



Original Article

Five-year Survival Rate of Stomach Cancer Patients in the Golestan Province, Iran

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Abstract

Introduction: Gastric cancer (GC) remains a major cause of cancer mortality worldwide, with particularly high incidence and poor survival in northeastern Iran. This study aimed to estimate the 1-, 3-, and 5-year survival rates of GC patients diagnosed in the Golestan Province in 2015–2016 and to identify demographic and clinical factors associated with survival.

Methods: In this cohort study, newly diagnosed GC cases were retrieved from the Golestan Population-based Cancer Registry. Vital status was determined through registry records and telephone follow-ups. Survival rates were calculated using life table and Kaplan–Meier methods, with group comparisons made using the log-rank test. Cox proportional hazards regression assessed the association between potential risk factors and mortality.

Results: Among 476 reviewed cases, 298 were included in the survival analysis. The mean age at diagnosis was 64.6 ± 13.7 years, and 67.9% of patients were male. At follow-up, 87.6% had died. The 1-, 3-, and 5-year survival rates were 59%, 21%, and 13%, respectively. Older age ($P < 0.001$), metastatic disease ($P < 0.001$), rural residence ($P = 0.001$), and lack of surgical treatment ($P < 0.001$) were significantly associated with poorer survival. Gender, smoking status, tumor location, and chemotherapy/radiotherapy showed no significant association.

Conclusion: GC survival in the Golestan Province remains low. Age at diagnosis, metastasis, residence, and surgical treatment were key prognostic factors. Enhancing early detection, increasing access to cancer care, and implementing structured screening programs may improve outcomes in this high-risk region.

Keywords: Iran, Mortality, Neoplasm, Stomach, Survival

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Introduction

Gastric cancer (GC) is the fifth most common type of cancer and the fourth leading cause of cancer-related deaths worldwide.¹ The global age-standardized incidence rate (ASIR) of GC was 11.1 per 100,000 people in 2018, according to the International Agency for Research on Cancer (IARC), with the highest incidence reported in East Asia (22.4 per 100,000).² Despite a steady global decline in the GC incidence over the past century, the disease continues to account for a substantial proportion of cancer deaths. Understanding prognostic indicators is vital for enhancing survival outcomes and guiding effective interventions.³

One of the principal obstacles in GC management is delayed diagnosis, as the disease typically presents without symptoms during its early stages. Consequently, a significant proportion of cases are diagnosed at advanced or metastatic stages.⁴ While early-stage GC can be managed successfully through surgical resection, often followed by adjuvant chemotherapy or radiotherapy, advanced

disease is generally less responsive to treatment, leading to markedly poorer survival rates.²

Survival outcomes are a key metric in cancer surveillance, reflecting both the quality of diagnosis and the effectiveness of treatment protocols. Various factors influence GC survival, including demographic characteristics, tumor biology, and the efficiency of the healthcare system. Among these, the stage at diagnosis is the most critical determinant, strongly influenced by the availability of structured screening programs. Countries such as Japan and South Korea have significantly improved GC survival through national screening initiatives, allowing early detection in up to 70% of new cases.⁵

GC is a major health issue in Iran, as it is the most frequent cancer among men (21.6 per 100,000) and the second prevalent cancer in women after breast cancer (9.8 per 100,000).² These odds are even worse for the Golestan Province, which is located in northeastern Iran; therefore, it is part of the Asian gastroesophageal cancer belt and a high-risk area for GC.⁶ In recent years, a growing body

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of research in Iran has examined GC survival patterns. These studies indicate that survival rates in Iran are comparable to those of other developing countries but remain substantially lower than those reported in high-income nations. However, efforts to conduct population-based cancer studies in Iran face notable barriers, including incomplete hospital documentation, inconsistent data registration, insufficient personnel training, inadequate patient follow-up systems, and lack of specialized cancer centers at regional and provincial levels.⁷

Globally, the prognosis for GC remains poor, with a 5-year survival rate typically below 20%, primarily due to late diagnosis. A systematic review and meta-analysis of 22 Iranian studies conducted between 1990 and 2011 reported a national 5-year survival rate of approximately 15%, with a range of 6% to 30%⁸. Similar results have been reported for survival of these patients in the Golestan province with a 5-year survival rate of 15.8% based on the populational cancer registry conducted in 2007-2012.⁹

Given the high burden of GC and the limited provincial-level survival data, this study aims to evaluate the 1-year, 3-year, and 5-year survival rates of patients newly diagnosed with gastric cancer in the Golestan Province during 2015–2016. Additionally, it seeks to examine the relationship between survival and selected risk factors, contributing to the evidence base for cancer control planning in the region.

