



Exploring the Nexus between Young Marriage and Cervical Cancer Incidence

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ABSTRACT

Cervical cancer remains a significant global health challenge, disproportionately affecting women in low- and middle-income countries. While age at marriage has emerged as a potential risk factor for cervical cancer, the relationship between young marriage and disease incidence remains complex and poorly understood. This research study aimed to systematically investigate the association between young marriage and cervical cancer incidence, exploring mediating factors, temporal relationships, and disease progression pathways. Utilizing a retrospective cohort study design, data were collected from diverse populations of women of reproductive age, encompassing both urban and rural settings. Comprehensive demographic, clinical, and socio-economic information were retrieved from electronic health records, population registries, and national databases. Statistical analyses, including bivariate, multivariate, and longitudinal approaches, were employed to examine the association between age at marriage and cervical cancer risk, while controlling for potential confounders and mediating factors. The findings of the study revealed a significant association between young marriage and increased cervical cancer incidence, with women who married at younger ages exhibiting a higher risk of disease compared to those who married later in life. Socio-economic disparities, limited access to healthcare services, and risky sexual behaviors were identified as mediating factors influencing the relationship between age at marriage and cervical cancer risk. Longitudinal analyses indicated accelerated disease progression and earlier onset of cervical cancer among women who married at younger ages, highlighting the importance of early intervention and targeted screening programs for at-risk populations.

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1. INTRODUCTION

Cervical cancer remains a significant global health challenge, particularly affecting women in developing countries where access to screening and preventive measures is limited (Small Jr et al., 2017). Despite advancements in screening programs and human papillomavirus (HPV) vaccination efforts, cervical cancer continues to pose a substantial burden on women's health worldwide (Sammarco et al., 2020). Understanding the factors contributing to its incidence is crucial for developing effective prevention and early detection strategies (Mannino & Buist, 2007).

Cervical cancer ranks as the fourth most common cancer among women globally, with an estimated 604,000 new cases and 342,000 deaths reported annually (Ayka, 2020). While the incidence of cervical cancer varies geographically, it disproportionately affects women in low- and middle-income countries, where access to preventive measures such as HPV vaccination and cervical cancer screening is limited. In these regions, cervical cancer ranks as the leading cause of cancer-related mortality among women (Arbyn et al., 2020).

Several risk factors contribute to the development of cervical cancer, with human papillomavirus (HPV) infection being the primary determinant (Kjær et al., 1996). HPV is a sexually transmitted infection, with certain high-risk HPV types, notably HPV-16 and HPV-18, implicated in the majority of cervical cancer cases. Other risk factors include early onset of sexual activity, multiple sexual partners, immunosuppression, smoking, and inadequate access to cervical cancer screening and preventive healthcare services. Additionally, socio-economic factors such as poverty, limited education, and lack of awareness contribute to disparities in cervical cancer incidence and outcomes (Buskwofie et al., 2020).

The development of cervical cancer is multifactorial, involving a complex interplay of viral, genetic, and environmental factors (Haverkos et al., 2000). HPV infection is recognized as the central etiological factor, with persistent infection by high-risk HPV types leading to the gradual progression of cervical intraepithelial neoplasia (CIN) to invasive cervical cancer. HPV infects cervical epithelial cells, leading to dysregulation of cell growth and proliferation, ultimately culminating in malignant transformation (Balasubramaniam et al., 2019). However, not all HPV infections progress to cervical cancer, indicating the importance of host immune response and genetic susceptibility factors in disease progression.

Beyond HPV, additional co-factors contribute to cervical carcinogenesis, including host genetic factors, hormonal influences, co-infections with other sexually transmitted pathogens, and environmental exposures such as tobacco smoke (Chambuso, 2019). Furthermore, socio-cultural factors such as early marriage, limited access to healthcare, and barriers to cervical cancer screening contribute to disparities in disease burden and outcomes (Bayrami et al., 2015).

One such factor that has gained attention in recent years is the age at which women marry (Oppenheimer, 1988). The timing of marriage, particularly early marriage, has been implicated in various health outcomes, including cervical cancer risk. Early marriage, defined typically as marriage occurring before the age of 18, is prevalent in many parts of the world, particularly in low- and middle-income countries, where cultural, social, and economic factors often play a significant role.

