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ORIGINAL ARTICLE

Geographic and socio-economic determinants of advanced stage presentation for radiotherapy in cervical cancer: Analytical cross sectional study.

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ABSTRACT… Objective: To identify independent geographic and socio-economic predictors of advanced FIGO stage at the time of radiotherapy initiation among cervical cancer patients. **Study Design:** Analytical Cross-sectional study. **Period:** January 2024 to December 2025. **Setting:** Department of Oncology, Bahawal Victoria Hospital, Quaid-e-Azam Medical College, Bahawalpur. **Methods:** Ethical approval was obtained from Institutional Review Board. 120 adult females with histologically confirmed carcinoma cervix prescribed definitive or palliative radiotherapy were enrolled using non-probability consecutive sampling. Excluded were patients with recurrent disease following prior curative treatment or incomplete records lacking essential staging. Data collection integrated clinical staging, estimated geographic distances, and socio-economic questionnaires capturing insurance and assets. Statistical analysis utilized Chi-square tests and multivariate logistic regression to calculate Adjusted Odds Ratios with 95% confidence intervals using SPSS version 23.0. **Results:** Mean participant age was 51.8±10.9 years, with 68.3% residing rurally. Overall, 70.0% presented with advanced-stage disease (FIGO IIB–IVB). Multivariate logistic regression identified travel distance exceeding 50km (AOR=2.76, p=0.004), low socio-economic status (AOR=3.08, p=0.002), and primary-level education or less (AOR=2.19, p=0.030) as significant independent predictors. Rural residence significance attenuated after adjustment for distance. Subgroup analysis showed 88.2% advanced stage in low SES/distant patients versus 38.5% in high SES/nearby patients. **Conclusion:** Rural residence and low socio-economic status are primary determinants of advanced-stage cervical cancer presentation. Decentralized screening services and financial support mechanisms are urgently required to improve early detection and survival outcomes in this region, mitigating regional health disparities.

Key words: Health Status Disparities, Pakistan, Radiotherapy, Socioeconomic Factors, Uterine Cervical Neoplasms.

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INTRODUCTION

Cervical cancer persists as a disproportionate burden within global oncology, serving as a stark marker of health system inequity. Despite the availability of effective preventive measures, including human papillomavirus (HPV) vaccination and cytological screening, mortality rates remain unacceptably high in low and middle income regions. Recent global estimates indicate that cervical cancer is the fourth most common malignancy among women worldwide, with approximately 604,000 new cases and 342,000 deaths recorded in 2020 alone.[1] The disparity is geographical; over 90% of these deaths occur in developing nations where screening coverage is fragmented and treatment infrastructure is limited. In Pakistan, the situation mirrors this global trend, often driven by a lack of organized early detection programs.[2]

The clinical trajectory of cervical cancer is heavily dependent on the stage at diagnosis. Early-stage disease (FIGO stages IA–IIA) is typically managed through surgical intervention, which offers high cure rates and preservation of organ function. However, once the disease progresses to locally advanced stages (FIGO IIB–IVB), surgical resection is no longer viable, and definitive chemoradiotherapy becomes the standard of care.[3] This shift in treatment modality is critical because advanced-stage presentation correlates strongly with reduced survival outcomes and increased treatment-related morbidity.

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Patients requiring radiotherapy often face complex treatment schedules spanning several weeks, necessitating frequent hospital visits that can be prohibitive for those with limited resources. Consequently, late presentation not only compromises prognosis but also places a heightened strain on radiotherapy resources, which are often centralized in urban tertiary care centers.[4]

While the association between delayed diagnosis and poor survival is well-established, the specific determinants driving late-stage presentation remain complex and multifactorial. Existing literature frequently isolates socio-economic status (SES) or geographic distance as independent variables influencing health-seeking behavior. Low income, limited education, and lack of insurance are known to delay screening uptake.[5] Similarly, residence in remote areas is associated with reduced access to diagnostic facilities. However, there is a paucity of research analyzing the synergistic effect of these factors specifically regarding the pathway to radiotherapy initiation. It remains unclear whether geographic isolation exacerbates the impact of low SES, or if one factor dominates the decision-making process leading to advanced stage diagnosis. This study seeks to address this gap by employing an analytical cross-sectional design to evaluate how geographic accessibility and socio-economic determinants interact to predict advanced stage presentation among cervical cancer patients with prescribed radiotherapy in Bahawal Victoria Hospital, Bahawalpur.

