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# Prognostic Factors and Survival in Stomach Cancer – Analysis of 15 Years of Data from a Referral Hospital in Iran and Evaluation of International Variation

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## Keywords

Prognostic factors · Survival · Stomach cancer · Iran · International

## Summary

**Background:** Stomach cancer is the most common cancer among Iranian men. We studied survival rates and prognostic factors of stomach cancer in a referral hospital in Tehran, Iran. **Patients and Methods:** We followed 367 stomach cancer patients hospitalized between 1991 and 2007 in the Baqiyatallah Hospital. We estimated survival rates overall and among operable patients exclusively. Hazard ratios (HR) for the different prognostic factors were estimated with the Cox regression model. Furthermore, we studied international variations in stage distribution and 5-year survival for stomach cancer. **Results:** Overall, 5-year survival of stomach cancer was low (14%), and the majority of patients (53%) were diagnosed at stage IV. Stage, tumor size, age, and gender were statistically significant prognostic factors. Relative risk of mortality in stage IV compared to stage IA was 9.9 (95% confidence interval 5.8–16.9). The highest 5-year survival was reported from Japan, particularly among screening detected patients (89.4%). Among operable patients, 5-year survival was 32.6% in France, 26% in the USA, and 30.5% in China, which was close to the rates estimated in our study (24%). **Conclusions:** Due to stomach cancer being frequently diagnosed in advanced stages, its prognosis is poor in Iran. Early diagnosis and downstaging strategies need to be prioritized to improve the prognosis of stomach cancer.

## Schlüsselwörter

Prognosefaktoren · Überleben · Magenkarzinom · Iran · International

## Zusammenfassung

**Hintergrund:** Das Magenkarzinom ist die häufigste Krebsform bei iranischen Männern. Wir haben die Überlebensraten und Prognosefaktoren von Magenkarzinompatienten einer Überweisungsklinik in Teheran, Iran untersucht. **Patienten und Methoden:** Insgesamt wurden 367 Magenkarzinompatienten, die zwischen 1991 und 2007 im Baqiyatallah-Krankenhaus stationär aufgenommen wurden, nachverfolgt. Überlebensraten wurden im Allgemeinen sowie spezifisch für chirurgisch behandelte Patienten estimiert. Die Hazard-Ratios (HR) für die verschiedenen Prognosefaktoren wurde mit dem Cox-Regressionsmodell ermittelt. Desweiteren wurden internationale Variationen bezüglich der Stadienverteilung und des 5-Jahresüberlebens untersucht. **Ergebnisse:** Insgesamt war das 5-Jahresüberleben beim Magenkarzinom gering (14%). Die Mehrzahl der Patienten (53%) wurde im Stadium IV diagnostiziert. Stadium, Tumorgroße, Alter und Geschlecht waren statistisch signifikante Prognosefaktoren. Das relative Mortalitätsrisiko im Stadium IV verglichen mit Stadium IA war 9,9 (95% Konfidenzintervall 5,8–16,9). Das höchste 5-Jahresüberleben wurde in Japan erzielt, insbesondere bei Patienten, die im Rahmen eines Screening-Programmes diagnostiziert werden (89,4%). Das 5-Jahresüberleben bei resezierbaren Patienten war 32,6% in Frankreich, 26% in den USA und 30,5% in China, ähnlich der in unserer Studie beobachteten Rate (24%). **Schlussfolgerungen:** Auf Grund der zumeist späten Diagnose ist die Prognose beim Magenkarzinom im Iran sehr schlecht. Frühe Diagnose und Downstaging-Strategien müssen priorisiert werden, um die Prognose zu verbessern.

