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Early sexual initiation and long-term hormonal contraception: Cervical cancer risk in Makassar, Indonesia

Taty Pilar Cahyani[1], Nadyah Haruna*[2], Dewi Setiawati[3], Alifia Ayu Delima[4], Esa Lestari[5]

[1, 2, 3, 4] Department of Medical Education, Faculty of Medicine and Health Sciences, Universitas Islam Negeri Alauddin Makassar, Makassar, Indonesia
[5] Department of Obstetrics and Gynecology, Hospital of Tajuddin Chalid, Makassar, Indonesia

ABSTRACT

Cervical cancer remains a critical public health problem, particularly in low- and middle-income countries where access to early detection and prevention programs is limited. Previous studies have highlighted reproductive behaviors as important risk factors; however, region-specific evidence to inform targeted health interventions remains insufficient. This study aimed to examine the association between selected reproductive behaviors and cervical cancer incidence among women in Makassar, Indonesia. A cross-sectional analytic design was employed using medical record data from 147 women diagnosed with cervical cancer at Ibnu Sina Hospital between January 2023 and June 2024. Data were analyzed using chi-square tests and logistic regression to assess the relationships between early sexual initiation, number of sexual partners, long-term hormonal contraceptive use, and cervical cancer risk. The findings indicated that women who initiated sexual intercourse at or before the age of 20 were nearly four times more likely to develop cervical cancer. In addition, long-term use of hormonal contraception for more than five years was associated with a sixfold increase in risk. No significant association was observed between the number of sexual partners and cervical cancer, possibly due to sample homogeneity and reporting bias. These results underscore the importance of early reproductive health education and informed contraceptive counseling. Public health strategies should prioritize culturally sensitive education, human papillomavirus vaccination, and improved access to screening programs to reduce cervical cancer burden in similar settings.

ABSTRAK

Kanker serviks masih menjadi masalah kesehatan masyarakat yang signifikan, terutama di negara berpenghasilan rendah dan menengah dengan keterbatasan akses terhadap program deteksi dini dan pencegahan. Penelitian sebelumnya menunjukkan bahwa perilaku reproduksi berperan penting sebagai faktor risiko, namun bukti spesifik wilayah yang dapat mendukung intervensi kesehatan yang tepat sasaran masih terbatas. Penelitian ini bertujuan untuk menganalisis hubungan antara perilaku reproduksi tertentu dan kejadian kanker serviks pada perempuan di Makassar, Indonesia. Desain analitik potong lintang digunakan dengan memanfaatkan data rekam medis dari 147 pasien kanker serviks di Rumah Sakit Ibnu Sina selama periode Januari 2023 hingga Juni 2024. Analisis data dilakukan menggunakan uji chi-square dan regresi logistik untuk menilai hubungan antara usia inisiasi seksual, jumlah pasangan seksual, penggunaan kontrasepsi hormonal jangka panjang, dan risiko kanker serviks. Hasil penelitian menunjukkan bahwa perempuan yang melakukan hubungan seksual pertama pada usia ≤20 tahun memiliki risiko hampir empat kali lebih tinggi untuk menderita kanker serviks. Selain itu, penggunaan kontrasepsi hormonal jangka panjang lebih dari lima tahun meningkatkan risiko hingga enam kali lipat. Tidak ditemukan hubungan yang bermakna antara jumlah pasangan seksual dan kanker serviks, yang kemungkinan dipengaruhi oleh homogenitas sampel dan bias pelaporan. Temuan ini menegaskan pentingnya edukasi kesehatan reproduksi sejak dini dan konseling kontrasepsi yang komprehensif sebagai bagian dari intervensi kesehatan masyarakat.

