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PAMJ One Health

Review

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Received: 06 Feb 2025 - **Accepted:** 02 Oct 2025 - **Published:** 12 Dec 2025

Keywords: Cervical cancer, early sexual initiation, multiple sexual partners, hormonal contraceptive use, and regular pap testing

Funding: This work received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Cite this article: Eugene Jamot Ndebia et al. Sexual behavior and cervical cancer in South Africa: a systematic review with meta-analysis. PAMJ-One Health. 2025;18(21). 10.11604/pamj-oh.2025.18.21.46804

Available online at: https://www.one-health.panafrican-med-journal.com/content/article/18/21/full

Sexual behavior and cervical cancer in South Africa: a systematic review with meta-analysis

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Abstract

Cervical cancer ranks as one of the foremost causes of death among women in South Africa. Although progressive sexual and reproductive health policies have been put in place, people still engage in many risky behaviors, which can increase exposure to HPV and the risk of cervical cancer. This systematic review aims to assess sexual patterns associated with cervical cancer in young women in South Africa to propose policies that may help curb the spread of the disease. To achieve this, relevant studies were selected from scientific databases (African Journal Online, Web

of Science, Google Scholar, PubMed/Medline, and Scopus), applying rigorous eligibility criteria using PRISMA 2020 guidelines. The extracted data were analyzed quantitatively to determine the associations between sexual risk behaviors and the incidence of cervical cancer using STATA 18 software. The study revealed a significant relationship between the combined use of injectable and oral hormonal contraceptives (1.37, 95% CI [1.19-1.58]), the number of sexual partners (1.36, 95% CI [1.22-1.51]), and having had sexual intercourse for the first time before the age of 16 (1.56, 95% CI [1.33-1.83]) with an increased risk of cervical cancer. On the other hand, frequent Pap testing showed a significant protective effect. These results underline the need for combined prevention strategies, including sexual health education, HPV vaccination, and regular screening programs, to reduce the incidence of cervical cancer. Further studies are needed to understand the mechanisms associated with the combined use of hormonal contraceptives.

Introduction

Cervical cancer is a malignant disease that develops from cells in the cervix, the lower part of the uterus that communicates with the vagina [1]. It is the fourth most common cancer in women, and the most common form is squamous cell carcinoma, which accounts for around 90% of diagnosed cases [2]. According to data from the World Health Organization (WHO), around 660,000 women were diagnosed with cervical cancer worldwide in 2022, and around 350,000 deaths were attributed to the disease in the same year [3]. In sub-Saharan Africa, the International Agency for Research on Cancer (IARC) reported around 110300 new cases in 2020, with a particularly high mortality rate, reaching almost 68% of cases [4]. It was the second most common cancer in South African women in 2023, and it topped the list for women aged 15-44 years [5]. According to ICO/IARC estimates (2023), approximately 10,702 women are diagnosed with cervical cancer each year in South Africa, and 5,870 of them die from the disease each year [5]. Precancerous lesions, or very early stages of the disease, are often asymptomatic and can be detected by a cervical smear [6]. Clinical symptoms usually occur when the tumor causes spontaneous bleeding or bleeding during sexual intercourse or pain if lymph nodes are involved. Other clinical signs include malodorous serosanguineous vaginal discharge or back pain [7].

Among the risk factors for cervical cancer, sexual habits occupy a prominent place although human papillomavirus (HPV) infection is the main and most widely recognised cause identified to date [8]. However, other factors, such as contraceptive use, number of sexual partners, and age at first intercourse, have also been suggested by several individual studies, although their exact link with cervical cancer remains controversial in South Africa [9-11]. To date, no systematic review has definitively established the relationship between these behavioral factors and cervical cancer in South Africa. Although several systematic reviews conducted in Europe, Asia, and North America have established links between sexual behaviors and cervical cancer risk, these findings may not be directly generalizable to African populations [12-14]. Differences in cultural norms, sexual practices, socioeconomic conditions, and the structure of healthcare systems (including access to HPV vaccination and cervical cancer screening) can significantly influence both exposure and disease risk [15]. In South Africa, where sexual and reproductive health policies are relatively progressive but risky sexual behaviors remain widespread, there is a pressing need for context-specific evidence. This work aims to assess, among South African women, how specific sexual behaviors (including early sexual initiation (before age 16), having multiple sexual partners, and the use of hormonal contraceptives) are associated with the risk of developing cervical cancer, compared to women without these risk factors. The goal is to generate evidence that can inform targeted prevention

strategies and national cervical cancer control policies.