## Introduction

Gastric cancer is the second cause of cancer death worldwide [1]. Although incidence and mortality rates of gastric cancer have decreased in Western countries, it is still a major killer in low and middle income countries, including Iran which exhibits the highest incidence rate of stomach cancer in the Middle East [2]. An age-standardized incidence rate (ASR) of up to about 50 per 100,000 for stomach cancer was reported in Northwestern Iran [3]. ASR of stomach cancer among males living in the capital city Tehran was 20 per 100,000 [2]. Survival rates of gastric cancer from different countries are varying. After age adjustment, the highest survival was reported from Japan where a mass screening program diagnoses patients in the early stages [1, 4]. In addition, early diagnosis of stomach cancer via endoscopic examination has led to relatively high survival in North America [1]. However, lower 5-year survival was reported from countries in Eastern Europe (15%) and from Sub-Saharan Africa (7%) [1]. Tumor stages, histology grade, age at diagnosis, surgical approach, and hospital or surgeon caseload are the main prognostic factors suggested for stomach cancer. A few studies have evaluated survival rates and prognostic factors of stomach cancer in Iran. The results of these studies are inconsistent, and 5-year survival rates from 0.8 up to 29.7% were reported [5, 6]. We used 15 years of data from a referral hospital (Baqiyatallah Hospital, Tehran) and estimated 1- to 5-year survival rates and prognostic factors of stomach cancer. We further compared the results of our study with survival rates reported from different countries.

## Patients and Methods

The Regional Ethics Committee of Baqiyatallah University approved this study. We followed 367 gastric adenocarcinoma patients who were hospitalized between 1991 and 2007 from the date of diagnosis until their death or end of follow-up (September 2007). We obtained follow-up information through telephone interviews with the patients or their close relatives, or the National Organization for Civil Registration (Sabt-e-Ahval). Age, date of diagnosis, sex, tumor size and stage, and type of treatment for the cohort were extracted from the hospital archive.

### Surgery and Treatment Routine

In Baqiyatallah Hospital, decisions about diagnosis and treatment of cancer patients are made in a weekly multidisciplinary tumor board session. Subtotal gastric resection for distal stomach cancer and total gastrectomy with Roux-en-Y esophagojejunostomy for proximal tumors is the main surgical approach. Among the cases with direct extension to adjacent organs, en bloc resection is performed. In all potentially curative surgeries, gastric resection is followed by removal of lymph nodes along the hepatic, left gastric, celiac, splenic arteries and splenic hilum (extended D1). Splenectomy is performed only in the case of spleen involvement. Palliative surgery is considered if curative surgery is impossible and patients need palliation. No major changes in the surgery protocols were made during the study period. Although adjuvant chemotherapy or chemoradiotherapy were administered after curative surgery with positive lymph node involvement or positive tumor margins, no neoadjuvant chemotherapy was given during the study period. In addition, combina-

tion chemotherapy was administered after palliative surgeries or among patients who were found unresectable during the laparotomy. Chemotherapy regimens included fluorouracil, adriamycin, mitomycin in the past and fluorouracil, adriamycin and cisplatin in more recent years. In elderly patients and those with lower performance, only fluorouracil and folic acid were administered.

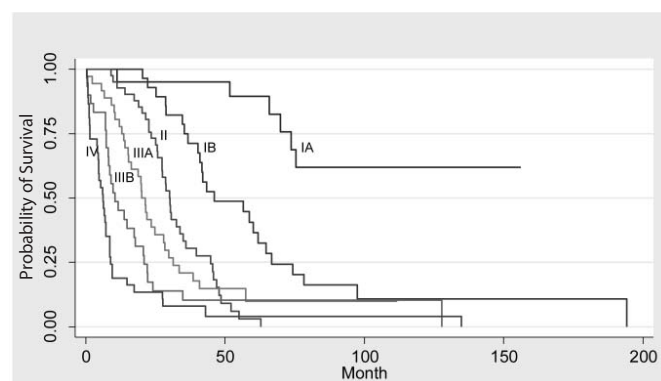
### Statistical Analyses

We estimated mean follow-up time, median survival time, and 1- to 5-year survival rates for stomach cancer. We used the Kaplan Meier and life table method to estimate crude survival rates. We estimated hazard ratios (HR) using Cox regression modeling and included tumor stage, grade, tumor size, age at diagnosis, place of residence, sex, stomach subsite (cardia/non-cardia). We repeated the analyses among patients who underwent curative surgery. STATA statistical software version 10 (StataCorp LP, College Station, TX, USA) was used for statistical analyses. We finally evaluated the published studies and compared stage distribution and 5-year survival reported from different countries.