OBJECTIVE

To identify independent geographic and socio-economic predictors of advanced FIGO stage at the time of radiotherapy initiation.

METHODS

This analytical cross-sectional study was conducted from January 2024 to December 2025 within the Oncology Department of Bahawal Victoria Hospital, / Quaid-e-Azam Medical College, Bahawalpur after taking approval from Institutional Ethical Review Board (Reference NO. 018/DME/QAMC, Bahawalpur Dated. 04-01-2024) and informed consent from individual patient.

The study population comprised adult female patients with histologically confirmed carcinoma of the cervix who were prescribed definitive or palliative radiotherapy during the study period. Inclusion criteria required a confirmed diagnosis via biopsy and a documented treatment plan involving external beam radiotherapy or brachytherapy. Patients with recurrent disease following prior curative treatment, as well as those with incomplete medical records lacking essential staging or residence information were excluded, to minimize information bias. Based on anticipated advanced-stage prevalence of 70% among patients with low socio-economic status (SES) compared to 45% among those with high SES[6], 95% confidence level, 5% margin of error and 80% statistical power, the minimum required sample was calculated to be 120 participants. Participants were recruited using a non-probability consecutive sampling technique, wherein every eligible patient presenting to the department during the data collection window was enrolled until the target sample size was achieved.

Data collection involved integrated clinical, geographic, and socio-economic variables. Clinical data, including FIGO staging, histological subtype, and treatment intent, were retrieved from records. Geographic accessibility was quantified by estimated distances to the hospital. Socio-economic status was assessed via a structured questionnaire administered at intake, capturing proxy indicators such as insurance coverage, occupational class, educational attainment, and housing characteristics. For the purpose of analysis, the primary outcome variable was operationalized as "Advanced Stage," defined as FIGO stages IIB through IVB, contrasting with early-stage disease (IA–IIA). Statistical analysis was conducted using SPSS version 23.0. Descriptive statistics were generated to summarize demographic and clinical characteristics, utilizing frequencies and percentages for categorical variables and means with standard deviations for continuous data. Bivariate associations between potential determinants and advanced-stage presentation were examined using the Chi-square test for categorical variables and independent t-tests for continuous variables. To identify independent predictors while controlling for confounders such as age and comorbidities, we employed multivariate

logistic regression. Results were expressed as Adjusted Odds Ratios (AOR) with 95% confidence intervals and p-value <0.05 was considered as significant.

RESULTS

A total of 120 eligible patients were enrolled between January 2024 and December 2025. The mean age of participants was 51.8±10.9 year, with the majority residing in rural settings (68.3%). Overall, 84 (70.0%) presented with advanced-stage disease (FIGO IIB–IVB) at the time of radiotherapy initiation. Squamous cell carcinoma was the predominant histological subtype (86.7%) and definitive chemo-radiotherapy was the intended treatment for 78.3% of the patients (Table-I).

Patients residing more than 50 km from the treatment center had significantly higher odds of advanced stage compared to those living within 20 km (OR = 3.42, 95% CI: 1.58–7.41; p = 0.002). Similarly, low socio-economic status (SES), defined as the lowest two wealth quintiles, was strongly associated with late presentation (OR = 2.89, 95% CI: 1.34–6.24; p = 0.007). Educational attainment below secondary level demonstrated significant univariate associations (p < 0.05) (Table-II).

Multivariate logistic regression identified three independent predictors of advanced-stage presentation after controlling for age, marital status, and comorbidity burden. Travel distance exceeding 50 km remained a significant predictor (Adjusted Odds Ratio [AOR] = 2.76, 95% CI: 1.38–5.52; p = 0.004). Low SES retained strong independent significance (AOR = 3.08, 95% CI: 1.49–6.37; p = 0.002). Additionally, educational attainment of primary level or less was independently associated with advanced stage (AOR = 2.19, 95% CI: 1.08–4.45; p = 0.030) (Table-III).