Methods

This study was carried out following the PRISMA 2020 guidelines, which provide a comprehensive, transparent, and reproducible framework for reporting systematic reviews and meta-analyses [16]. Compliance with these standards guarantees a structured and rigorous approach, ensuring the reliability and clarity of the analysis process.

Eligibility criteria

This work will include original studies on the South African female population assessing the impact of sexual habits on the risk of cervical cancer (histologically confirmed invasive cervical cancer), whether as a primary or secondary objective, and will be published before February 2025. The studies selected must have obtained ethical approval and have adjusted for potential confounding variables (such as age, HIV status, smoking, socioeconomic status, or parity in their statistical models) either through multivariate regression, stratification, or matching techniques. There will be no language or year of publication restrictions, but studies must be published in peer-reviewed journals. Studies involving non-South African populations and non-peer-reviewed journals, editorials, letters, and studies will be excluded.

Exposure and outcome

The sexual habits of South African women were considered as the exposure, while their impact on cervical cancer risk was assessed as the outcome.

Search strategy

The following electronic databases were searched: Scopus, PubMed/Medline, Web of Science, Google Scholar, and African Journal Online. Search terms included 'cervical cancer' 'risk factors', 'sexual habits' and 'South Africa'. In addition, manual searches were performed by searching the references of selected studies that met the eligibility criteria.

Study selection process

The study selection process was conducted in two phases: title/abstract screening and full-text review. Two independent reviewers screened all titles and abstracts identified through the database search to determine preliminary eligibility. Potentially relevant studies were then retrieved in full and assessed independently by both reviewers against the predefined inclusion and exclusion criteria. Any disagreements between the reviewers at either stage were resolved through discussion and consensus. The selection process was documented using a PRISMA 2020-compliant flow diagram (Figure 1).

Data extraction

Study characteristics such as title, authors, year of publication, and study design were extracted. Concerning the participants, the information taken into account included the age of the participants as well as the sample size. The participants' sexual behavior was also analyzed, including the date of first sexual intercourse, contraceptive use, types of contraceptives used, number of sexual partners, and frequency of sexual intercourse. Finally, parameters expressing the association between sexual behavior and cervical cancer, such as the odds ratio (OR), relative risk (RR), and their respective confidence intervals, were retrieved from the included studies. For the quantitative synthesis, studies were grouped according to the specific sexual behavior assessed: (1) age at first sexual intercourse, (2) number of sexual partners, and (3) hormonal contraceptive use (oral, injectable, or combined). This grouping was done to ensure alignment with planned subgroup analyses and to enable meaningful comparison of pooled effect estimates. Only studies reporting odds ratios (ORs) or relative risks (RRs) with corresponding confidence intervals for these

variables were included in each respective subgroup. No attempts were made to contact study authors for missing or unclear data, as all relevant information was available from the included articles.

Quality assessment

This will be assessed using the appropriate tool (Newcastle-Ottawa Scale (NOS)) [17], and studies will be graded according to criteria such as methodological rigor, quality of reports, and validity of results. Two reviewers independently evaluated each study based on three domains: selection of study groups, comparability of groups, and ascertainment of exposure. Discrepancies in scoring were resolved through discussion and consensus.