## Results

The mean age at diagnosis for stomach adenocarcinoma was 63.5 years (standard deviation (SD)  $\pm$  11.8). Overall, 328 (89.4%) patients died during follow-up. Among our patients, 199 (54%) underwent curative and 63 (17%) palliative surgery, while 106 (29%) patients were not operated on, mainly due to metastases at the time of diagnosis. Median survival for stomach cancer was about 9 month overall, and 27 and 3.7 months among patients who received curative surgery or no surgery, respectively. One- and 5-year survival rates were 45 and 14% overall, and 71 and 24% among operable cases. However, almost all patients who received palliative surgery or were not operated on died during the 5 years after diagnosis.

Analyses restricted to operated patients showed an obvious difference of survival in the first and second years after operation (fig. 1). However, the survival curves converged soon and reached less than 10% before month 50, except for patients who were staged IA at diagnosis. Stage IA patients had more than 50% survival throughout the follow-up.



**Fig. 1.** Distribution of stomach cancer survival stratified by tumor stage at diagnosis among patients operated at the Baqiyatallah Hospital of Tehran from 1990 to 2007. The label above each line shows the tumor stage at diagnosis. Survival of stomach cancer in all stages higher than IA and IB converges and approaches zero before month 50.

**Table 1.** Hazard ratios (HR) of stomach cancer mortality and 95% confidence intervals (CI) for different variables among patients hospitalized between 1991 and 2007 at the Baqiyatallah Hospital, Tehran

Variable	Patients operated with curative intent		All patients	
	HR (95% CI)	n (%)	HR (95% CI)	n (%)
Stomach sub-site				
Cardia	reference	43 (21.5)	reference	96 (26.1)
Non-cardia	1.3 (0.8–2.0)	156 (78.0)	1.0 (0.8–1.4)	269 (73.3)
Stage				
0	0.7 (0.3–1.9)	6 (3.00)	0.7 (0.3–1.9)	6 (1.6)
IA	reference	20 (10.0)	reference	20 (5.4)
IB	1.5 (0.8–2.7)	28 (14.00)	1.2 (0.7–2.2)	28 (7.6)
II	4.6 (2.4–8.6)	41 (20.5)	2.7 (1.5–4.7)	45 (12.2)
IIIA	5.3 (2.8–10.0)	37 (18.5)	3.1 (1.7–5.6)	39 (10.6)
IIIB	6.7 (3.6–12.5)	31 (15.5)	4.3 (2.4–7.7)	37 (10.0)
IV	13.5 (6.6–27.7)	37 (18.5)	9.9 (5.8–16.9)	193 (52.4)
P value for trend	0.000	–	0.000	
Grade				
I	reference	69 (35.2)	reference	77 (21.4)
II	0.7 (0.5–1.0)	61 (31.1)	1.0 (0.7–1.4)	103 (28.7)
III	0.8 (0.5–1.15)	61 (31.1)	1.0 (0.7–1.4)	161 (44.8)
IV	1.3 (0.4–3.7)	5 (2.5)	1.3 (0.7–2.3)	18 (5.0)
P value for trend	0.3		0.74	
Age at diagnosis, years				
≤ 49	reference	23 (11.6)	reference	44 (12.0)
50–59	1.2 (0.7–2.1)	35 (17.6)	1.3 (0.8–2.0)	63 (17.2)
60–69	1.2 (0.7–2.0)	75 (37.7)	1.5 (1.0–2.2)	135 (36.8)
70–79	1.4 (0.8–2.0)	61 (30.6)	1.5 (1.0–2.2)	107 (29.2)
≥ 80	1.0 (0.4–2.8)	5 (2.5)	2.5 (1.4–4.6)	18 (4.9)
P value for trend	0.165		0.009	
Sex				
Female	reference	55 (27.5)	reference	95 (25.8)
Male	1.5 (1.0–2.1)	145 (72.5)	1.5 (1.1–1.9)	273 (74.2)
Province				
Tehran	reference	109 (54.5)	reference	197 (53.5)
Other	1.2 (0.88–1.7)	88 (44.0)	1.0 (0.8–1.30)	166 (45.1)
Tumor size, cm <sup>a</sup>				
1–4	reference	87 (49.1)	reference	98 (28.8)
4–6	1.5 (1.0–2.2)	42 (23.7)	1.7 (1.3–2.4)	80 (23.5)
7–9	1.7 (1.0–2.3)	30 (16.9)	2.2 (1.6–3.0)	79 (23.2)
9–15	4.2 (2.3–7.7)	18 (10.2)	2.5 (1.8–3.5)	83 (24.4)
P value for trend	0.000		0.000	