Materials and Methods

Study Design and Case Selection

This study employed a cohort study design to identify 1-, 3-, and 5-year survival rates and their associated factors in GC patients from Golestan, northern Iran. The study population included newly diagnosed cases of GC in 2015 and 2016 registered at the Golestan Population-based Cancer Registry, in the Golestan Province, Iran. All diagnoses were confirmed by histopathological examination.

Patient data were obtained from the registry's data repository. To supplement the registry data, patient or family contacts were made via phone to confirm vital status and date of death. All patient information was handled confidentially and was not disclosed to unauthorized individuals.

Data Collection

Data were collected using a structured checklist, included the patient's full name, age group at diagnosis (less than, more than, or equal to 60), gender (male/female), history of smoking (yes/no), location of tumor (cardia or non-cardia), place of residence (rural/urban), metastasis (yes/no), surgery history (yes/no), and chemo- or radiotherapy history (yes/no) as independent variables, and patient's vital status and survival time as dependent variables. Survival time was calculated from the date of gastric cancer diagnosis to the date of death or the last follow-up/censoring date. Patients who were alive at the end of follow-up or lost to follow-up were considered censored observations (Figure 1).

Statistical Analysis

Statistical analysis was performed using SPSS software, version 16.0 (IBM Corp., Armonk, NY, USA). Numerical variables were presented as means, while categorical variables were reported as frequencies and percentages. A significance level of $\alpha=0.05$ was used for all tests.

The 1, 3, and 5-year survival rates were calculated using life table analysis. The Kaplan–Meier method and the log-rank test was applied to compare median survival across groups. Variables with a P -value <0.20 in univariable analysis were entered into the multivariable Cox regression model to assess the multivariable association between independent variables and risk of death. The proportional hazards assumption was evaluated using log-minus-log survival plots, and no meaningful violation of the proportional hazards assumption was observed.

The study protocol was approved by the Ethics Committee of Golestan University of Medical Sciences (Approval Code: IR.GOUMS.REC.1402.082). Informed consent was obtained from all participants or their legal representatives after a brief explanation of the study objectives.

Results

Patient Characteristics

A total of 476 cases of gastric cancer were initially reviewed. The mean age of patients was 64.62 ± 13.73 years, and the majority were male (67.9%). Tumor location was recorded in 288 cases. Of these, 175 patients (60.8%) had tumors located in the cardia, and 113 patients (39.2%) in non-cardia regions. Regarding place of residence, 237 patients (48.5%) lived in urban areas, while 252 patients (51.5%) resided in rural areas. Smoking history was available for 290 patients, of whom 224 (77.2%) reported no history of smoking (Table 1).

Following data validation and inclusion criteria, 298 cases were selected for survival analysis (Figure 1). Median follow-up time was 17.75 months (IQR:5.48-31.66 months). At the end of the follow-up period, 261 patients (87.6%) had died, and 37 (12.4%) were still alive. Metastasis status was available for 273 patients, with 139 (50.9%) presenting with metastatic disease and 134 (49.1%) with non-metastatic disease. Surgical treatment status was documented for 293 patients, of whom 76 (25.9%) had undergone surgery and 217 (74.1%) had not. Chemotherapy and/or radiotherapy (CRT) history was known for 294 patients, with 215 (73.1%) receiving CRT and 79 (26.9%) not receiving it.

Survival Analysis

Based on life table analysis, the 1-year, 3-year, and 5-year overall survival rates were 59%, 21%, and 13%, respectively. First, in univariate analyses, in order to compare survival rates in sub-groups of the estimated variables and to identify factors affecting survival time, the log-rank test was used. Variables such as the age at cancer diagnosis (HR:1.71, CI:1.31-2.25, $P<0.001$), metastatic disease (HR:1.89, CI:1.45-2.45, $P<0.001$), residence (HR:1.51, CI:1.18-1.94, $P=0.001$), and surgical resection treatment