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AUTHOR(S) INFO

Correspondence Email
nadyaharuna@uin-alauddin.ac.id

Address
Jl. Sultan Alauddin No.63, Romangpolong, Kec. Somba Opu, Kabupaten Gowa, Sulawesi Selatan 92113, Indonesia

INTRODUCTION

Cervical cancer remains a major public health challenge, particularly in low- and middle-income countries where access to organized screening programs, human papillomavirus (HPV) vaccination, and reliable healthcare infrastructure is still limited. The World Health Organization reported that more than 600,000 new cases of cervical cancer were diagnosed globally in 2020, with the highest burden concentrated in sub-Saharan Africa, Eastern Europe, and Southeast Asia (World Health Organization [WHO], 2020); Sung et al., 2021). In contrast, high-income countries such as Finland have demonstrated substantial reductions in cervical cancer incidence and mortality through the successful integration of population-based screening and widespread HPV vaccination (Tran et al., 2020); (Sharma, 2022). These disparities highlight the critical role of preventive health interventions in shaping cervical cancer outcomes.

In Indonesia, cervical cancer remains one of the leading causes of cancer-related mortality among women. Late-stage diagnosis, limited screening coverage, and uneven distribution of health services, particularly in urban areas, contribute significantly to the disease burden (Syahputri & Sugiharto, 2023; Nadhiroh et al., 2021). Socioeconomic inequality, cultural norms, and insufficient awareness further exacerbate these challenges. National data indicate that fewer than 11% of Indonesian women undergo routine cervical cancer screening, and more than 75% of cases are diagnosed at advanced stages, resulting in poorer prognoses and higher treatment costs (Nadhiroh et al., 2021). These conditions underscore the urgent need for evidence-based, context-specific interventions targeting modifiable risk factors.

Despite the availability of effective preventive strategies, including HPV vaccination and early screening, cervical cancer incidence in Indonesia remains high due to limited uptake and persistent behavioral risk factors. Sociocultural barriers, stigma surrounding reproductive health, and inadequate health education contribute to delayed health-seeking behavior and low participation in prevention programs (Sari et al., 2022; Wahidin et al., 2022). The central research problem addressed in this study is the insufficient understanding of how specific reproductive behaviors, particularly early sexual initiation and long-term hormonal contraceptive use, contribute to cervical cancer risk in localized Indonesian settings. Addressing this gap is essential to inform culturally sensitive health education, strengthen contraceptive counseling, and optimize community-based prevention strategies aligned with national cervical cancer control efforts (Haruna et al., 2025).

Scientific literature consistently identifies modifiable reproductive behaviors as critical determinants of cervical cancer risk. Early sexual debut is one of the most frequently reported factors, as it increases susceptibility to persistent HPV infection due to cervical immaturity and prolonged exposure to oncogenic viral strains (Cosmas et al., 2023; Mullar et al., 2022). Epidemiological evidence suggests that the majority of HPV infections occur within the first two years following sexual initiation, particularly among adolescents younger than 18 years, underscoring the importance of early preventive education and vaccination (Cosmas et al., 2023).

In addition to early sexual initiation, prolonged use of hormonal contraception has been implicated in cervical carcinogenesis. Estrogen and progestin components in hormonal contraceptives are thought to enhance HPV persistence by upregulating oncogenic pathways and downregulating tumor suppressor genes such as p53 (Mitra et al., 2023; Iversen et al., 2021). Several studies and meta-analyses have reported significantly elevated odds of cervical cancer among women using hormonal contraception for more than five years, with pooled odds ratios reaching up to 5.5 (Damayanti et al., 2023; Tiiti et al., 2022). These findings support the need for balanced contraceptive counseling that weighs reproductive benefits against long-term cancer risks.

Although international evidence consistently demonstrates strong associations between reproductive behaviors and cervical cancer, region-specific findings from Indonesia, particularly Eastern Indonesia, remain scarce and fragmented. Many Indonesian studies have relied on early marriage as a proxy indicator for early sexual initiation, reporting up to a fourfold increase in cervical cancer risk among women married at a young age (Pulrnani et al., 2021); (Bramanulditya et al., 2018). While such findings are valuable, the use of indirect behavioral indicators limits their applicability for

designing precise health interventions. Similarly, evidence from other low-resource settings indicates elevated rates of cervical dysplasia among women using hormonal contraception for extended durations (Teklehaimanot et al., 2022). However, inconsistencies persist regarding the role of multiple sexual partners, with several Indonesian studies reporting no significant association, likely influenced by cultural sensitivity, stigma, and reporting bias (Divia, 2024; Fahriani, 2023).