<sup>a</sup>Because stage is a combination of tumor size, lymph node involvement, and distance metastasis, tumor size and stage were not studied in the same model. All other estimates were based on the model including stage.

Based on multivariate analyses, stage, tumor size, age, and gender were significant prognostic factors for stomach cancer. Tumor stage was the most important prognostic factor (table 1). Patients with stage IIIA or more had a more than 3-fold higher risk of mortality compared to patients who were staged IA. HRs of up to 10 (HR = 9.9, 95% confidence interval (CI) 5.8–16.9) were estimated in stage IV. This increasing trend on relative risk was statistically significant ( $p < 0.001$ ). The 1.5-fold significant excess relative risk among male compared to female patients remained constant in the model restricted to operable patients (HR = 1.5, 95% CI 1.0–2.1).

Five-year survival in France (32.6%), the USA (26%), China (30.5%), and Japan (screening: 89.4%, no screening: 66.5%) was better than in our patients (24%) (table 2). In Japan, overall survival was significantly higher than in other countries, and patients who were diagnosed through screening had a better 5-year survival (89.4%) than patients who were diagnosed without screening (66.5%) [4]. In a multi-center German study in which survival rate was estimated based on data from 19 centers in Germany and Austria, more extensive lymph node dissection and examination of

more than 25 lymph nodes resulted in a better prognosis than dissection of less than 25 lymph nodes. In stage I and stage II, patients with more dissected lymph nodes experienced longer survival. A few studies from countries including Norway, the Netherlands, Jordan, and Chile included all stomach cancer patients without any restrictions to their analyses. Because the majority of patients in these studies were stage IV, overall survival was considerably lower than in operated cohorts. While 5-year survival was low in these studied, the lowest survival was reported from Chile (10.4) followed by Iran (14%).

## Discussion

In this study, 5-year survival of stomach cancer was 14% overall and 24% among operable patients. Tumor stage, tumor size, age, and gender were the main prognostic factors. Data from the Cancer Institute of Iran showed that 5-year survival rates of stomach cancer were 12% overall and 25% among operable patients [8, 9], supporting the results of our study.

Due to a screening program, most patients are diagnosed in the early stages in Japan. Five-year survival for stomach cancer was notably higher in Japan than the rates reported from the USA, France, Germany, and other Western countries. The reason for this superior outcome in Japan could be screening and diagnosis at an earlier stage and extensive surgery (D2) [10]. Although more extensive surgery and radical gastrectomy with level 2 extended lymphadenectomy (D2 resection) is favored in Japan, clinical trials in Western countries could not show a survival benefit from D2 resection, and a more limited lymph node dissection (D1 resection) is still practiced [11–13]. The German multi-center study stratified the results of survival analyses by number of lymph node dissection. Although overall 5-year survival was not reported, removal and examination of more than 25 lymph node lead to a higher survival rate, particularly in stages I, II, and IIIA [7]. Although the incidence rate of stomach cancer in Iran is as high as the rates reported from Japan, Iranian surgeons favor a more conservative approach.