Data synthesis

The data collection and analysis were organized systematically followed the PRISMA 2020 guidelines [18,19]. It began with a review of the available studies, followed by an organization of the studies to better understand the key points. A detailed summary table was drawn up to present the main findings of the studies. Prior to synthesis, data were harmonized across studies. When necessary, relative risks (RRs) were converted to odds ratios (ORs) using standard formulas to ensure consistency of effect measures. Statistical analyses for the quantitative synthesis were performed using STATA software 18.0. Overall effect estimates and their 95% confidence intervals (CIs) were calculated using the inverse variance method of DerSimonian and Laird [20]. Odds ratios (ORs) with 95% CIs were used to illustrate the dichotomous data related to sexual habits and cervical cancer in a forest plot. A random effects model was applied to account for study heterogeneity, and the I^2 statistic and the Cochran's Q (χ^2) test were used to assess variability between included studies. A threshold of $P < 0.05$ was used to define statistical significance. I^2 values were interpreted as follows: low (0-40%), moderate (30-60%), substantial (50-90%), and considerable (>75%) and significant heterogeneity was observed when the I^2 value was between 75% and 100%. To explore the impact of sexual habits in more detail, planned subgroup analyses were conducted to examine the influence of three key exposures: (1) age at first sexual intercourse (<16 vs ≥16 years), (2) number of sexual partners (>2 vs ≤2), and (3) hormonal contraceptive use (oral, injectable, combined). Sensitivity analyses were performed to assess the robustness of pooled estimates. The p-values and confidence intervals were visually inspected to assess and compare differences between subgroups.

Assessment of publication bias and certainty of evidence

Potential publication bias was evaluated through a visual examination of the funnel plot. To statistically assess any asymmetry observed, the Egger regression test [21] was applied. Publication bias was deemed present when the p-value was below 0.10 [22]. The risk of bias was assessed using STATA 18.0. The certainty of evidence for each key outcome was assessed using the GRADE approach. This method evaluates the overall quality of evidence based on five domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias. Two reviewers independently graded the certainty of evidence for the association between each sexual behavior and cervical cancer risk. Discrepancies were resolved by consensus.

Data availability

This study's data sources are available in African Journal Online, Web of Science, Google Scholar, PubMed/Medline and Scopus databases.

Results

Summary of the characteristics of the included studies

Bibliographic searches identified 1815 studies, of which 10 fully meet the inclusion criteria and were selected for analysis (Figure 1, Table 1). These 10 case-control studies involved a sample of 27,079 people, comprising 12,460 cases and 12,756 controls, from the provinces of Gauteng (Johannesburg) and the Western Cape (Cape Town) (Table 1) [9-11,23-29]. Cases were women with a histological diagnosis of invasive cervical cancer, while controls were healthy volunteers with no family or personal history of cancer. The main parameters studied included age at first intercourse, the number of sexual partners, contraceptive use, and the types of contraceptives used (oral, injectables, condoms, etc.). Data were collected mainly using questionnaires in the various studies.

Effect of contraceptive use on the risk of cervical cancer

The impact of contraceptive use on cervical cancer risk is presented in the forest plot in Figure 2. The analysis shows an overall odds ratio of 1.05 (95% CI, 0.86-1.28, P = 0.65) and high heterogeneity (I^2 = 93.26%). These results suggest that there is no significant association between contraceptive use and cervical cancer. A funnel plot appeared symmetrical, suggesting a low probability of publication bias. Egger's regression test confirmed this symmetry with a p-value of 0.284, indicating that there is no statistically significant evidence of small study effects or publication bias for this result. In contrast, no relationship was observed between cervical cancer and the exclusive use of oral or injectable hormonal contraceptives. However, a significant risk of 1.37 (95% CI, 1.19-1.58; P = 0.00) was found in people using both oral and injectable contraceptives (Table 2).

Effect of the number of sexual partners on the risk of cervical cancer

The link between the number of sexual partners and cervical cancer is presented in the forest plot in Figure 3. The analysis shows an overall odds ratio of 1.36 (95% CI, 1.22-1.51, P = 0.00) and low heterogeneity (I^2 = 21.37%). These results suggest that a high number of sexual partners (>2) is significantly associated with the risk of cervical cancer.

Effects of age at first intercourse and regular cervical smears on the risk of cervical cancer

The relationship between age at first sexual intercourse, Pap test uptake, and risk of cervical cancer is presented in the forest plot in Table 3. The analysis shows an overall odds ratio of 1.56 (95% CI, 1.33-1.58, P = 0.00) for age at first intercourse, and 0.37 (95% CI, 0.32-0.43, P = 0.00) for having a Pap test. These results indicate that women who had their first sexual intercourse before the age of 16 have a significant risk of developing cervical cancer.