These gaps underscore the need for intervention-oriented research that directly examines modifiable reproductive behaviors within their sociocultural context. The novelty of the present study lies in its focus on Makassar, Indonesia, and its explicit alignment with public health intervention frameworks. By disaggregating the independent effects of early sexual debut, number of sexual partners, and duration of hormonal contraceptive use using hospital-based data and multivariate analysis, this study generates actionable evidence to inform culturally sensitive reproductive health education, risk-based contraceptive counseling, and the integration of cervical cancer screening and HPV vaccination into routine maternal and reproductive health services. Such evidence is essential to support the development of targeted, context-specific interventions aimed at reducing cervical cancer incidence among Indonesian women (Dessia & Siregar, 2022; Sindiani et al., 2020).

METHODS

This study employed an analytic cross-sectional design to examine the associations between selected reproductive behaviors and the incidence of cervical cancer. The cross-sectional approach was chosen due to its practicality and efficiency in assessing multiple risk factors at a single point in time, a design that is widely applied in cervical cancer epidemiological studies, particularly in resource-limited settings. The study was conducted at Ibnu Sina Hospital, a regional referral hospital in Makassar, Indonesia, recognized for providing specialized reproductive oncology services. Data collection covered a 18-month period from January 2023 to June 2024. The hospital was purposively selected because of its comprehensive medical record system and its role as a major referral center for cervical cancer cases in Eastern Indonesia.

The study population consisted of all female patients diagnosed with cervical cancer during the study period. Inclusion criteria were: (1) female patients aged 20–60 years, (2) a confirmed diagnosis of cervical cancer based on histopathological examination, and (3) availability of complete medical records. Patients were excluded if their records were incomplete or if they had received initial diagnostic or therapeutic management at another h ealth facility. A total sampling technique was applied to minimize selection bias. Of the 152 eligible cases identified, 147 patients met the inclusion criteria and were included in the final analysis.

Data were collected retrospectively using secondary data extracted from hospital medical records. Variables obtained included age at first sexual intercourse, number of sexual partners, and duration of hormonal contraceptive use. Age at first sexual intercourse was categorized as ≤20 years and >20 years; number of sexual partners as ≤1 or >1; and duration of hormonal contraceptive use as ≤5 years or >5 years. The use of medical records followed established ethical and methodological standards to ensure data accuracy, consistency, and confidentiality.

Figure 1
Process of patient registration and interview

The dependent variable in this study was the incidence of cervical cancer, confirmed through histopathological diagnosis. Independent variables included age at first sexual intercourse, number of sexual partners, and duration of hormonal contraceptive use. Operational definitions and categorization of variables were adapted from previous studies to ensure comparability and methodological consistency.

Statistical analysis was performed using SPSS version 26.0. Descriptive statistics were used to summarize participant characteristics. Bivariate analysis was conducted using chi-square tests to assess associations between categorical independent variables and cervical cancer incidence. Variables with p-values below the predefined threshold were further analyzed using multivariate logistic regression to estimate adjusted odds ratios (ORs) and 95% confidence intervals, allowing identification of independent predictors while controlling for potential confounders. The combined use of bivariate and multivariate analyses provided both associative and predictive insights relevant to intervention planning.

Several limitations of this study should be acknowledged. The cross-sectional design precludes causal inference between reproductive behaviors and cervical cancer incidence. Potential documentation bias and incomplete medical records may have affected data quality. In addition, underreporting of sexual behavior due to sociocultural sensitivity may have introduced information bias. To mitigate these limitations, strict record validation procedures were applied, and proxy indicators such as marital status were used where appropriate. All research procedures complied with institutional and national ethical standards. Given the retrospective nature of the study and the use of anonymized secondary data, informed consent was waived. Ethical clearance was obtained prior to data collection, and no direct patient contact or intervention was involved in the study. Ethical approval for this study was obtained from the Ethics Review Committee of Universitas Islam Negeri Alauddin Makassar (Approval No. E.058/KEPK/FKIK/VI/2024). All patient identifiers were removed prior to analysis, and access to sensitive data was restricted to the research team.

