

Incidence of Stomach Cancer in Oman and the Other Gulf Cooperation Council Countries

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Abstract

Objectives: Stomach cancer is the most common cancer among males in Oman and the second most frequent among females from 1997 to 2007. Reports have suggested the rate is higher in Oman than in the other GCC countries. This study aims to describe the epidemiology of stomach cancer in Oman and to explore the apparent differences in the incidence of stomach cancer between Oman and the other Gulf Cooperation Council (GCC) countries.

Methods: Data were obtained from the Omani National Cancer Registry (1997 - 2007) and from Gulf Centre for Cancer Registration reports (1998 - 2004).

Results: The annual average age-adjusted incidence rates for stomach cancer in Oman were 10.1 per 100,000 for males and 5.6 per 100,000 for females between 1997 and 2007. The age-adjusted incidence varied by region within Oman, and the incidence rate was higher in Oman than in most other GCC countries between 1998 and 2004.

Conclusion: Further investigation of the completeness and accuracy of cancer registration is essential for exploration of variations in stomach cancer rates in the GCC countries.

Keywords: Oman; Stomach cancer; Epidemiology; Incidence; Gulf Cooperation Council.

Introduction

Stomach cancer is a major contributor to the global burden of cancer morbidity and mortality. It is the fourth most commonly occurring cancer worldwide, with an estimated 933,000 new cases diagnosed annually.¹ Moreover, because of its poor prognosis, it is the second most common cause of cancer death.

There are substantial variations in the incidence of stomach cancer by region and nation, with the highest rates being observed in Asia, Eastern Europe, and the western region of South America. Annual age-standardised incidence for males vary from four per 100,000 to 42 per 100,000, and the rates in females are generally about half those of males.² The trends in stomach cancer incidence over time depend on the subtype, but overall there has been a

decline.¹ It is thought that much of the decline is due to changes in environmental risk factors, such as salt consumption, which has declined as refrigeration replaced salt preservation.³

In Oman, a member of the Gulf Cooperation Council (GCC), stomach cancer was the most common cancer in men and the second most frequent cancer in women over the decade 1997-2007.⁴ Furthermore, a recent report suggested that for both men and women, the age-standardised incidence of stomach cancer is higher in Oman than in all other GCC nations (Saudi Arabia, the United Arab Emirates [UAE], Qatar, Bahrain, and Kuwait).⁵ However, not all of the GCC countries had mandatory reporting systems when these data were collected, and there may have been other variations in reporting systems affecting data quality and completeness. Hence, while the reported differences in incidence could be real, they may also be an artefact of incomplete reporting.

This study had two broad aims, firstly; to describe the epidemiology of stomach cancer in Oman, and secondly; to explore the apparent differences in reported stomach cancer incidence between Oman and other GCC states.

Methods

The Omani National Cancer Registry (NCR) is a population-based registry which was established in 1996, although cancer notification did not become mandatory until 2001.⁴ The number of stomach cancer registrations in Oman in each of the years from 1997 to 2007 were obtained from the annual NCR reports. These data were available by sex and age (in 5 year categories) at the national level, however regional data comprised total counts only (both sexes and all ages combined). Similarly, national figures were available separately for stomach cancer and malignant gastric lymphoma, whereas in the regional data, these were combined. Population counts (based on census data) by age, sex and region were obtained from the statistical year books published annually by the Ministry of National Economy.

Kuwait was the first GCC country to establish a population-based national cancer registry (in 1974), followed by Qatar (1990), Saudi Arabia (1994), Oman (1996), UAE (1998), and Bahrain (1998).⁶⁻¹⁰ In Kuwait, Qatar, Saudi Arabia, and Bahrain, notification of cancer diagnoses was mandatory from the outset, however registration did not become compulsory in Oman or UAE until 2001.^{6,9} The Gulf Centre for Cancer Registration (GCCR), which was established in 1998, collects data from each of the

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GCC national cancer registries and publishes periodic incidence reports.⁵ Although several possible sources of information about stomach cancer in the GCC countries were identified,^{2,5,10} the GCCR reports were the only publications which provided original data (including counts of cancer registrations) from all of the national cancer registries in the Gulf. Apart from Saudi Arabia and UAE, figures in other publications were based on the same cancer registry data. For Saudi Arabia and UAE, figures given in the Globocan database were estimates based on data from surrounding countries.² The number of cases of stomach cancer by country, sex, and age in the years 1998 - 2004, were therefore obtained from three GCCR reports which covered the years 1998 - 2002 combined, 2003, and 2004.^{5,11,12} More recent data were not available. These reports excluded malignant gastric lymphoma from the counts of stomach cancer because it was regarded as a lymphoma. Malignant gastric lymphomas make up about 5-10% of all stomach cancer cases.⁴ Population data for each of the GCC countries were also obtained from these reports.