Discussion

South Africa, known for its progressive and liberal adolescent sexual and reproductive health policies, faces a persistent challenge of risky sexual behavior among young people [30,31]. Despite political, social, and technological advances, some common sexual practices among young women expose them to serious diseases, such as cervical cancer [32]. In this study, several sexual behaviors were associated with an increased risk of cervical cancer. The combined use of oral and injectable hormonal contraceptives showed a significant association [1.37 (95% CI, 1.19-1.58; P = 0.00)] with this type of cancer. This association could be attributed to their ability to modify the cervical environment and increase susceptibility to persistent HPV infections, the leading risk factor for this cancer [27]. Simultaneous use of oral and injectable contraceptives could have a synergistic effect on the cervix, modifying the local immune

response and increasing vulnerability to persistent HPV infections. In addition, this combined use could prolong exposure to contraceptive hormones, which could alter cervical biology over a prolonged period, thereby increasing the risk of pre-cancerous cell changes.

However, the overall results concerning contraceptive use, and more specifically, the exclusive use of oral and injectable contraceptives in this analysis, show no significant association. This contradicts the work of Asthana *et al.* [12], who reported an OR of 1.51 (95% CI = 1.35-1.68), suggesting a significant association between oral contraceptive use and cervical cancer. This lack of association could be explained, on the one hand, by the fact that the impact of contraceptives on cervical cancer may be moderate and depend on additional factors such as duration of use, age at onset of use, or HPV infection status. On the other hand, this absence could also be due to the few studies available on this subject.

The high level of heterogeneity (I^2 = 93.26%) observed in the analysis suggests that the included studies differ substantially in terms of design, study populations, and methodologies. This heterogeneity could mask an overall association, making it challenging to identify a uniform effect. Participants varied according to demographic factors such as age, socio-economic status, and level of education, which could influence both their exposure to contraceptives and their risk of developing cervical cancer. In addition, differences in the duration and frequency of contraceptive use between studies due to the inclusion of women of different age groups could also affect the impact of contraceptives on cancer risk [33].

The number of sexual partners was significantly associated with the risk of cervical cancer [1.36 (95% CI 1.22-1.51; P=0.00)]. These results confirm those of Liu *et al.* [34] (OR = 1.77, 95%CI 1.50-2.05), who reported similar effects on young women. However, this work contradicts the results of Zhou *et al.* [35], who concluded that cervical cancer is not linked to the number of sexual partners in China. This association could be explained by the fact that women with many sexual partners are also more likely to adopt other risky behaviors, such as unprotected intercourse, thereby increasing the risk of HPV infections. Given that HPV is the leading risk factor for this type of cancer and that it is transmitted mainly by sexual contact, a high number of sexual partners exposes women to an increased risk of repeated or persistent infection [34]. This prolonged exposure to the virus can lead to precancerous lesions on the cervix, increasing the likelihood of progression to cancer.

The study also revealed that women who had their first sexual intercourse before the age of 16 had a significantly higher risk of developing cervical cancer [OR = 1.56, 95%CI, 1.33-1.58; P = 0.00)] compared to those who began sexual activity after the age of 16. These results confirm those of Mekonnen *et al.* [13] (OR = 2.95; 95%CI = 1.06 - 4.83), as well as those of Jiang *et al.* [36], who also reported similar effects in girls who had their first sexual intercourse before the age of 18. This increased risk can be explained, on the one hand, by the fact that women who have sex early are exposed for longer to HPV infections, particularly if these infections are not detected and treated at an early stage [37]. In addition, the cervix of young women under the age of 16 is biologically more vulnerable to infection due to its cellular immaturity, which can increase the risk of cervical dysplasia [38,39]. This dysplasia can eventually develop into cervical cancer if it is not treated at a sufficiently early stage.

The weak association observed between Pap testing and the risk of cervical cancer highlights the crucial importance of screening and vaccination programs. HPV vaccination, combined with regular screening, can significantly reduce the risk of developing cervical cancer, even in women who have had their first sexual intercourse at an early age [26].