Studies from the USA, Germany, France, China, and Japan restricted their analyses to operable patients (local-regional), while reports from Norway, the Netherlands, Jordan, and Chile included both operable and advanced cancers. Although the Chinese study was based on operable patients, more than 50% of patients were in stage IV [14]; As previously suggested, comparison of stomach cancer prognosis from different countries is challenging [15]. Variation in selection criteria, stage distribution, study size, experience of the surgeons, hospital volume, type of operation, and extent of lymph node dissection may explain the observed differences.

It is widely accepted that stage at diagnosis is the main prognostic factor for gastric cancer patients [7, 16, 17]. Stage IV patients had a 10-fold excess risk of mortality compared to stage IA. In addition, in line with previous reports [18–21], age at diagnosis was associated with stomach cancer survival in this study, although some authors found no association [5,

22–26]. Poor prognosis among older patients could be associated with co-morbidities and intolerance to the surgery or other aggressive treatment modalities. We found that patients who were referred from other cities had a relatively more advanced stage compared to those living in the capital city Tehran. Although survival data from different parts of the country are scarce, 5-year survival in the Ardabil province, a less developed province in Northwestern Iran, was reported to be about zero [5], most likely due to late diagnoses, surgical skills, treatment in a low-volume hospital, and poor health care and hospital facilities. Further studies are needed to scrutinize the reasons for lower survival among patients living in small and less developed regions.

Attempts need to be made to increase early detection and downstaging in our high risk area. Implementation of a national guideline for diagnosis, treatment, and follow-up of stomach cancer patients in all hospitals/centers dealing with these patients may mitigate the disparities and improve overall survival of stomach cancer in Iran. Because detailed clinical information is important for evaluation of the cancer survival, we propose a large multicenter prospective study in Iran that includes data from large and small-volume hospitals.

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### Disclosure Statement

All authors declare no conflict of interest.

### References

- Parkin DM, Bray F, Ferlay J, Pisani P: Global cancer statistics, 2002. *CA Cancer J Clin* 2005;55:74–108.
- Mohagheghi MA, Mosavi-Jarrahi A, Malekzadeh R, Parkin M: Cancer incidence in Tehran metropolis: the first report from the Tehran population-based cancer registry, 1998–2001. *Arch Iran Med* 2009; 12:15–23.
- Sadjadi A, Malekzadeh R, Derakhshan MH, Sepehr A, Nouraei M, Sotoudeh M, Yazdanbod A, Shokoohi B, Mashayekhi A, Arshi S, Majidpour A, Babaei M, Mosavi A, Mohagheghi MA, Alimohammadian M: Cancer occurrence in Ardabil: results of a population-based cancer registry from Iran. *Int J Cancer* 2003;107:113–118.
- Kunisaki C, Ishino J, Nakajima S, Motohashi H, Akiyama H, Nomura M, Matsuda G, Otsuka Y, Ono HA, Shimada H: Outcomes of mass screening for gastric carcinoma. *Ann Surg Oncol* 2006;13: 221–228.
- Samadi F, Babaei M, Yazdanbod A, Fallah M, Nouraei M, Nasrollahzadeh D, Sadjadi A, Derakhshan MH, Shokuhi B, Fuladi R, Malekzadeh R: Survival rate of gastric and esophageal cancers in Ardabil province, north-west of Iran. *Arch Iran Med* 2007;10:32–37.
- Moghimi-Dehkordi B, Safaee A, Zali MR: Survival rates and prognosis of gastric cancer using an actuarial life-table method. *Asian Pacific J Cancer Prevention* 2008;9:317–322.
- Siewert JR, Bottcher K, Stein HJ, Roder JD: Relevant prognostic factors in gastric cancer: ten-year results of the German gastric cancer study. *Ann Surg* 1998;228:449–461.
- Sadighi S, Raafat J, Mohagheghi M, Meemary F: Gastric carcinoma: 5 year experience of a single institute. *Asian Pac J Cancer Prev* 2005;6:195–196.
- Zeraati H, Mahmoudi M, Kazemnejad A, Mohammad K: Postoperative survival in gastric cancer patients and its associated factors: a time dependent covariates model. *Iranian J Publ Health* 2006;35:40–46.
- Sasako M, Sano T, Yamamoto S, Kurokawa Y, Nashimoto A, Kurita A, Hiratsuka M, Tsujinaka T, Kinoshita T, Arai K, Yamamura Y, Okajima K: D2 lymphadenectomy alone or with para-aortic nodal dissection for gastric cancer. *N Engl J Med* 2008; 359:453–462.
- Cuschieri A, Fayers P, Fielding J, Craven J, Bancewicz J, Joypaul V, Cook P: Postoperative morbidity and mortality after d1 and d2 resections for gastric cancer: preliminary results of the MRC randomised controlled surgical trial. *The surgical cooperative group. Lancet* 1996;347:995–999.
- Bonenkamp JJ, Songun I, Hermans J, Sasako M, Welvaart K, Plukker JT, van Elk P, Obertop H, Gouma DJ, Taat CW, et al.: Randomised comparison of morbidity after d1 and d2 dissection for gastric cancer in 996 Dutch patients. *Lancet* 1995;345:745–748.
- Cuschieri A, Weeden S, Fielding J, Bancewicz J, Craven J, Joypaul V, Sydes M, Fayers P: Patient survival after d1 and d2 resections for gastric cancer: long-term results of the MRC randomized surgical trial. *Surgical co-operative group. Br J Cancer* 1999;79:1522–1530.