Incidence rates of stomach cancer were age-standardised to the World Standard Population of Segi,¹³ and 95% confidence intervals were computed using the method proposed by Fay and Feuer based on the gamma distribution.¹⁴ The estimated populations at the midpoint of the relevant time-periods were used as denominators. Standardised morbidity ratios (SMR) were calculated for each region of Oman rather than using directly standardised rates because numbers in each region were small and age-specific figures were not available. To calculate 95% confidence intervals, Byar's approximation,¹⁵ was used if the observed number was more than 100 cases and the Poisson distribution was used if the observed number was less than 100.

Poisson regression was used to calculate adjusted relative risks and 95% confidence intervals in the comparison of stomach cancer incidence in the individual GCC countries relative to the rates in Oman.

Ethical approval for the research was granted by the University of Otago Human Ethics Committee and the Ministry of Health ethics committee, Oman.

Results

Between 1997 and 2007, on average 45 males and 25 females were registered with stomach cancer each year in Oman. Most cases were aged 45 years or older (90% of males, 83% of females). The age-standardised average annual incidence rates for males and females during the period 1997 - 2007 were 10.1 (95% CI 9.2 - 11.0) and 5.6 (95% CI 4.9 - 6.3) per 100,000 respectively.

Overall, the age-standardised annual incidence of stomach cancer in males and in females declined between 1997 and 2007, (Fig. 1). Among males, there was no suggestion of increased reporting following the introduction of compulsory notification in 2001. In fact, there was a noticeable dip in 2003, followed by higher incidence rates in 2004 and 2005, after which the rates continued to decline. In females, the dip was less pronounced, but there was

a sharp increase in 2004. Overall, for both males and females, the average annual rates in the periods before (1997 - 2000) and after (2001 - 2007) mandatory notifications were very similar.

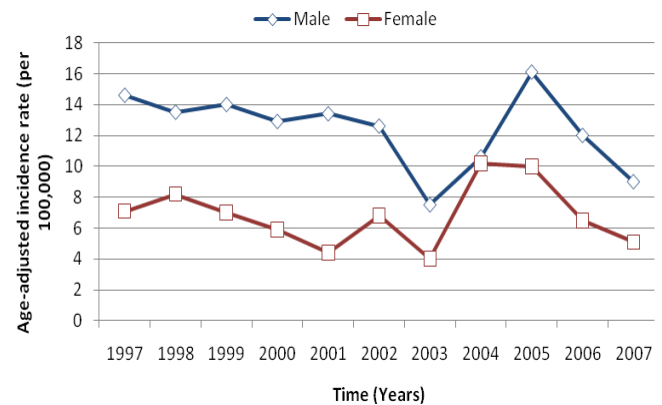


Figure 1: The trend of age-adjusted annual incidence rate of stomach cancer in Oman.*

*Excludes malignant gastric lymphoma

Regional variations in stomach cancer incidence were evaluated using indirect standardization because data by age-group were not available, and the numbers were small. Over the period of 1997-2007, four of the five coastal regions, Al-Batinah, Muscat, Dhofar and Musandam, had higher numbers of cases than would be expected based on the national age-specific incidence rates, (Table 1). However, the difference was statistically significant only for Al-Batinah and Muscat; the SMRs for these were 1.21 (95% CI 1.17 to 1.24) and 1.15 (95% CI 1.10 to 1.20) respectively. For Dhofar and Musandam, the confidence intervals were wider reflecting smaller populations in these areas. In the remaining coastal area, Asharqiyah, the number of cases was very close to what would be expected. There were fewer than expected cases in the three inland regions, Addhahirah, Al-Wusta and Addakhliyah; the differences were statistically significant for Addhahirah and Addakhliyah, with SMRs 0.29 (95% CI 0.18 to 0.45) and 0.66 (95% CI 0.51 to 0.83) respectively. Similar patterns were observed when SMRs were calculated for the periods before and after mandatory notification.