Limitations

However, the studies included in this analysis, which focused mainly on populations in the economically more stable provinces of Gauteng (Johannesburg) and the Western Cape (Cape Town), present a significant limitation. Although these results are relevant, it is difficult to generalize them to the country, as risk factors can vary considerably from region to region, depending on access to healthcare, socioeconomic status, cancer screening programs, cultural practices, and people's level of education. The limited number of studies available and the incomplete geographical coverage of some areas of South Africa restrict the overall interpretation of the results. In addition, several potential biases may affect the conclusions of this analysis, particularly the recall biases frequently observed in case-control studies, where participants may have difficulties recalling past behaviors accurately, such as the number of sexual partners or age at first intercourse. In addition, the lack of detailed data on the duration of contraceptive use, the age of initiation, and the use of non-hormonal contraceptives limits the ability to fully assess the impact of these factors on the risk of cervical cancer.

Conclusion

The results of this study clearly show that the combined use of oral and injectable hormonal contraceptives, the number of sexual partners, as well as having sexual intercourse for the first time before the age of 16, are associated with an increased risk of cervical cancer. However, frequent Pap tests play a crucial role in preventing this cancer. These findings underline the need for combined prevention strategies, including sexual health education, HPV vaccination, and regular screening programs, to reduce the incidence of cervical cancer. Nevertheless, future research into the impact of the combined use of oral and injectable contraceptives is essential to better understand the underlying mechanisms and refine prevention strategies.

What is known about this topic

- *Cervical cancer is a leading cause of death among women in South Africa, with significant regional variation in risk factors;*
- *Existing systematic reviews primarily highlight the link between HPV infection and cervical cancer in the country;*
- *However, with sexuality no longer being a significant taboo among young people, many girls engage in sexual activity from an early age, often as early as primary school - this early initiation of sexual activity and associated habits could potentially increase the risk of developing cervical cancer.*

What this study adds

- *The combined use of injectable and oral hormonal contraceptives, early sexual initiation (before age 16), and a high number of sexual partners are strongly associated with an increased risk of cervical cancer in young South African women;*
- *The study highlights the inadequacy of national healthcare coverage regarding cervical cancer awareness, with efforts concentrated mainly in economically stable provinces (Gauteng and Western Cape), leaving other regions less informed and more vulnerable;*
- *To reduce the incidence of cervical cancer, the study emphasizes the importance of comprehensive prevention strategies, including sexual health education and regular screening programs, particularly through the Pap smear method, as well as HPV vaccination.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Eugene Jamot Ndebia and Gabriel Tchuente Kamsu conceived the idea, collected and analyzed the data, drafted the article, reviewed, revised, and agreed to the published version of the article.

Tables and figures

Table 1: summary of included studies on sexual behavior and cervical cancer risk in South Africa

Table 2: summary results of different types of contraceptives and cervical cancer risk

Table 3: summary results of the effect of first sexual intercourse and regular pap smears with cervical cancer risk

Figure 1: flow diagram for study selection

Figure 2: forest diagrams for the link between contraceptive use and cervical cancer

Figure 3: forest plots for the relationship between multiple sexual partners and cervical cancer in South Africa

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Table 1: summary of included studies on sexual behavior and cervical cancer risk in South Africa					
First Author's names (years)	**Type of Study**	**Data collection period**	**Location**	**Simple size**	**Sexual behavior parameters assessed**
International Collaboration of Epidemiological Studies of Cervical Cancer, (2007) [23]	Case-control studies	/	Johannesburg, Gauteng	16 573 cases 35509 controls	age at first intercourse, Number of sexual partners, oral contraceptive use
International Collaboration of Epidemiological Studies of Cervical Cancer, (2009) [24]	Case-control studies	/	Johannesburg, Gauteng	809 cases 738 controls	Number of sexual partners
Moodley et al. (2006)**10**	Case-control study	January 1998 to December 2001	Cape Town, Western Cape	486 cases 103 controls	Age of first sex; Use contraceptive; Number of sexual partners
Cooper et al. (2007) [25]	Case-control study	January 1998 to September 2001	Cape Town, Western Cape	524 cases 1541 controls	Age of first sex; hormonal contraceptives; Number of sexual partners
Hoffman et al. (2003) [26]	Case-control study	/	Cape Town, Western Cape	524 Cases 1540 controls	Injectable and Oral Contraceptive Use; Pap smears
Shapiro et al. (2003) [9]	Case-control study	January 1998 to December 2001	Cape Town, Western Cape	524 cases 1541 controls	Age of first sexual intercourse, Contraceptive Use; number of sexual partners, number of previous Pap smears
Urban et al. (2012) [27]	Case-control study	8 March 1995 to 31 December 2006	Johannesburg, Gauteng	1,492 controls 2,182 cases	Injectable and oral contraceptive; time since last use
Plummer et al. (2011) [28]	Case-control study	/		5,074 cases 16,137 controls	First sexual intercourse
Singini et al. (2021) [11]	Case-control study	Between 1995 and 2016	Johannesburg, Gauteng	3,450 cases 5,709 Controls	Hormonal contraceptive use; Number of sexual partners
Singini et al. (2022) [29]	Case-control study	Between 1995 and 2016	Johannesburg, Gauteng	1346 cases 2532 controls	Number of sexual partners