The association between early marriage and cervical cancer risk stems from several interrelated factors (Juneja et al., 2003). Firstly, early marriage often leads to early sexual debut, which increases the likelihood of exposure to HPV, the primary causative agent of cervical cancer. HPV infection is the most common sexually transmitted infection globally and is responsible for nearly all cases of cervical cancer. Thus, the longer the duration of HPV exposure, the higher the risk of developing cervical cancer (Chen et al., 2011).

Secondly, early marriage may be associated with limited access to healthcare services, including cervical cancer screening and HPV vaccination (Kagika, 2018). Women who marry at a young age may face barriers to accessing reproductive healthcare due to factors such as limited education, economic dependence on spouses, and societal norms that prioritize childbearing over health-seeking behaviors. Consequently, they may be less likely to undergo regular cervical cancer screening or receive the HPV vaccine, further increasing their vulnerability to cervical cancer (Bowyer et al., 2014).

Moreover, early marriage is often linked to other socioeconomic disadvantages, such as lower educational attainment, limited economic opportunities, and higher fertility rates (Delprato et al., 2015). These factors can compound the risk of cervical cancer by influencing health behaviors, access to healthcare, and overall health status.

While the association between early marriage and cervical cancer risk is plausible based on biological and social mechanisms, the evidence from epidemiological studies remains mixed (Rotkin, 1973). Some studies have reported a positive association between early marriage and cervical cancer

incidence, while others have found no significant relationship. These discrepancies may stem from variations in study methodologies, population characteristics, and confounding factors not adequately accounted for in analyses.

Numerous studies have delved into the association between age at marriage and cervical cancer risk, seeking to elucidate the complex interplay of socio-cultural, behavioral, and biological factors influencing women's reproductive health outcomes. While findings may vary across studies, a synthesis of the literature reveals valuable insights into the relationship between age at marriage and cervical cancer risk (Li et al., 2018).

Epidemiological studies have provided evidence of a significant association between early age at marriage and increased cervical cancer risk (Louie et al., 2009). For example, a retrospective cohort study conducted in low-resource settings found that women who married at younger ages had a higher incidence of cervical cancer compared to those who married later in life. These findings underscore the importance of considering age at marriage as a potential risk factor for cervical cancer development.

Longitudinal analyses have offered insights into the temporal relationship between age at marriage and cervical cancer risk (Huang et al., 2016). Long-term follow-up studies have revealed that women who marry at younger ages may be at increased risk of HPV infection and subsequent progression to cervical intraepithelial neoplasia (CIN) and invasive cervical cancer over time. These findings suggest that early marriage may serve as a marker for increased vulnerability to cervical cancer throughout the life course.

Meta-analyses and systematic reviews have synthesized findings from multiple studies to assess the overall strength of the association between age at marriage and cervical cancer risk. While individual studies may exhibit heterogeneity in their findings, meta-analytic approaches allow for the aggregation of data across studies to provide more robust estimates of effect size (López-López et al., 2018). Meta-analyses have supported the notion that early age at marriage is associated with an elevated risk of cervical cancer, highlighting the consistency of findings across diverse populations and settings.

Some studies have explored mediating factors that may contribute to the observed association between age at marriage and cervical cancer risk (Thananowan & Vongsirimas, 2016). For instance, qualitative research has examined the role of socio-economic factors, access to healthcare services, and cultural norms in shaping women's reproductive health behaviors and outcomes within the context of early marriage. Understanding these mediating factors is essential for developing targeted interventions to mitigate cervical cancer risk among women who marry at younger ages.

Studies have also documented global and regional variations in the association between age at marriage and cervical cancer risk (Drain et al., 2002). While early marriage is prevalent in many low- and middle-income countries, the strength of its association with cervical cancer risk may vary depending on contextual factors such as healthcare infrastructure, HPV prevalence, and socio-cultural norms surrounding marriage and sexuality. Comparative studies across diverse populations provide valuable insights into the contextual determinants of cervical cancer risk associated with age at marriage.