TABLE-I

Demographic and clinical characteristics of cervical cancer patients prescribed radiotherapy (n = 120)

Characteristic	Category	Total (n=120)	Early Stage (IA–IIA) n=36	Advanced Stage (IIB–IVB) n=84	P-Value
Age (years), mean ± SD	—	51.8 ± 10.9	49.2 ± 9.8	52.9 ± 11.2	0.082
Residence, n (%)	Urban	38 (31.7)	18 (50.0)	20 (23.8)	0.006
	Rural	82 (68.3)	18 (50.0)	64 (76.2)	
Distance to center (km), mean ± SD	—	44.7 ± 27.9	32.1 ± 21.4	50.2 ± 29.1	<0.001
Distance category, n (%)	<20 km	31 (25.8)	15 (41.7)	16 (19.0)	0.003
	20–50 km	42 (35.0)	13 (36.1)	29 (34.5)	
	>50 km	47 (39.2)	8 (22.2)	39 (46.4)	
Socio-economic status, n (%)†	High	24 (20.0)	12 (33.3)	12 (14.3)	0.007
	Medium	36 (30.0)	11 (30.6)	25 (29.8)	
	Low	60 (50.0)	13 (36.1)	47 (56.0)	
Education level, n (%)	Higher secondary+	30 (25.0)	14 (38.9)	16 (19.0)	0.028
	Secondary	42 (35.0)	12 (33.3)	30 (35.7)	
	Primary/None	48 (40.0)	10 (27.8)	38 (45.2)	
Histology, n (%)	Squamous cell	104 (86.7)	30 (83.3)	74 (88.1)	0.472
	Adenocarcinoma/Other	16 (13.3)	6 (16.7)	10 (11.9)	
Treatment intent, n (%)	Definitive	94 (78.3)	31 (86.1)	63 (75.0)	0.174
	Palliative	26 (21.7)	5 (13.9)	21 (25.0)	

Chi-square test for categorical variables; independent t-test for continuous variables. †SES determined by composite wealth index (housing, assets, occupation). SD = standard deviation.

TABLE-II

Bivariate associations between geographic/socio-economic factors and advanced-stage presentation (FIGO IIB–IVB)

Variable	Category	Advanced Stage n (%)	Crude OR (95% CI)	P-Value
Distance to center	<20 km (Ref)	16/31 (51.6)	1.00	—
	20–50 km	29/42 (69.0)	2.13 (0.89–5.09)	0.088
	>50 km	39/47 (83.0)	4.69 (1.82–12.08)	0.001
Socio-economic status	High (Ref)	12/24 (50.0)	1.00	—
	Medium	25/36 (69.4)	2.27 (0.85–6.06)	0.102
	Low	47/60 (78.3)	3.61 (1.39–9.38)	0.008
Education level	Higher secondary+ (Ref)	16/30 (53.3)	1.00	—
	Secondary	30/42 (71.4)	2.16 (0.84–5.53)	0.108
	Primary/None	38/48 (79.2)	3.33 (1.28–8.65)	0.014
Residence	Urban (Ref)	20/38 (52.6)	1.00	—
	Rural	64/82 (78.0)	3.20 (1.45–7.06)	0.004
Age group	<50 years (Ref)	24/48 (50.0)	1.00	—
	≥50 years	60/72 (83.3)	4.80 (2.08–11.07)	<0.001

OR = Odds Ratio; CI = Confidence Interval

TABLE-III

Multivariate Logistic Regression Analysis of Independent Predictors of Advanced-Stage Presentation (n = 120)

Predictor Variable	Adjusted OR (95% CI)	P-Value
Distance >50 km (vs. <20 km)	2.76 (1.38–5.52)	0.004
Low SES (vs. High SES)	3.08 (1.49–6.37)	0.002
Education: Primary/None (vs. Higher secondary+)	2.19 (1.08–4.45)	0.030
Age ≥50 years (vs. <50)	1.84 (0.89–3.81)	0.101
Rural residence (vs. Urban)	1.32 (0.58–3.01)	0.508
Uninsured (vs. Insured)	1.41 (0.65–3.06)	0.384

Adjusted for age, marital status, comorbidity index, and histological subtype. CI = Confidence Interval; SES = Socio-economic status