Table 2: summary results of different types of contraceptives and cervical cancer risk			
Types of contraceptives	**OR [95% CI]**	**Heterogeneity (I2)**	**P value**
Oral contraceptive use	0.96 [0.69-1.34]	86.87%	0.81
Injectable contraceptive use	1.25 [0.76-2.06]	95.40%	0.037
Oral & Injectable contraceptive use	1.37 [1.19-1.58]	0.00%	0.00

Table 3: summary results of the effect of first sexual intercourse and regular pap smears with cervical cancer risk		
Parameter	**Effects (OR with [95%CI])**	**P-value**
First sexual intercourse <16 years old	1.56 [1.33-1.83]	0.00
Number of previous Pap smears	0.37 [0.32-0.43]	0.93

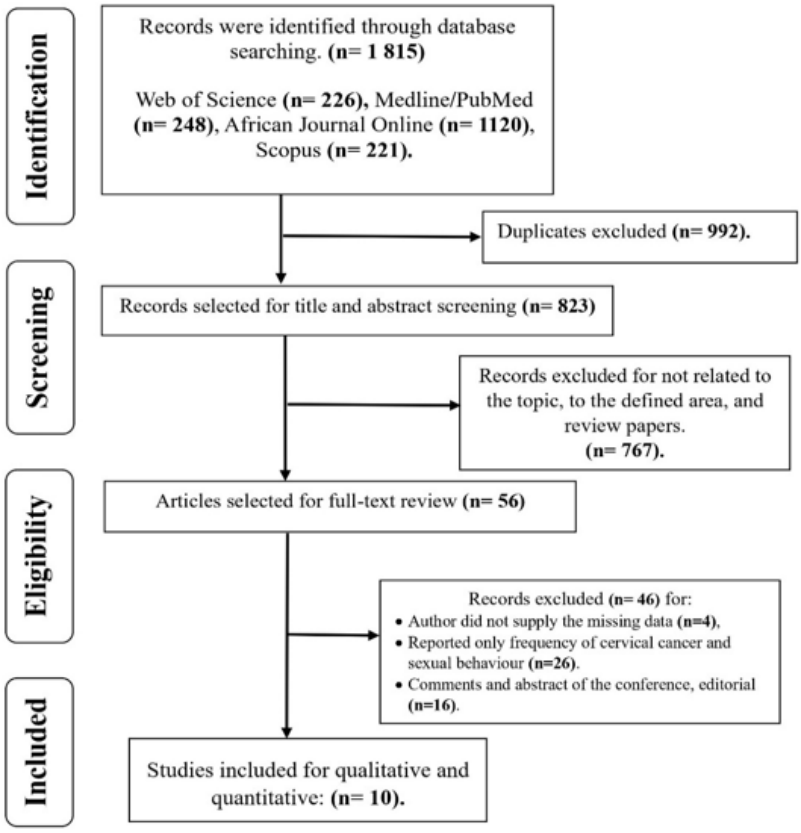

Figure 1: flow diagram for study selection

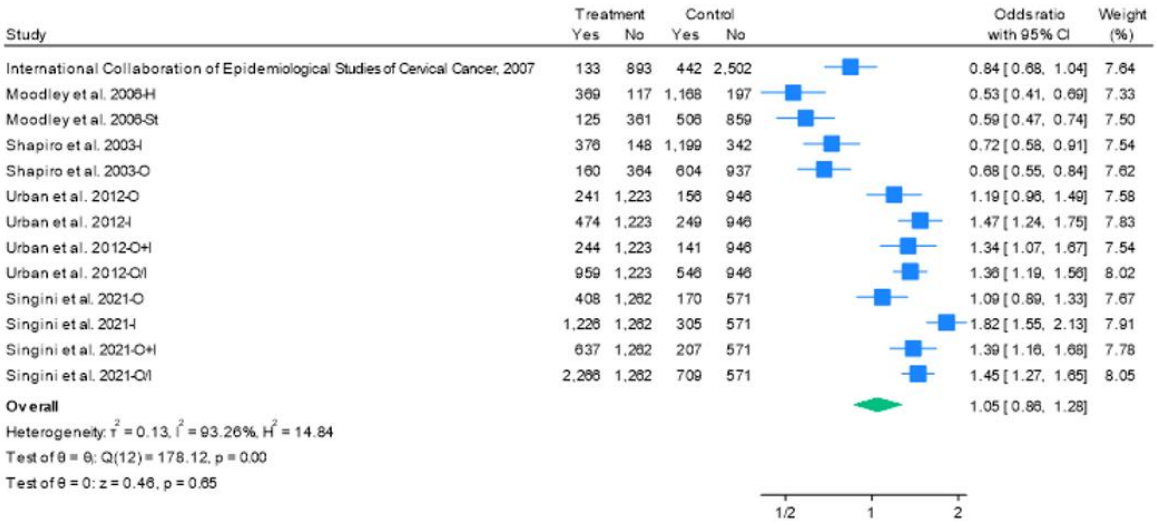

Figure 2: forest diagrams for the link between contraceptive use and cervical cancer

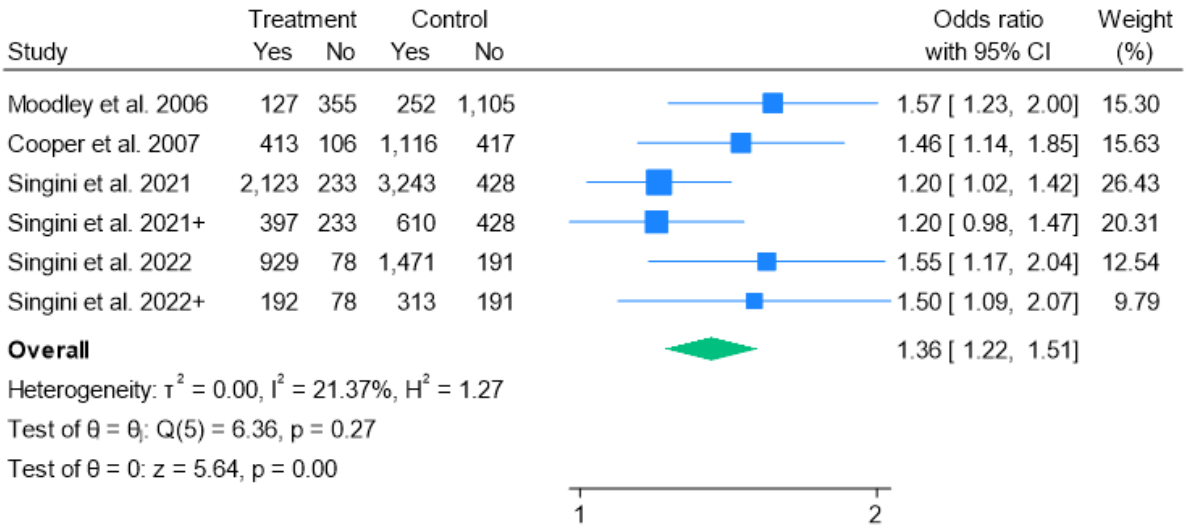

Figure 3: forest plots for the relationship between multiple sexual partners and cervical cancer in South Africa