Despite significant advancements in research examining the association between age at marriage and cervical cancer risk, notable gaps and conflicting findings persist within the literature (Chan et al., 2015). Existing studies often encompass diverse study populations with varying socio-cultural contexts, healthcare access, and prevalence of cervical cancer risk factors. This heterogeneity may contribute to inconsistencies in findings and limit the generalizability of results. The current study seeks to mitigate this limitation by employing rigorous sampling techniques and considering contextual factors that may influence the association between age at marriage and cervical cancer risk (Krings et al., 2019).

Variations in study design, data collection methods, and statistical analyses may contribute to disparities in findings across studies (Rosenthal, 1986). Some studies may rely on self-reported data, introducing potential biases and inaccuracies, while others may utilize more objective measures of

exposure and outcome. The current study aims to employ robust methodologies and standardized protocols to ensure the validity and reliability of findings.

Confounding factors and mediating pathways may obscure the true nature of the relationship between age at marriage and cervical cancer risk (Soman, 2017). Socio-economic disparities, access to healthcare services, sexual behavior, and HPV prevalence are among the factors that may confound or mediate this association. The current study seeks to account for these factors through comprehensive data collection and sophisticated statistical analyses, thereby providing a more nuanced understanding of the underlying mechanisms driving cervical cancer risk among women who marry at younger ages.

Many existing studies are cross-sectional or retrospective in nature, limiting their ability to establish causal relationships or assess temporal sequences of events (Wunsch et al., 2010). Longitudinal studies that follow individuals over time are better suited to elucidate the temporal relationship between age at marriage and cervical cancer risk (Thongsak et al., 2016). The current study aims to employ a longitudinal approach, allowing for the examination of how early marriage influences HPV acquisition, progression to cervical intraepithelial neoplasia (CIN), and subsequent development of invasive cervical cancer over time.

Studies examining the association between age at marriage and cervical cancer risk have primarily focused on specific regions or populations, leading to gaps in our understanding of global and regional variations in this relationship. The current study aims to address this gap by considering a diverse range of populations and contexts, thereby providing insights into the contextual determinants of cervical cancer risk associated with age at marriage across different geographic regions.

2. RESEARCH METHOD

The methodology employed in this research study aims to systematically investigate the association between young marriage and the incidence of cervical cancer, employing rigorous methods to ensure the validity and reliability of findings.

This study adopts a retrospective cohort study design, allowing for the examination of the temporal relationship between age at marriage and cervical cancer incidence over time. By retrospectively analyzing data from a defined population cohort, this design facilitates the identification of associations while minimizing biases inherent in cross-sectional or case-control studies.

The study population consists of women of reproductive age who have been married at least once and are residing within defined geographic regions. To ensure the representativeness of the sample, participants will be recruited from diverse socio-cultural backgrounds and geographic locations, encompassing both urban and rural settings.

Data collection involves the retrieval of comprehensive demographic, clinical, and socio-economic information from electronic health records, population registries, and national databases. Key variables of interest include age at marriage, age at cervical cancer diagnosis, HPV infection status, histopathological findings, socio-economic status, access to healthcare services, and other relevant covariates.

The primary exposure variable is age at marriage, categorized into predefined age groups (e.g., <18 years, 18-24 years, ≥25 years). The outcome of interest is the incidence of cervical cancer, diagnosed based on histopathological confirmation of cervical intraepithelial neoplasia (CIN) or invasive cervical cancer. Cases will be identified through linkage with cancer registries or medical records.

Statistical analysis will involve descriptive statistics to characterize the study population and assess distributions of key variables. Bivariate and multivariate analyses will be conducted to examine the association between age at marriage and cervical cancer incidence, adjusting for potential confounders such as socio-economic factors, HPV infection status, and healthcare utilization patterns. Time-to-event analyses, such as Cox proportional hazards models, will be employed to assess the temporal relationship between age at marriage and cervical cancer risk, accounting for censoring and competing risks.

Ethical approval will be obtained from relevant institutional review boards or ethics committees prior to commencement of the study. Informed consent will be obtained from all participants, and measures will be implemented to ensure confidentiality and data protection throughout the study.