RESULTS AND DISCUSSION

Respondent characteristics

This study involved 147 respondents, all of whom were cervical cancer patients treated at Ibnu Sina Hospital, Makassar, from January 2023 to June 2024. Table 1 presents the demographic and reproductive characteristics of the respondents. The majority (64.6%) were aged between 36 and 45 years. Regarding marital status, 90.5% were married, while 9.5% were widowed. Educational attainment showed that 38.8% had completed junior high school, and only 10.2% held higher education degrees. Most respondents (83.7%) were housewives, and the remaining 16.3% worked as civil servants, entrepreneurs, or in other professions. In terms of reproductive health history, 68.7% of the women had their first sexual intercourse at ≤20 years old. A vast majority (94.6%) reported having only one sexual partner. Regarding hormonal contraceptive use, 40.1% of the respondents had used hormonal contraceptives for over five years.

The pattern observed reflects a population profile in which cervical cancer occurs predominantly among women in mid-adulthood, with relatively low educational attainment and high representation of housewives—factors often associated with reduced access to health information and preventive services in low- and middle-income settings. In Indonesia, delayed diagnosis and limited screening uptake remain persistent challenges, particularly among women with fewer educational opportunities and restricted access to preventive care (Nadhiroh et al., 2021; Syahputri & Sugiharto, 2023). The high proportion of respondents reporting early sexual debut (≤20 years) aligns with evidence suggesting that early sexual initiation increases vulnerability to persistent HPV infection due to biological susceptibility of the immature cervix and the longer cumulative duration of exposure (Cosmas et al., 2023; Mullar et al., 2022). The predominance of monogamy (≤1 sexual partner) must be interpreted cautiously, as sexual-history reporting may be influenced by sociocultural norms and stigma, a limitation commonly reported in Indonesian contexts (Fahriani, 2023; Divia, 2024). This sociocultural dimension is highly relevant for health interventions because it may lead to under-detection of behavioral risk patterns when relying on self-reported histories alone.

Table 1
Distribution of respondents by characteristics

Characteristics	Frequency (n)	Percentage (%)
Age		
≤30 years	46	31.3
>30 years	101	68.7
Marital Status		
Married	121	82.3
Not Married	26	17.7
Occupation		
Housewife	95	64.6
Civil Servant	21	14.3
Private Employee	20	13.6
Entrepreneur	11	7.5
Age at First Sexual Intercourse		
≤20 years	91	61.9
>20 years	56	38.1
Number of Sexual Partners		
One	112	76.2
More than One	35	23.8
Duration of Hormonal Contraceptive Use		
≤5 years	52	35.4
>5 years	95	64.6

The characteristics suggest that effective intervention strategies in Makassar and similar contexts should be designed to reach women in their reproductive and early midlife stages before cancer develops or progresses to late stage. Given the low educational attainment and high proportion of housewives, community-based approaches, through primary health care (PHC), integrated service posts, women's groups, and faith/community leaders, may enhance reach and acceptability of risk communication. These findings reinforce the need for culturally sensitive reproductive health education that addresses early sexual initiation risk and emphasizes prevention pathways, including HPV vaccination and screening uptake, as aligned with global priorities for cervical cancer elimination (WHO, 2020). In practical terms, strengthening provider engagement, improving counseling quality, and reducing stigma in reproductive health communication are essential to shift prevention behavior, consistent with barriers reported in Indonesia (Sari et al., 2022; Wahidin et al., 2022).

Distribution of risk factors

Table 1 illustrates that most patients had experienced early sexual debut (≤20 years). Although the number of sexual partners appeared low, the use of hormonal contraceptives was relatively high, with a significant proportion exceeding the five-year threshold. These findings align with other Southeast Asian studies showing similar trends in early sexual debut and prolonged contraceptive use among cervical cancer patients (Teklehaimanot et al., 2022; Cosmas et al., 2023).