- 14 Deng J, Liang H, Sun D, Wang D, Pan Y: Suitability of 7th UICC N stage for predicting the overall survival of gastric cancer patients after curative resection in China. *Ann Surg Oncol* 2010;17:1259–1266.
- 15 Lello E, Furnes B, Edna TH: Short and long-term survival from gastric cancer. A population-based study from a county hospital during 25 years. *Acta Oncol* 2007;46:308–315.
- 16 Tian J, Wang XD, Chen ZC: Survival of patients with stomach cancer in Changle City of China. *World J Gastroenterol* 2004;10:1543–1546.
- 17 Launoy G, Milan C, Day NE, Pienkowski MP, Gignoux M, Faivre J: Diet and squamous-cell cancer of the oesophagus: a French multicentre case-control study. *Int J Cancer* 1998;76:7–12.
- 18 Pinto-De-Sousa J, David L, Seixas M, Pimenta A: Clinicopathologic profiles and prognosis of gastric carcinomas from the cardia, fundus/body and antrum. *Dig Surg* 2001;18:102–110.
- 19 Faivre J, Forman D, Esteve J, Gatta G: Survival of patients with oesophageal and gastric cancers in Europe. Eurocare Working Group. *Eur J Cancer* 1998;34:2167–2175.
- 20 Gatta G, Capocaccia R, Coleman MP, Gloeckler Ries LA, Hakulinen T, Micheli A, Sant M, Verdecchia A, Berrino F: Toward a comparison of survival in American and European cancer patients. *Cancer* 2000;89:893–900.
- 21 Pinheiro PS, van der Heijden LH, Coebergh JW: Unchanged survival of gastric cancer in the south-eastern Netherlands since 1982: result of differential trends in incidence according to Lauren type and subsite. *Int J Cancer* 1999;84:28–32.
- 22 Kim JP, Kim YW, Yang HK, Noh DY: Significant prognostic factors by multivariate analysis of 3,926 gastric cancer patients. *World J Surg* 1994;18:872–877; discussion 877–878.
- 23 Li Q, Hao X, Zhang D: (Gastric cancer in the young). *Zhonghua Zhong Liu Za Zhi* 1999;21:224–226.
- 24 Jin F, Wang S, Chen J, Qi C, Shan J, Xu H, Zhang W: (Biologic behavior and prognosis of patients with gastric cancer in young persons). *Zhonghua Wai Ke Za Zhi* 1999;37:154–156.
- 25 Sasao S, Hiyama T, Tanaka S, Yoshihara M, Yasui W, Chayama K: Clinicopathologic and genetic characteristics of gastric cancer in young male and female patients. *Oncol Rep* 2006;16:11–15.
- 26 Cunningham SC, Kamangar F, Kim MP, Hammoud S, Haque R, Iacobuzio-Donahue C, Ashfaq R, Kern SE, Maitra A, Heitmiller RE, Choti MA, Lillemoe KD, Cameron JL, Yeo CJ, Montgomery E, Schulick RD: MKK4 status predicts survival after resection of gastric adenocarcinoma. *Arch Surg* 2006;141:1095–1099; discussion 1100.
- 27 Msika S, Benhamiche AM, Jouve JL, Rat P, Faivre J: Prognostic factors after curative resection for gastric cancer. A population-based study. *Eur J Cancer* 2000;36:390–396.
- 28 Cunningham SC, Kamangar F, Kim MP, Hammoud S, Haque R, Maitra A, Montgomery E, Heitmiller RE, Choti MA, Lillemoe KD, Cameron JL, Yeo CJ, Schulick RD: Survival after gastric adenocarcinoma resection: eighteen-year experience at a single institution. *J Gastrointest Surg* 2005;9:718–725.
- 29 Bani-Hani KE, Yaghan RJ, Heis HA, Shatnawi NJ, Matalka, II, Bani-Hani AM, Gharaibeh KA: Gastric malignancies in northern Jordan with special emphasis on descriptive epidemiology. *World J Gastroenterol* 2004;10:2174–2178.
- 30 Heise K, Bertran E, Andia ME, Ferreccio C: Incidence and survival of stomach cancer in a high-risk population of Chile. *World J Gastroenterol* 2009;15:1854–1862.