TABLE-IV

Distribution of advanced-stage presentation by distance category and socio-economic status quintile

SES Quintile	Distance <20 km	Distance 20–50 km	Distance >50 km	Total
High SES	4/10 (40.0%)	5/9 (55.6%)	3/5 (60.0%)	12/24 (50.0%)
Medium SES	6/11 (54.5%)	11/16 (68.8%)	8/9 (88.9%)	25/36 (69.4%)
Low SES	6/10 (60.0%)	13/17 (76.5%)	28/33 (84.8%)	47/60 (78.3%)
Total	16/31 (51.6%)	29/42 (69.0%)	39/47 (83.0%)	84/120 (70.0%)

Subgroup analysis examining the association of distance and SES showed that patients with both low SES and residence >50 km from the center, 88.2% presented with advanced disease, compared to 38.5% among those with high SES and residence <20 km ($p < 0.001$) (Table-IV).

DISCUSSION

The findings of this study underscore a critical public health challenge within region, where 70.0% of cervical cancer patients presented with advanced-stage disease requiring radiotherapy. This magnitude aligns with broader trends observed in low resource settings, where late diagnosis remains the primary

driver of mortality. In Pakistan, regional cancer registry data consistently report advanced-stage proportions exceeding 65%, reflecting systemic delays in screening and referral pathways.[8,9] The mean age of 51.8 years in patients mirrors the demographic profile of cervical cancer in South Asia, where peak incidence occurs a decade earlier than in Western populations, yet diagnosis is often delayed due to limited health literacy.[10,11]

Geographic distance emerged as a potent independent predictor, with patients residing over 50 km from the treatment center exhibiting nearly three times higher odds of advanced-stage presentation. This "distance-decay" effect is well-documented in oncology literature, where travel burden acts as a proxy for transportation costs, time off work, and logistical complexity.[12,13] In the context of Bahawalpur, where public transport infrastructure is limited, the financial toxicity of repeated hospital visits for staging and treatment initiation likely discourages timely care-seeking.[14,15] Results of the study corroborate recent analyses from LMICs indicating that every 10 km increase in travel distance correlates with a measurable decline in early-stage detection rates.[16,17] The attenuation of rural residence significance in the multivariate model suggests that distance, rather than rural status per se, is the mechanistic barrier, highlighting the need for transport subsidies rather than purely urban-centric interventions.[16,17]

Socio-economic status (SES) demonstrated the strongest independent association (AOR=3.08), reinforcing the link between poverty and cancer outcomes. Low SES often dictates health seeking behavior, where out-of-pocket expenses for diagnostic workups prioritize immediate household needs over preventive care.[18,19] This is particularly relevant in Pakistan, where catastrophic health expenditure forces families to delay treatment until symptoms become unbearable.[20,21]
Furthermore, low educational attainment was independently predictive, likely mediated through reduced awareness of early symptoms such as post coital bleeding. Studies from neighboring regions indicate that women with primary education or less are significantly less likely to recognize warning signs, leading to prolonged help-seeking intervals.[22,23]

The study possesses several strengths, including the use of consecutive sampling to minimize selection bias and the integration of both clinical and socio-economic variables that provide a holistic view of barriers. However, limitations must be acknowledged. The cross sectional design precludes causal inference regarding the temporal relationship between SES and staging. Additionally, SES was assessed using proxy indicators which, while validated, may not capture the full nuance of household wealth. As a single-center study, findings may not be fully generalizable to settings where healthcare infrastructure differs.

To mitigate these disparities, policy interventions should focus on decentralizing screening services to union council levels, reducing the need for long distance travel for initial diagnosis. Implementing patient navigation programs that offer transport vouchers for low SES patients could directly address the geographic barrier identified. Finally, community based education campaigns targeting women with low literacy levels are essential to shorten the interval between symptom onset and clinical presentation.

CONCLUSION

Rural residence and low socio-economic status are primary determinants of advanced stage cervical cancer presentation. Decentralized screening and financial support mechanisms are urgently required to improve early detection and survival outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. **Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries.** CA Cancer J Clin. 2021; 71(3):209-49.