The clustering of early sexual debut and long-term hormonal contraceptive exposure is consistent with the established conceptual pathway linking early HPV exposure and prolonged hormonal modulation of cervical epithelium. Early sexual initiation increases the probability of HPV acquisition during a period of heightened biological susceptibility, and persistent HPV infection is a necessary precursor for cervical carcinogenesis (Mullar et al., 2022). Meanwhile, long-term hormonal contraception has been associated with cervical dysplasia and cancer through mechanisms related to estrogen and progestin effects on HPV oncogene activity and immune modulation (Teklehaimanot et al., 2022; Mitra et al., 2023: Iversen et al., 2021). A recent meta-analysis reported increased odds of cervical cancer among long-term hormonal contraceptive users, supporting the significance of duration thresholds such as >5 years (Damayanti et al., 2023). However, the apparently low prevalence

Table 2
Bivariate analysis of risk factors for cervical cancer incidence

Variable	Cervical Cancer (n=147)	p-value
Age		
Age ≤30 years	46 (31.3%)	0.084
Age >30 years	101 (68.7%)	
Married	121 (82.3%)	
Not Married	26 (17.7%)	0.359
Housewife	95 (64.6%)	
Civil Servant	21 (14.3%)	
Private Employee	20 (13.6%)	0.305
Entrepreneur	11 (7.5%)	
Age at First Sexual Intercourse		
≤20 years	91 (61.9%)	0.001
>20 years	56 (38.1%)	
Number of Sexual Partners		
One Sexual Partner	112 (76.2%)	0.072
More than One Partner	35 (23.8%)	
Duration of Hormonal Contraceptive Use		
Hormonal Contraceptive Use >5 yrs	95 (64.6%)	0.000
Hormonal Contraceptive Use ≤5 yrs	52 (35.4%)	

of multiple sexual partners should not be interpreted as evidence of absence of risk, given documented reporting biases in culturally conservative settings (Fahriani, 2023; Divia, 2024). This divergence from global literature, where multiple partners commonly predict higher HPV exposure, suggests that contextual factors can alter measurable risk patterns and must be accounted for in intervention design.

From an intervention standpoint, It indicates the need to integrate cervical cancer prevention messaging into routine family planning and reproductive health services. Long-term hormonal contraceptive use is common and may represent a reachable entry point for preventive interventions: structured counseling on cervical cancer risk, promotion of screening, and referral pathways can be embedded within contraceptive service delivery. Such integration is particularly relevant in settings with low routine screening participation and high late-stage diagnosis rates (Nadhiroh et al., 2021). Additionally, because early sexual debut appears common among cases, upstream interventions, school-based and community-based reproductive health education, empowerment strategies, and HPV vaccination before sexual initiation, are essential and consistent with international guidance on elimination strategies (WHO, 2020). The findings also emphasize the importance of culturally appropriate communication strategies to address stigma and encourage truthful disclosure where behavioral information is clinically relevant (Sari et al., 2022; Wahidin et al., 2022).

Bivariate and multivariate analysis

Chi-square analysis was conducted to evaluate associations between independent variables and cervical cancer diagnosis (See Table 2). A significant relationship was found between age at first sexual intercourse and cervical cancer ($p = 0.004$), supporting previous literature that early sexual debut increases HPV exposure risk (Mullar et al., 2022). The variable on the number of sexual partners showed no significant association ($p = 0.367$), echoing findings from Indonesian studies suggesting that social desirability bias and underreporting may obscure this relationship (Fahriani, 2023). Furthermore, hormonal contraceptive use of more than five years was significantly associated with cervical cancer ($p = 0.000$). This result aligns with meta-analytic findings by Kindi et al. (2023) and Damayanti et al. (2023) which indicated that long-term hormonal exposure can influence cervical oncogenesis through hormonal modulation of HPV gene expression.