**Table 2.** Comparison of stage distribution and 5-year survival of stomach cancer by stage in different countries

	All gastric cancer patients										
	After Gastric resection			The Netherlands [21]							
	France [27]	USA [28]	Germany <sup>a</sup> [7] < 25 LN	Germany <sup>a</sup> [7] > 25 LN	China [14]	Japan <sup>b</sup> [4] non-screening	Japan <sup>b</sup> [4] screening	Norway [15]	Jordan [29]	Chile [30]	Present study
Study period	1976–1995	1984–2002	1986–1989	1986–1989	1997–2003	1992–2000	1992–2000	1980–2004	1991–2001	1998–2002	1991–2007
Sample size, n	649	425	379	803	456	581	337	356	201	629	367
Stage distribution, %											
Stage I	13	20	25	16	16.2	46.3	62.9	3.6	9	2.1	5.5
Stage IA	9.4	19	20	17	16.2	17.4	13.6	5.6			7.7
Stage IB	28	34	20	16	16.2	15.5	26.7	7.5	24.4	4.1	12.4
Stage II	29.2		17	18	16.2	9.1	3.0	8.7	35.1	12.1	
Stage IIIA	6.1	27	8	16		3.6	3.9	3.9			10.8
Stage IIIB	12.1		9	17	51.0	8.1	3.0	46	31.5	64.0	10.2
Stage IV	1.6							24		17.8	53.3
Unstaged											
5-year survival, %											
Stage I	69.3	63	81.4	84.3	95.8	99.5	96.9	91	67.3	85.1	89
Stage IA	52.9		68.6	68.0		93.5	83.1	64			41
Stage IB	38.1		29.2	56.7	66.7	73.0	74.3	27		65.4	3
Stage II	19.5	18	24.3	32.1	34.7	69.3	52.7	18	5.7	32.2	9
Stage IIIA	2.5		20	13.5		56.0	27.8	0			10
Stage IIIB	8.2	10	21.7	21.7	9.1	50.0	20.9	0	0	2.2	2
Stage IV	32.6	26	NA	NA	30.5	89.4	66.5		21.1	3.8	14
Unstaged											
Overall											

<sup>a</sup>German study provided the 5-year survival stratified by number of lymph node dissection (less or more than 25 lymph node). Overall 5-year survival was not provided in the paper.

<sup>b</sup>Japanese study separated the 5-year survival among patients who were detected by screening and patients who were detected through routine admission.

LN = Lymph nodes.