The age-standardised average annual incidence rates and relative risks of notified stomach cancer in the GCC countries for the period of 1998 - 2004 are shown in Table 2. For both males and females, the highest age-standardised incidence rates were observed in Oman.

The rates for males in Saudi Arabia, UAE, Bahrain, and Kuwait were all significantly lower than the rate in Omani males; the age-adjusted relative risks were between 0.26 and 0.64. A lower incidence was also observed for males in Qatar, although this was of borderline significance. The pattern for females was very similar, although with smaller numbers the estimates were less precise and a significantly lower risk was observed for Saudi Arabia, the UAE, and Kuwait only.

Table 1: Number of stomach cancer cases and standardised morbidity ratios (SMR) for the regions of Oman over the period 1997 - 2007. Separate figures are also given for the two periods before and after introduction of mandatory reporting of cancer cases (1997 - 2000 and 2001 - 2007). SMRs were calculated using the age-specific rates for the total population of Oman. Figures available for the regions include malignant gastric lymphomas.

Region	Population 2001	1997 – 2000		2001 – 2007		1997 – 2007	
		No. of cases	SMR (95% CI)	No. of cases	SMR (95% CI)	No. of cases	SMR (95% CI)
Addhahirah	165,500	6	0.20 (0.07 – 0.44)	14	0.36 (0.19 – 0.60)	20	0.29 (0.18 – 0.45)
Al-Wusta	16,814	1	0.32 (0.01 – 1.76)	3	0.56 (0.12 – 1.63)	4	0.47 (0.13 – 1.20)
Addakhliyah	242,669	29	0.66 (0.44 – 0.95)	40	0.66 (0.47 – 0.90)	69	0.66 (0.51 – 0.83)
Asharqiyah	267,788	46	0.88 (0.65 – 1.18)	85	1.11 (0.89 – 1.38)	131	1.02 (0.98 – 1.07)
Al-Batinah	573,058	122	1.17 (1.11 – 1.22)	185	1.23 (1.15 – 1.33)	307	1.21 (1.17 – 1.24)
Muscat	377,777	73	1.26 (0.99 – 1.58)	92	1.07 (0.86 – 1.31)	165	1.15 (1.10 – 1.20)
Dhofar	155,090	36	1.37 (0.96 – 1.89)	45	1.18 (0.86 – 1.58)	81	1.26 (1.00 – 1.56)
Musandam	27,428	10	1.85 (0.89 – 3.40)	10	1.41 (0.68 – 2.59)	20	1.60 (0.98 – 2.47)

Table 2. Standardised average annual incidence rates and relative risks of stomach cancer in the GCC countries for 1998 – 2004 by sex and age-group. Figures exclude malignant gastric lymphomas.

Country	Males		Females	
	ASR (95%CI) per 100,000	RR (95%CI)	ASR (95% CI) per 100,000	RR (95%CI)
Oman	11.6 (10.4 – 12.9)	1.0	6.0 (5.2 – 7.0)	1.0
Saudi Arabia	3.1 (2.9 – 3.3)	0.26 (0.23 – 0.29)*	1.7 (1.5 – 1.8)	0.28 (0.23 – 0.33)*
UAE	6.6 (5.2 – 8.2)	0.55 (0.44 – 0.70)*	3.4 (2.4 – 4.8)	0.56 (0.40 – 0.79)*
Qatar	7.8 (5.0 – 11.6)	0.67 (0.44 – 1.0)	4.3 (2.3 – 7.8)	0.79 (0.46 – 1.40)
Bahrain	7.9 (6.0 – 10.1)	0.64 (0.49 – 0.84)*	5.3 (3.8 – 7.1)	0.85 (0.62 – 1.20)
Kuwait	4.0 (3.0 – 5.3)	0.33 (0.25 – 0.45)*	2.4 (1.7 – 3.4)	0.42 (0.30 – 0.59)*
Country	Less than 45 years		45 years and over	
	ASR (95%CI) per 100,000	RR (95%CI)	ASR (95% CI) per 100,000	RR (95%CI)
Oman	1.0 (0.8 – 1.3)	1.0	31.4 (28.5 – 34.4)	1.0
Saudi Arabia	0.26 (0.23 – 0.30)	0.28 (0.21 – 0.37) [†]	8.4 (8.0 – 8.9)	0.26 (0.24 – 0.29) [†]
UAE	0.54 (0.30 – 0.90)	0.54 (0.31 – 0.94)*	18.3 (15.0 – 22.1)	0.56 (0.45 – 0.69) [†]
Qatar	0.90 (0.30 – 1.80)	0.78 (0.36 – 1.7)	21.6 (14.7 – 30.7)	0.69 (0.48 – 0.99) [†]
Bahrain	0.56 (0.30 – 0.98)	0.57 (0.31 – 1.0)	23.6 (19.1 – 28.9)	0.74 (0.59 – 0.92) [†]
Kuwait	0.30 (0.20 – 0.50)	0.32 (0.18 – 0.58) [†]	11.4 (8.9 – 14.3)	0.37 (0.29 - 0.47) [†]