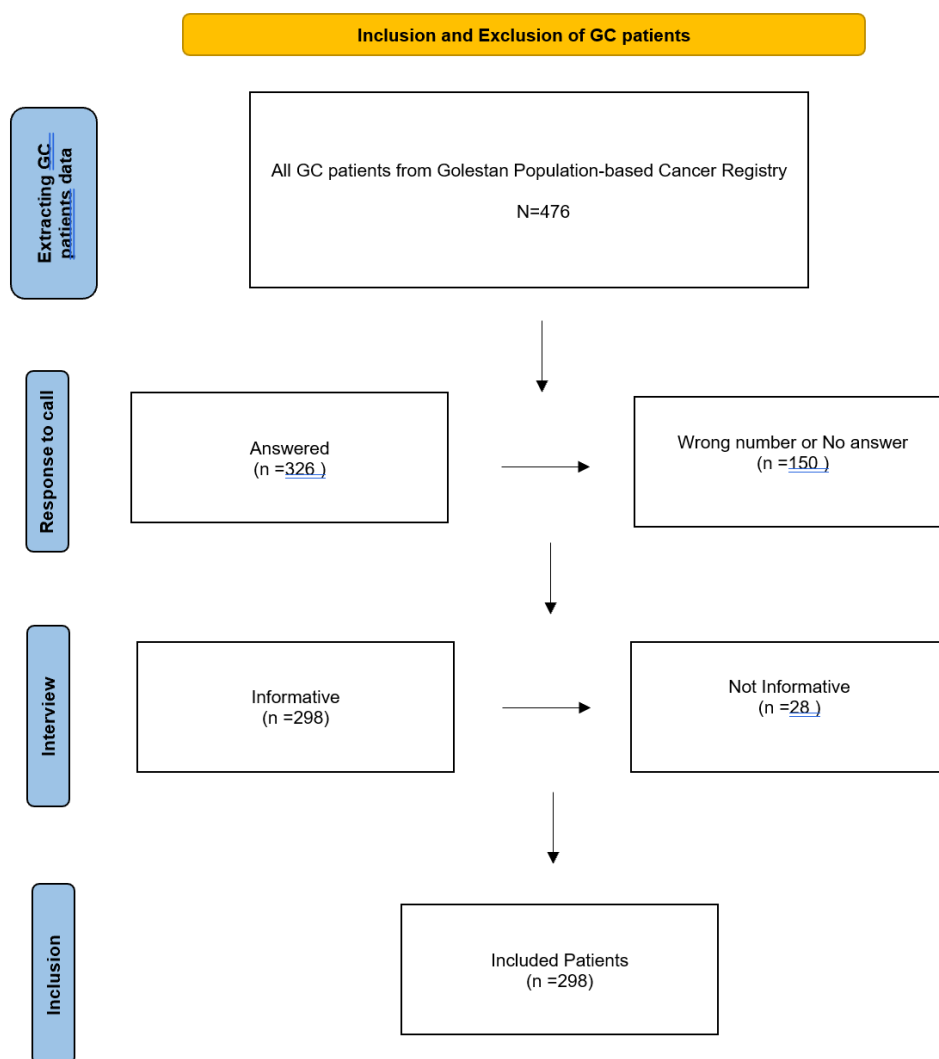


Figure 1. Flowchart of Extracting Gastric Cancer Patients' Data

Table 1. Demographic Characteristics of all GC Patients and Survival Assessed Group

Variables	Groups	All GC patients	Survival assessed group
Sex	Male	339	210
	Female	160	88
Age (years)	<60	170	97
	60>	329	201
Place of residence	Urban	237	150
	Rural	252	147

(HR:4.18, CI:2.97-5.89, $P<0.001$) were found to have a significant relationship with patient survival (Tables 2-4).

Kaplan–Meier survival curves demonstrated that older patients, those with metastasis at diagnosis, rural residents, and those who did not undergo surgery had markedly lower survival probabilities over time (Figures 2-5).

There was no significant relationship between survival time and factors such as gender, history of smoking, tumor location, and receiving chemo- or radiotherapy.

Discussion

Gastric cancer (GC) continues to pose a serious global public

Table 2. One-, 3-, and 5-year Survival of Patients with Gastric Cancer

Variables	Groups	Survival median (month)	95% Confidence Interval	P value*
Sex	Male	16.17	10.60-21.74	0.115
	Female	18.73	13.31-24.15	
Age (years)	<60	23.9	18.60-29.20	0.000
	60>	13.13	9.74-16.52	
Place of residence	Urban	19.2	15.17-25.17	0.001
	Rural	14.33	5.59-28.15	
Smoking	Yes	11.5	8.02-14.98	0.295
	No	18.73	14.47-22.99	
Site of involvement	Cardia	20.1	15.17-25.17	0.116
	Non-cardia	16.87	5.59-28.14	
Metastasis	Yes	11.67	9.38-13.96	0.000
	No	24.7	20.84-28.62	
CRT ^a	Yes	19.47	15.92-23.01	0.538
	No	11.9	6.42-17.38	
Surgical treatment	Yes	43.9	15.12-72.74	0.000
	No	12.37	10.51-14.23	

^aChemoradiation Therapy.