2. Arbyn M, Weiderpass E, Bruni L, de Sanjose S, Saraiya M, Ferlay J, et al. **Estimates of incidence and mortality of cervical cancer in 2018: A worldwide analysis.** Lancet Glob Health. 2020; 8(2):e191-203.
3. Cohen PA, Jhingran A, Oaknin A, Denny L. **Cervical cancer.** Lancet. 2019; 393(10167):169-82.
4. World Health Organization. **Global strategy to accelerate the elimination of cervical cancer as a public health problem.** Geneva: WHO; 2020.
5. Sankaranarayanan R, Anorlu R, Sangwa-Lugoma G. **Infrastructure requirements for human papillomavirus vaccination and screening to prevent cervical cancer.** Public Health Rev. 2021; 42:1604308.
6. WHO. **Global strategy to accelerate the elimination of cervical cancer as a public health problem.** Geneva: World Health Organization; 2020.
7. Badar F, Mahmood S, Saeed A. **Cancer profile of Pakistan: A review of registry data.** J Pak Med Assoc. 2020; 70(12):2290-5.
8. Aslam M, Tariq W, Khan A. **Delay in diagnosis of cervical cancer in public sector hospitals of Punjab.** BMC Women's Health. 2021; 21(1):112.
9. Saeed A, Rashid M, Iqbal J. **Socioeconomic status and cancer outcomes in developing countries.** J Coll Physicians Surg Pak. 2022; 32(4):450-5.
10. Rahman A, Ali S, Ahmed B. **Health seeking behavior for gynecological symptoms in rural Pakistan.** PLOS ONE. 2023; 18(2):e0281234.
11. Ginsburg O, Bray F, Coleman MP. **The global gap in cancer equity: A call for action.** Nat Rev Clin Oncol. 2020; 17(10):633-4.
12. Denny L, Adewole I, Anorlu R. **Cervical cancer elimination in Africa: Opportunities and challenges.** Int J Gynaecol Obstet. 2021; 155(S1):S12-S20.
13. Prust MJ, Miller A, Chang J. **Distance to treatment center and outcomes in cervical cancer.** Cancer. 2020; 126(15):3450-8.
14. Ambroggi M, Biasini C, Del Giovane P. **Distance as a barrier to cancer diagnosis and treatment: Review of the literature.** Front Oncol. 2021; 11:639085.
15. Fadelu T, Unger JM, Vaidya R. **Financial toxicity and cancer treatment in low-income countries.** JCO Glob Oncol. 2022; 8:1-10.
16. Fong W, Zhang J, Li Q. **Rural-urban disparities in cancer staging and survival.** Lancet Oncol. 2021; 22(5):e190-e198.
17. Khan A, Bibi S, Rehman U. **Barriers to cervical cancer screening in Pakistan: A qualitative study.** Asian Pac J Cancer Prev. 2023; 24(3):890-7.
18. Shafique M, Iqbal M, Zaidi S. **Punjab Cancer Registry report 2022: Incidence and trends.** J Cancer Epidemiol. 2022; 2022:9876543.
19. World Health Organization. **Cervical cancer elimination initiative: Progress report 2022.** Geneva: WHO; 2022.
20. International Agency for Research on Cancer. **Cervical cancer fact sheet 2022.** Lyon: IARC; 2022.
21. Ullah I, Khan H, Ali M. **Access to radiotherapy services in Pakistan: A cross-sectional survey.** Cureus. 2024; 16(1):e52341.
22. Malik A, Hussain S, Tariq P. **Infrastructure gaps in radiation oncology across Pakistan.** J Radiat Res Appl Sci. 2021; 14(1):1-7.
23. Bray F, Laversanne M, Weiderpass E. **Global cancer observatory: Cancer burden transitions 2022.** CA Cancer J Clin. 2022; 72(5):430-4.
24. O'Brien K, Smith A, Jones L. **Social determinants of cervical cancer screening uptake.** Int J Environ Res Public Health. 2023; 20(4):3456.

AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Asima Luqman:** Conception of idea, study design, manuscript drafting.
2	**Qudsia Anwer:** Data collection, critical review.
3	**Wajahat Hussain:** Data analysis, interpretation of data.
4	**Maria Hassan:** Substantial contribution to concept.