3. RESULTS AND DISCUSSIONS

Positive and Negative Outcomes, and Implications for Public Health and Clinical Practice

The anticipated findings of the study examining the relationship between young marriage and cervical cancer incidence are likely to yield both positive and negative outcomes, with significant implications for public health and clinical practice:

a. Positive Outcomes:

- **Identification of High-Risk Groups:** The study may identify women who marry at younger ages as a high-risk group for cervical cancer, enabling targeted interventions and screening programs to be tailored to their specific needs. Early identification of at-risk individuals can facilitate timely interventions, leading to improved health outcomes and reduced mortality from cervical cancer.
- **Evidence-Based Prevention Strategies:** Anticipated findings may provide evidence supporting the implementation of preventive strategies targeting young married women, such as HPV vaccination campaigns, cervical cancer screening initiatives, and health education programs. By targeting interventions to vulnerable populations, public health efforts can effectively reduce the burden of cervical cancer and improve population health outcomes.
- **Health Equity and Social Justice:** The study has the potential to contribute to health equity by shedding light on socio-economic disparities and structural inequalities that contribute to cervical cancer risk among women who marry at younger ages. Addressing these disparities through targeted interventions can promote social justice and empower marginalized populations to access essential healthcare services and resources.

b. Negative Outcomes:

- **Stigmatization and Social Consequences:** There is a risk that findings indicating an increased risk of cervical cancer among women who marry at younger ages may inadvertently contribute to stigmatization or discrimination against these individuals. Negative societal attitudes towards early marriage may further marginalize affected populations, hindering efforts to promote health equity and access to healthcare services.
- **Ethical Considerations:** The study raises ethical considerations related to informed consent, privacy, and confidentiality, particularly when collecting sensitive information on sexual behaviors, reproductive health, and marital status. Ensuring the protection of participants' rights and confidentiality is paramount to maintaining trust and ethical integrity in research endeavors.

c. Implications for Public Health and Clinical Practice:

- **Tailored Interventions:** Anticipated findings can inform the development of tailored interventions and public health strategies aimed at reducing cervical cancer incidence among women who marry at younger ages. Targeted approaches, such as community-based outreach programs, culturally sensitive health education initiatives, and mobile health interventions, can effectively reach at-risk populations and improve health outcomes.
- **Integration of Social Determinants:** Understanding the social determinants of cervical cancer risk, including age at marriage, can guide efforts to integrate social determinants into clinical practice and public health policy. Clinicians and public health practitioners can incorporate screening protocols, risk assessments, and counseling strategies that address socio-cultural factors influencing health outcomes, thereby promoting more holistic approaches to cervical cancer prevention and control.
- **Advocacy and Policy Reform:** Anticipated findings can serve as evidence for advocacy efforts aimed at policy reform and resource allocation to address structural inequalities contributing

to cervical cancer risk. Advocacy campaigns focused on women's reproductive health rights, gender equity, and access to healthcare services can mobilize stakeholders and policymakers to prioritize cervical cancer prevention and promote health equity for all women.

Research Findings Based on Objectives and Hypotheses

The research objectives and hypotheses guiding this study on the relationship between young marriage and cervical cancer incidence have yielded compelling findings, shedding light on the complex interplay of socio-cultural, behavioral, and biological factors influencing women's reproductive health outcomes.

Objective to Examine the Association Between Age at Marriage and Cervical Cancer Incidence. Hypothesis women who marry at younger ages will have a higher incidence of cervical cancer compared to those who marry later in life. Analysis of the study cohort revealed a statistically significant association between age at marriage and cervical cancer incidence. Women who married at younger ages, particularly below the age of 18, exhibited a significantly elevated risk of developing cervical cancer compared to those who married later in life. These findings support Hypothesis 1 and underscore the importance of considering age at marriage as a significant risk factor for cervical cancer.

Objective to Explore Mediating Factors and Pathways Influencing the Association Between Age at Marriage and Cervical Cancer Risk Hypothesis Socio-economic disparities, access to healthcare services, and sexual behavior will mediate the association between age at marriage and cervical cancer risk. Mediation analysis revealed that socio-economic disparities, access to healthcare services, and sexual behavior partially mediated the association between age at marriage and cervical cancer risk. Women who married at younger ages were more likely to experience socio-economic disadvantages, limited access to healthcare services, and risky sexual behaviors, which in turn contributed to their elevated risk of cervical cancer. These findings support Hypothesis 2 and highlight the importance of addressing mediating factors in designing targeted interventions to mitigate cervical cancer risk among women who marry at younger ages.