*Log-rank test.

Table 3. Survival Median and Standard Error of the Patients.

Variables	Groups	Number (%)	1-year survival (%)	3-year survival (%)	5-year survival (%)
Sex	Male	210(70.5)	58	19	11
	Female	88(29.5)	64	20	19
Age (years)	< 60	97(32.5)	69	34	26
	> 60	201(67.5)	55	14	7
Place of residence	Urban	150(50.5)	64	28	20
	Rural	147(49.5)	54	14	7
Smoking	Yes	66(22.7)	50	20	9
	No	224(77.3)	63	21	15
Site of involvement	Cardia	175(60.7)	64	14	6
	Non-cardia	113(39.3)	61	29	16
Metastasis	Yes	139(50.9)	49	13	5
	No	134(49.1)	72	30	25
CRT*	Yes	215(73.1)	48	22	18
	No	79(26.9)	64	21	12
Surgical treatment	No	217(74.1)	53	8	2
	YES	76(25.9)	80	58	46

*Chemoradiation Therapy.

Table 4. Adjusted and Unadjusted Gastric Cancer Survival According to Patient Characteristics.

Variable	Group		Univariate analysis*			Multivariable analysis*		
			Hazard ratio	Confidence interval	P value	Adjusted hazard ratio	Confidence interval	P value
Gender	men	ref	1.24	0.948-1.63	0.11	1.09	0.75-1.58	0.639
	Women							
Age (years)	> 60	ref	1.71	1.31-2.25	<0.001	1.05	0.70-1.58	0.800
	< 60							
Metastasis	Yes	ref	1.89	1.45-2.45	<0.001	1.34	0.96-1.88	0.081
	No							
Surgery	Yes	ref	4.18	2.97-5.89	<0.001	3.72	2.31-6.01	<0.001
	No							
Smoking	Yes	ref	1.16	0.87-1.55	0.29	-	-	-
	No							
Place of residence	Rural	ref	1.51	1.18-1.94	<0.001	1.61	1.15-2.25	0.005
	Urban							
Site of involvement	Non-cardia	ref	1.29	0.93-1.77	0.11	0.94	0.66-1.35	0.762
	Cardia							
CRT†	Yes	ref	1.09	0.82-1.44	0.53	-	-	-
	No							

*Univariate Cox proportional hazards regression.

†Multivariate Cox proportional hazards regression.

‡Chemoradiation Therapy.

health challenge and remains one of the leading causes of malignancy-related mortality in the 21st century.¹⁰ The overall GC prognosis is relatively poor, with 5-year survival rates ranging from 10% to 40% globally and approximately 20% in low- and middle-income countries. Survival rates are often considered indicators of the effectiveness of cancer care systems, including prevention, diagnosis, and treatment efforts.¹¹ Understanding the demographic, biological, and pathoclinical factors associated with survival can inform prevention strategies and treatment planning

for GC.

In the present study, 67.9% of the patients were male and 32.1% were female, yielding a male-to-female ratio of 2.11. This gender distribution is consistent with findings from similar studies conducted in the United States, China, Europe, and other regions of Iran.^{2,8,11-18} The highest prevalence of GC was observed in the seventh decade of life, aligning with previous studies.^{2,8,12,17} The average age of diagnosis in our study was 64.62 years, slightly higher than that reported in some Iranian studies,^{2,8,15,16,18} and slightly

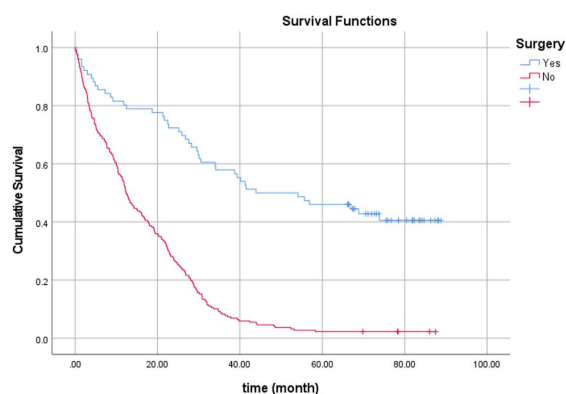


Figure 2. Association between Surgery and Survival Rate for Gastric Cancer using Log-rank (Mantel-Cox) Test