* *P* value <0.05

[†] *P* value <0.01

To explore possible between-country differences in the occurrence of early-onset stomach cancer (predominantly determined by genetic causes) and cancer occurring at older ages (predominantly attributable to environmental causes), sex and age-standardised incidence rates in two age groups (<45 and ≥45 years) were also estimated. Compared with other GCC countries during the period of 1998 - 2004, Oman had the highest sex and age-standardised average annual incidence of both early-onset stomach cancer and cancer occurring at older ages, (Table 2). Among those aged 45 years and above, the rates in the other GCC countries were all significantly lower than the incidence in Oman. For early-onset stomach cancer, where the number of cases were smaller, Saudi Arabia, UAE, and Kuwait all had significantly lower incidence rates of early-onset stomach cancer than Oman; the relative risk for Bahrain was of borderline significance.

Data from two periods, 1998 - 2002 and 2003 - 2004, were also analysed separately to explore the impact of the later introduction of mandatory cancer registration in Oman and the UAE. It was not possible to undertake analyses for the periods before and after

2001 because data for the period 1998 - 2002 were not provided by individual year. Results for the between-country comparisons in the two periods (1998 - 2002 and 2003 - 2004) for males and females, and those aged <45 years and ≥45 years, were very similar to those found for the combined 7-year period.

Discussion

This is the first study to describe the epidemiology of stomach cancer in Oman, and provides a summary of available data on stomach cancer incidence both in Oman and in the surrounding GCC countries. During the period of 1997 - 2007, the age-standardised average annual incidence rates of stomach cancer for Omani males and females were 10.1 (95% CI 9.2 - 11.0) and 5.6 (95% CI 4.9 - 6.3) per 100,000 respectively. While these rates are low compared with rates in countries such as Korea and Japan, the data presented here suggests they may be high compared with other GCC countries. Nevertheless, there remain questions about the degree of under-reporting in all GCC countries.

In Oman, the age-standardised annual incidence rates of stomach cancer declined between 1997 and 2007 in males and females, although there were marked fluctuations between 2003 and 2005. In 2003, a sudden drop in incidence was observed for many cancers in Oman,⁴ and this was followed by a more than compensatory increase in 2004 and 2005, suggesting some systematic issue with cancer registrations. It has been suggested that the drop in 2003 was due to a shortage of staff at the cancer registry and the 2004 - 2005 increase was related to the opening of the National Oncology Centre in Oman in 2004. As well as bringing all cancer patients to one specialised centre for treatment, the Centre introduced radiotherapy treatment in Oman for the first time. This may have facilitated capturing some of the cancer cases which may have been missed in the past because they were sent abroad for treatment.

Regional variations in incidence were observed in Oman, with coastal regions tending to have higher numbers of cases than would be expected based on the national Omani age-specific incidence rates, and inland regions having lower numbers. It is possible that the patterns of under-reporting differed by region; for example, cases in the more remote inland regions may have been more likely to be missed. Alternatively, differences in exposure to risk factors might explain the findings. For example, people living in coastal areas may consume more salt-preserved fish.

Compared with Omani males, reported cases in males from the other GCC countries all gave lower reported age-standardised annual incidence rates of stomach cancer; the relative risks for Saudi Arabia, UAE, Bahrain, and Kuwait were all statistically significant. Similarly, the numbers for females in other GCC countries gave lower age-standardised rates than for Omani females; a significantly lower risk was observed for Saudi Arabia, the UAE, and Kuwait.