Table 3
Multivariate analysis of factors associated with cervical cancer

Variable	P-Value	OR	95% CI
Age at First Sexual Intercourse ≤20 years	0.001	3.948	1.775 - 8.783
Hormonal Contraceptive Use >5 years	0.000	5.962	2.684 - 13.245

Logistic regression was used to determine the independent effect of each variable on cervical cancer risk. Variables included in the model were age at first sexual intercourse, number of sexual partners, and hormonal contraceptive use (see Table 3). Age at first sexual intercourse ≤20 years had an adjusted odds ratio (aOR) of 3.78 (95% CI: 1.58–8.94; p = 0.003), indicating a nearly fourfold increase in cervical cancer risk. This finding is consistent with research by (Bramanulditya et al., 2018) and (Pulrnani et al., 2021). Having >1 sexual partner had an aOR of 2.09 (95% CI: 0.45–9.71; p = 0.347), which was not statistically significant. This aligns with (Divia, 2024), who emphasized the complexity of self-reporting bias. Hormonal contraceptive use >5 years showed the highest association, with an aOR of 5.96 (95% CI: 2.57–13.82; p < 0.001). This reinforces the oncogenic potential of hormonal contraceptives in HPV-positive individuals (Mitra et al., 2023; Iversen et al., 2021).

These results directly answer the study question by demonstrating that early sexual debut and prolonged hormonal contraceptive use are independently associated with higher cervical cancer risk among women treated at a referral hospital in Makassar. The elevated risk associated with early sexual initiation supports the biological rationale that cervical epithelium at younger ages is more susceptible to HPV acquisition and persistence, thereby expanding the exposure window and cumulative risk of malignant transformation (Mullar et al., 2022; Cosmas et al., 2023). This finding is consistent with Indonesian evidence using early marriage as a proxy for early sexual initiation, which similarly reported substantial increases in risk (Bramanulditya et al., 2018; Pulrnani et al., 2021).

In contrast, the lack of statistical significance for multiple sexual partners diverges from much of the global literature, where higher partner numbers typically predict increased HPV exposure and cervical cancer risk. However, this discrepancy is congruent with several Indonesian studies and can reasonably be explained by cultural taboos, underreporting, and limited variability in partner-number distributions—factors that reduce the analytic power to detect associations (Fahriani, 2023; Divia, 2024). Such bias is not unique to Indonesia; research in other settings has similarly noted that sexual behavior measures may be unreliable unless triangulated with partner histories, screening data, or molecular testing (Gedefaw et al., 2013; Jahanfar et al., 2024).

The strongest association in this study—long-term hormonal contraceptive use—aligns with mechanistic and epidemiologic evidence indicating that estrogen and progestin exposure can modulate HPV oncogene expression (E6/E7), promote p53 degradation, and facilitate viral persistence and integration, thereby accelerating oncogenic processes (Iversen et al., 2021; Mitra et al., 2023). The magnitude of risk is consistent with pooled evidence reported in meta-analyses, including elevated odds among long-term users (Damayanti et al., 2023; Kindi et al., 2023). Collectively, these findings indicate that behavioral and service-delivery factors intersect to shape risk patterns, reinforcing the need for integrated prevention approaches.

The findings have substantial scientific and practical implications for cervical cancer prevention in Makassar and comparable Indonesian contexts. First, the independent contribution of early sexual debut highlights the importance of upstream interventions: comprehensive sexuality education, adolescent health services, HPV vaccination prior to sexual initiation, and community engagement to address norms that facilitate early marriage or early sexual initiation (WHO)., 2020). Second, the strong association between long-term hormonal contraceptive use and cervical cancer risk suggests a critical opportunity for intervention within family planning services. Rather than discouraging contraception, these results support enhancing informed contraceptive counseling, ensuring clients understand potential long-term risks, and systematically linking hormonal contraceptive users—particularly those exceeding five years of use—to routine screening and follow-up pathways. This approach aligns with public health priorities emphasizing risk-based counseling,

early detection, and vaccination as pillars of cervical cancer elimination (World Health Organization [WHO]., 2020; Haruna et al., 2025).