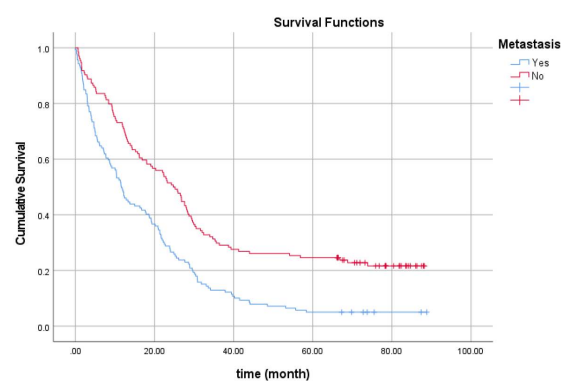


Figure 4. Association between Metastasis and Survival Rate for Gastric Cancer using Log-rank (Mantel-Cox) Test

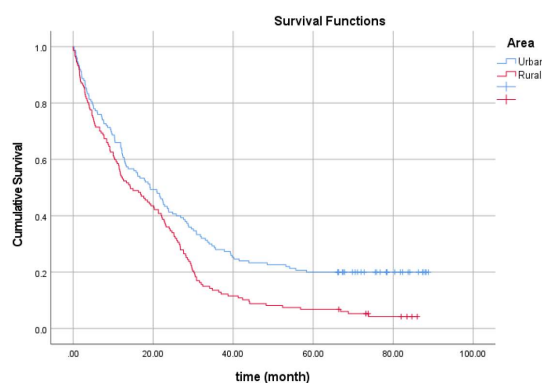


Figure 3. Association between Place of Residence and Survival Rate for Gastric Cancer using Log-rank (Mantel-Cox) Test

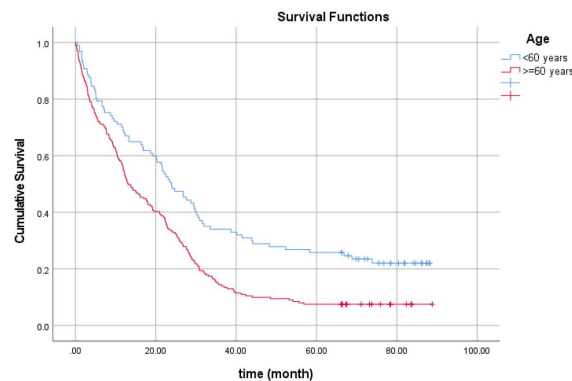


Figure 5. Association between Age and Survival Rate for Gastric Cancer using Log-rank (Mantel-Cox) Test

lower than others.^{12,13,17}

In this study, the 1-, 3-, and 5-year survival rates of patients were 59%, 21%, and 13%, respectively, which matched with studies conducted in Ilam (52%, 24%, and 15%), Urmia (37%, 14%, and 11%), and Kohgiluyeh and Boyer-Ahmad (37%, 20%, and 18%). However, they differ from the study by Karamoozian in Kerman, which reported higher 3-year (41%) and 5-year (32%) survival rates.^{7,13,16,19} The reasons for the higher survival in Karamoozian's study remain unclear and may warrant further investigation. Notably, a 2008 study conducted in the Golestan Province estimated a 1-year survival rate of 37.5%, which is approximately 22% lower than our findings.²⁰ The improvement may be attributed to increased access to healthcare facilities, greater public awareness of cancer symptoms, and the implementation of more systematic screening practices in recent years. In comparison, 5-year survival rates in developed countries remain substantially higher: 45% in the United States, 44.5% in China, and 81% in Japan. This disparity may reflect earlier diagnosis in countries with robust screening programs, such as Japan, where early-stage detection is more common.^{14,21} It seems that public education on risk factors and symptoms, as well as nationwide screening programs, could contribute significantly to earlier diagnosis and better outcomes in countries like Iran.

In our study, metastasis was significantly associated with

lower survival, a finding consistent with studies conducted in China, Iran, and Belgium.^{11,13-16,18-20,22} While our study did not assess the impact of specific metastasis sites on survival due to data limitations, future research could benefit from including this level of detail.