The sex and age-standardised rates of early-onset and later onset stomach cancer were both higher in Oman than in any of

the other GCC countries. Unfortunately, information about anatomical site (cardia or non-cardia) was not recorded for most of the registered cases of stomach cancer in the Omani NCR. Similarly, data provided in the GCCR reports did not specify the site or histological type (diffuse or intestinal) of stomach cancer. Hence it was not possible to ascertain which site and histological type accounted for the apparent differences in rates between Oman and the other GCC countries; differences in the incidence of stomach cancer of the non-cardia site and intestinal histological type (predominantly environmentally determined) are thought to explain most of the international variation in overall stomach cancer incidence.¹⁶ A search of the medical literature and key health,¹⁷⁻²³ and other,^{24,25} websites was carried out to explore variations in the prevalence of risk factors (including *H. pylori* infection, smoking, salt intake, obesity, socio-economic status, and fruit and vegetable intake). However the search failed to find reliable data, either by region of Oman or for the separate GCC countries.

The absence of a comprehensive review of the completeness and quality of cancer registrations in all of the GCC countries limits the conclusions that can be drawn from the comparative analyses. It was not possible to undertake such an evaluation in this study because the necessary data were not freely available; however, some useful information was derived from the GCCR reports and two additional sources, the Cancer Incidence in Five Continents reports (published by the International Agency for Research on Cancer, IARC) and the IARC Globocan database (which contains country-specific estimates of cancer incidence throughout the world in 2002). The latest IARC Cancer Incidence in Five Continents periodic report (covering the period 1998 - 2002), which contained only those data from cancer registries which were considered to be of sufficient quality and completeness, included data from only three of the GCC countries: Oman, Kuwait, and Bahrain. Data submitted by Saudi Arabia were apparently excluded because of concerns about completeness, while UAE and Qatar did not submit data. The estimated 2002 stomach cancer incidence rates for Oman, Qatar, Bahrain and Kuwait which were published in the Globocan database were all based on original data provided by the respective national cancer registries and were therefore similar to those published in the 1998 - 2002 GCCR incidence report.² However, the incidence rates presented for Saudi Arabia and UAE were estimated using data from Oman, Kuwait, Israel, and Jordan, because of concerns regarding incomplete reporting,² and the resulting rates were higher than those published in the GCCR report. The 1998 - 2002 GCCR report also revealed a very high percentage of microscopic verification as a basis for diagnosis in Saudi Arabia, a quality indicator which suggests that some cases could have been missed. In addition, it was noted that only Kuwait and Bahrain had adequate mortality databases and were therefore able to identify additional cases from death certificates.

Hence, there is some evidence to suggest that there may be under-reporting of cancer cases in Saudi Arabia and possibly in UAE. The impact of this would have been to underestimate the

true incidence and hence bias the relative risks further away from 1.0. Nonetheless, if there truly were no differences in the rates between Oman and Saudi Arabia, at least 400 stomach cancer cases annually would need to be unregistered in Saudi Arabia (total population 16.1 million in 2003)¹¹ to account for a relative risk of 0.3. The corresponding figures for UAE (total population 858,710 in 2003)¹¹ would be 35 unregistered cases annually to explain a relative risk of 0.5. Thus it seems unlikely that under-reporting could entirely account for the difference in rates.

Several of the findings in this study are consistent with previous research in other countries. In Oman and the other GCC countries, the incidence of stomach cancer in males was approximately twice that of females; a similar two-fold difference in risk has been documented in many other countries.² The male: female ratio in the present study approached 1.0 for early-onset stomach cancer (data not shown), as has been observed elsewhere.²⁶⁻²⁸ Similarly, the observed decline in the incidence in Oman over time is consistent with international findings.²⁹

Conclusion

This study has highlighted the importance of collecting and recording good quality cancer data. Further investigation into the quality and completeness of cancer registration practices in the GCC countries is required before any firm conclusions can be drawn as to whether Omani males and females really do have higher rates of stomach cancer than citizens of neighboring GCC countries. If it transpires that the differences are real, more research will be needed into the prevalence of known risk (and protective) factors for stomach cancer in the GCC countries before any possible explanations for the variation in rates can be identified.

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