Objective to Assess Temporal Relationships and Disease Progression Among Women Who Marry at Younger Ages. Hypothesis Women who marry at younger ages will experience accelerated disease progression and earlier onset of cervical cancer compared to those who marry later in life. Longitudinal analysis of disease progression among women who married at younger ages revealed a shorter time interval between marriage and cervical cancer diagnosis, as well as a higher proportion of advanced-stage disease at diagnosis compared to women who married later in life. These findings support Hypothesis 3 and suggest that early marriage may serve as a marker for accelerated disease progression and earlier onset of cervical cancer.

Research Limitations

While the research findings of this study offer valuable insights into the relationship between young marriage and cervical cancer incidence, it is important to acknowledge and critically evaluate the limitations inherent in the study design, methodology, and interpretation of results. The study subject to sampling bias, as participants were recruited from specific geographic regions or healthcare facilities, potentially limiting the generalizability of findings to broader populations. Selection bias may arise if certain groups, such as marginalized or underserved communities, are underrepresented in the study cohort, leading to biased estimates of association.

The retrospective cohort design of the study relies on secondary data sources, such as electronic health records and cancer registries, which may be subject to inaccuracies, missing data, or incomplete documentation. Retrospective data collection may introduce recall bias or misclassification of exposure and outcome variables, affecting the validity and reliability of findings.

Despite efforts to control for potential confounders, residual confounding may remain due to unmeasured or inadequately adjusted covariates. Additionally, the study's ability to assess mediation pathways may be limited by the availability of data on mediating factors, such as socio-economic status, access to healthcare services, and sexual behavior, which may influence the association between age at marriage and cervical cancer risk.

The study's cross-sectional or retrospective nature preclude the establishment of temporal relationships or causal inference between age at marriage and cervical cancer incidence. While longitudinal analyses provide insights into disease progression over time, reverse causation or temporal confounding cannot be definitively ruled out, necessitating cautious interpretation of findings.

The accuracy and completeness of data on exposure and outcome variables, such as age at marriage, cervical cancer diagnosis, and HPV infection status, may vary across data sources and rely on diagnostic coding or self-reporting, potentially leading to misclassification bias or measurement error.

The study raises ethical considerations related to informed consent, privacy, and confidentiality, particularly when collecting sensitive information on sexual behaviors, reproductive health, and marital status. Ensuring the protection of participants' rights and confidentiality is paramount to maintaining ethical integrity in research endeavors.

4. CONCLUSION

This research study has provided valuable insights into the intricate relationship between young marriage and cervical cancer incidence, shedding light on the multifaceted interplay of socio-cultural, behavioral, and biological factors influencing women's reproductive health outcomes. Through rigorous methodology, comprehensive data analysis, and critical interpretation of findings, the study has advanced our understanding of this important public health issue while also highlighting areas for further inquiry and intervention. The findings of the study have underscored the significance of age at marriage as a determinant of cervical cancer risk, with women who marry at younger ages exhibiting a higher incidence of the disease compared to those who marry later in life. These findings emphasize the importance of considering socio-cultural contexts and structural inequalities in understanding health disparities and designing targeted interventions to mitigate cervical cancer risk among vulnerable populations. Moreover, the study has elucidated mediating factors and pathways through which age at marriage influences cervical cancer risk, including socio-economic disparities, access to healthcare services, and sexual behavior. By identifying these mediating factors, the study has provided valuable insights into the mechanisms underlying cervical cancer disparities and informed the development of evidence-based interventions aimed at reducing the burden of disease among at-risk populations. While the study has contributed significant insights to the existing literature, it is important to acknowledge its limitations and complexities. Sampling biases, data quality issues, methodological constraints, and ethical considerations must be carefully considered when interpreting the findings and drawing conclusions. Addressing these limitations and building upon the study's findings through future research endeavors will be essential for advancing knowledge, refining interventions, and promoting health equity in cervical cancer prevention and control efforts.

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