Surgical treatment was also associated with significantly improved survival, which supports the findings of numerous national studies.^{11,15-18,23} However, our ability to evaluate the impact of adjuvant therapies was limited. Specifically, receiving at least one cycle of chemotherapy or radiotherapy did not significantly improve 5-year survival in our study. This finding contrasts with other studies: Akhondi-Meybodi reported that chemotherapy had a positive effect on survival, while radiotherapy did not;²³ In Roshanaei's study, radiotherapy was recognized as an affecting factor on the survival of GC patients.¹¹ These inconsistencies highlight the importance of staging data; without accurate disease staging, the true impact of adjuvant therapies cannot be fully assessed.

Smoking history was not found to significantly influence 5-year survival in our study, which is in line with the findings of Tabesh, Moghimi-Dehkordi, and Jamali.^{8,16,18} On the other hand, Torre La's study conducted in Italy and a study in Korea indicate that smoking tobacco is a factor affecting the survival of patients.^{24,25} Discrepancies may be due to differences in study design, statistical populations, or measurement methods, such as pack-year history. Further

investigation with more detailed smoking variables is recommended.

The place of residence was found to significantly impact survival, with urban patients showing better outcomes than rural residents. This finding aligns with results from Heise and Ghorbani Gholiabad,^{15,22} but contrasts with other studies.^{13,16-18} The inconsistency could be due to differences in urban-rural population ratios, sample sizes, healthcare access, or education levels. Larger meta-analyses are needed to confirm the role of residence in GC survival outcomes.

In this research, the age at cancer diagnosis was also found to be an influential factor in survival, with patients whose disease is diagnosed at a younger age having higher survival rates than others. This may be due to the slower progression of the disease or better physical condition at younger ages. This result aligns with findings from both Iranian and international studies,^{2,8,11,16,18,22} although some studies (e.g. Nikpour, Semnani, Orman) have reported contrary findings.^{17,20,26}

Finally, although female patients had a slightly higher 5-year overall survival (OS) rate than males in our study, the difference was not statistically significant. This is consistent with prior studies conducted in Iran and elsewhere.^{11,16,17,20,22} One research has suggested that hormonal factors may contribute to gender differences in GC outcomes, but more data are needed to confirm this hypothesis.²⁷ Additionally, it has been suggested that women may be more proactive in seeking medical care and following up on symptoms, which could contribute to better outcomes.²⁸

A few limitations should be considered when interpreting the results of this study. First, the retrospective nature of the data and reliance on existing medical records limited our ability to control for all potential confounding variables. In particular, staging information was unavailable for most patients due to incomplete pathology, imaging, or biopsy reports, which restricted our analysis of disease severity and treatment effectiveness. Second, data on chemotherapy and radiotherapy were limited to whether patients had received at least one cycle, without details on treatment regimen, adherence, or intent (curative vs. palliative). Third, survival data were collected in part through telephone follow-ups, which may have introduced recall bias or misclassification. Fourth, this study was limited to one province and may not fully reflect national trends in gastric cancer survival. Lastly, the hazard ratios estimated from the Cox proportional hazards model should be interpreted cautiously, since hazard ratios may be affected by time-dependent selection processes and therefore may not directly represent causal effects.²⁹ Nevertheless, visual assessment of the survival curves did not demonstrate any clear evidence suggestive of substantial bias in the present study. Future research should aim to include staging data, treatment details, and a broader population to better assess survival determinants and inform national cancer control efforts.

Conclusion

This study provides updated survival estimates and prognostic factors for gastric cancer patients diagnosed in

the Golestan Province during 2015–2016. The observed 1-, 3-, and 5-year survival rates were 59%, 21%, and 13%, respectively, which remain lower than those reported in developed countries. Our findings indicate that age at diagnosis, metastasis status, type of treatment (particularly surgery), and place of residence significantly influence patient survival. These results underscore the urgent need for early detection strategies, improved access to cancer care, and the integration of structured cancer screening programs in high-risk regions. Enhancing public awareness and ensuring timely diagnosis may contribute to better outcomes for gastric cancer patients in Iran.

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Competing Interests

The authors declare that they have no conflict of interest.

Ethical Approval

The ethics committee of Golestan University of Medical Sciences approved the protocol (IR.GOUMS.REC.1402.082).

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