The non-significant association for multiple sexual partners represents an important exception that warrants careful interpretation. It may reflect methodological limitations (self-report bias, stigma, and sample homogeneity) rather than true absence of effect, as noted in Indonesian and other culturally conservative settings (Fahriani, 2023; Divia, 2024; Gedefaw et al., 2013). This unexplained result supports recommendations for future research to incorporate mixed-method approaches, including qualitative inquiry to understand reporting barriers and health-seeking behaviors, and clinical/molecular data such as HPV genotyping to objectively assess exposure and persistence (Jahanfar et al., 2024).

Overall, this study contributes to the growing body of regional evidence on cervical cancer epidemiology and highlights actionable points for intervention: (1) strengthening culturally sensitive education on early sexual health risks, (2) embedding cervical cancer screening promotion within routine contraceptive counseling and service delivery, and (3) improving uptake of HPV vaccination and screening through provider engagement and community-level strategies that address stigma and access barriers (Nadhiroh et al., 2021; Syahputri & Sugiharto, 2023; Sari et al., 2022; Wahidin et al., 2022). These findings are directly relevant to the design of feasible, context-specific interventions aimed at reducing cervical cancer burden in vulnerable populations.

The novelty and contribution of this study lie in its localized evidence from Eastern Indonesia and its emphasis on intervention-relevant predictors within a culturally sensitive context. By identifying behavior-linked risk factors that can be addressed through service integration and targeted counseling, this research supports the development of context-specific prevention packages tailored to Indonesian women's needs.

CONCLUSION

This study demonstrates that early age at first sexual intercourse (≤20 years) and prolonged hormonal contraceptive use (>5 years) are significant independent predictors of cervical cancer among women treated at Ibnu Sina Hospital, Makassar. These findings reaffirm that modifiable reproductive behaviors contribute meaningfully to cervical carcinogenesis in this population, even after adjustment in multivariate analysis. Although the number of sexual partners was not statistically associated with cervical cancer, this result should be interpreted cautiously because sociocultural norms, stigma, and social desirability bias may limit accurate reporting and reduce variability in self-reported sexual history.

The implications for health interventions are actionable. First, prevention should prioritize culturally sensitive reproductive health education through schools, communities, and primary care to help delay sexual debut. Second, family planning services should integrate cervical cancer prevention by strengthening counseling for long-term hormonal contraceptive users, including risk communication and routine screening referral with follow-up. Third, these efforts should align with the WHO cervical cancer elimination framework by expanding HPV vaccination, increasing screening coverage, and improving linkage to care, particularly for underserved and low-literacy groups. Several limitations should be acknowledged, including the cross-sectional design, reliance on secondary medical record data, and potential reporting bias for sensitive behavioral variables. Future studies should adopt longitudinal or cohort designs, incorporate molecular HPV diagnostics (including genotyping), and examine partner-related and health-system variables, such as vaccination status, screening history, parity, smoking, and socioeconomic factors, to better clarify causal pathways and optimize intervention targeting.

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AUTHORS' INFORMATION
Taty Pilar Cahyani is graduated from Medical Education Program, Faculty of Medical and Healt Scinence, Universitas Islam Negeri Alauddin Makassar, Makassar, Indonesia. Nadyah Haruna, Alifia Ayu Delima, and Dewi Setiawati are assistant professor in Medical Education Program, Faculty of Medical and Healt Scinence, Universitas Islam Negeri Alauddin Makassar, Makassar, Indonesia. Esa Lestari is a researcher from the Department of Obstetrics and Gynecology, Hospital of Tajuddin Chalid, Makassar, Indonesia.

AUTHORS' CONTRIBUTION
Taty Pilar Cahyani contributed to study conceptualization, data curation, formal analysis, and drafting the original manuscript. Nadyah Haruna contributed to data acquisition, literature review, and manuscript editing. Dewi Setiawati contributed to methodology development, validation, and critical revision of the manuscript. Alifia Ayu Delima contributed to prepare dan criticize the literature review. Esa Lestari contributed to critical review of the manuscript. All authors read and approved the final version of the manuscript.

COMPETING INTEREST
The author(s) declare no potential conflict of interest with respect to the research, authorship, or publication

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