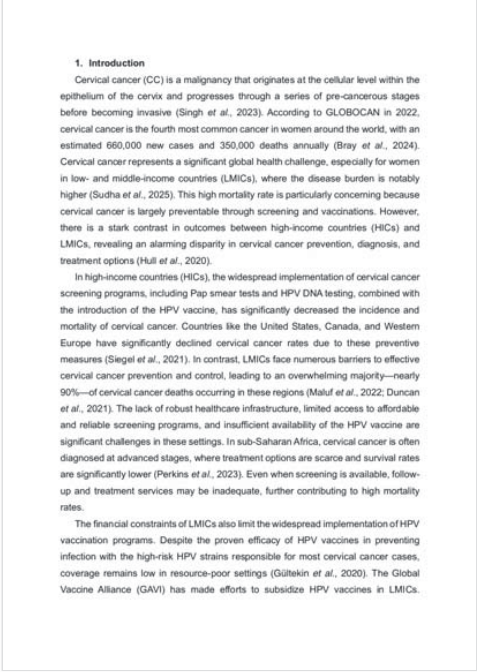

**1. Introduction**

Cervical cancer (CC) is a malignancy that originates at the cellular level within the epithelium of the cervix and progresses through a series of pre-cancerous stages before becoming invasive (Singh *et al.*, 2023). According to GLOBOCAN in 2022, cervical cancer is the fourth most common cancer in women around the world, with an estimated 660,000 new cases and 350,000 deaths annually (Bray *et al.*, 2024). Cervical cancer represents a significant global health challenge, especially for women in low- and middle-income countries (LMICs), where the disease burden is notably higher (Sudha *et al.*, 2025). This high mortality rate is particularly concerning because cervical cancer is largely preventable through screening and vaccinations. However, there is a stark contrast in outcomes between high-income countries (HICs) and LMICs, revealing an alarming disparity in cervical cancer prevention, diagnosis, and treatment options (Hull *et al.*, 2020).

In high-income countries (HICs), the widespread implementation of cervical cancer screening programs, including Pap smear tests and HPV DNA testing, combined with the introduction of the HPV vaccine, has significantly decreased the incidence and mortality of cervical cancer. Countries like the United States, Canada, and Western Europe have significantly declined cervical cancer rates due to these preventive measures (Siegel *et al.*, 2021). In contrast, LMICs face numerous barriers to effective cervical cancer prevention and control, leading to an overwhelming majority—nearly 90%—of cervical cancer deaths occurring in these regions (Maluf *et al.*, 2022; Duncan *et al.*, 2021). The lack of robust healthcare infrastructure, limited access to affordable and reliable screening programs, and insufficient availability of the HPV vaccine are significant challenges in these settings. In sub-Saharan Africa, cervical cancer is often diagnosed at advanced stages, where treatment options are scarce and survival rates are significantly lower (Perkins *et al.*, 2023). Even when screening is available, follow-up and treatment services may be inadequate, further contributing to high mortality rates.

The financial constraints of LMICs also limit the widespread implementation of HPV vaccination programs. Despite the proven efficacy of HPV vaccines in preventing infection with the high-risk HPV strains responsible for most cervical cancer cases, coverage remains low in resource-poor settings (Gültekin *et al.*, 2020). The Global Vaccine Alliance (GAVI) has made efforts to subsidize HPV vaccines in LMICs.