

Research article

Open Access

Comparison of breast cancer survival in two populations: Ardabil, Iran and British Columbia, Canada

Alireza Sadjadi^{1,2}, T Gregory Hislop³, Chris Bajdik*³, Morteza Bashash³, Anahita Ghorbani¹, Mehdi Nouraie¹, Masoud Babaei¹, Reza Malekzadeh¹ and Parvin Yavari*⁴

Address: ¹Digestive Disease Research Center, Shariati Hospital, Tehran University of Medical Sciences; Kargar Street, Tehran, Iran, ²Department of Epidemiology, University Medical Center Groningen, Groningen, the Netherlands, ³Cancer Control Research Program, BC Cancer Agency, Vancouver British Columbia, Canada and ⁴Department of Health and Community Medicine, School of Medicine and Department of Epidemiology, School of Public Health, Shahid Behshti University of Medical Sciences, Tehran Iran

Email: Alireza Sadjadi - sadjadi@ams.ac.ir; T Gregory Hislop - gmsislop@telus.net; Chris Bajdik* - cbajdik@bccrc.ca; Morteza Bashash - mbashash@bccrc.ca; Anahita Ghorbani - ghorbani@ams.ac.ir; Mehdi Nouraie - normehdi@ams.ac.ir; Masoud Babaei - masoud_babaei@yahoo.com; Reza Malekzadeh - malek@ams.ac.ir; Parvin Yavari* - parvinyavari@yahoo.com

* Corresponding authors

Published: 28 October 2009

Received: 2 September 2008

BMC Cancer 2009, 9:381 doi:10.1186/1471-2407-9-381

Accepted: 28 October 2009

This article is available from: <http://www.biomedcentral.com/1471-2407/9/381>

© 2009 Sadjadi et al; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Patterns in survival can provide information about the burden and severity of cancer, help uncover gaps in systemic policy and program delivery, and support the planning of enhanced cancer control systems. The aim of this paper is to describe the one-year survival rates for breast cancer in two populations using population-based cancer registries: Ardabil, Iran, and British Columbia (BC), Canada.

Methods: All newly diagnosed cases of female breast cancer were identified in the Ardabil cancer registry from 2003 to 2005 and the BC cancer registry for 2003. The International Classification of Disease for Oncology (ICDO) was used for coding cancer morphology and topography. Survival time was determined from cancer diagnosis to death. Age-specific one-year survival rates, relative survival rates and weighted standard errors were calculated using life-tables for each country.

Results: Breast cancer patients in BC had greater one-year survival rates than patients in Ardabil overall and for each age group under 60.

Conclusion: These findings support the need for breast cancer screening programs (including regular clinical breast examinations and mammography), public education and awareness regarding early detection of breast cancer, and education of health care providers.

Background

Despite the extensive knowledge about incidence and survival rates for cancer in the western world, little information is available for the majority of developing countries [1,2]. International comparisons involving developing

countries are few in number. Where done, survival differences have been largely attributed to differences in patient's age, stage of disease at diagnosis, and the presence of metastasis. Socioeconomic factors, differential access to health care, insurance status, comorbidities, and

tolerance to prescribed treatment have also been suggested to determine survival [3-5]. Immigration status and ethnicity may also play a role. A study of breast cancer among ethnic Chinese women reported that those born in East Asia had lower survival than those born in the US [6]. A recent study in British Columbia (BC) compared survival for three cancer sites in Chinese, South Asians and the predominantly Caucasian general population and found that Chinese women had the highest survival rates for both breast and cervical cancer, whereas South Asian women had the highest rate for colorectal cancer and the lowest rate for cervical cancer [7].

Patterns in cancer incidence can provide important insight into the impact of lifestyle upon cancer development whereas patterns in survival can provide information about the burden and severity of cancer. Identifying differences in survival between populations can help to uncover gaps in systemic policy and program delivery, and support the planning of enhanced cancer control systems [7]. The aim of this study was to describe one-year survival rates for breast cancer in two populations using population-based cancer registries: Ardabil, Iran, and BC, Canada.

Methods

Study groups

Two groups with established population-based cancer registries were examined: residents of Ardabil, Iran and BC, Canada.

Ardabil province, located in the northwestern Iran, is a mountainous land with an area of nearly 18,000 square kilometers and a population of 1.1 million persons, 46% living in urban areas. The Ardabil Cancer Registry (ACR) was established in 2003 by the Digestive Diseases Research Center (DDRC) of Tehran University of Medical Sciences and Ardabil University of Medical Sciences (ARUMS), with collaboration of the International Agency for Research on Cancer (IARC). There are 4 kinds of information collected by the registry: patient demographics, tumor characteristics, treatment and patient outcome. Data are actively collected for newly-diagnosed cancer cases among permanent residents of Ardabil province. Patients who are diagnosed in other provinces are captured in the ACR through sharing of data among Iran's provinces. All rural residents are covered by a family physician network and have governmental medical insurance. Reporting cases of cancer to the ACR is obligatory for family physicians. Ardabil's cancer patterns have been studied since the 1970s [8], its cancer registry is relatively complete, its population is largely homogeneous (98% being of Azeri ethnicity), and there is minimal immigration into this area [9].

In contrast, BC, the westernmost province in Canada, has a land area of nearly 945,000 square kilometers and a population of about 4 million persons with various ethnic backgrounds [10]. The provincial cancer registry was established in 1969, with cancer registration mandated by law. It has excellent standards of quality control, completeness of registration and follow-up. It contains personal and demographic information as well as information on diagnosis and death of all the cases of cancer diagnosed among BC residents (<http://www.bccancer.bc.ca/HPI/CancerStatistics> accessed May 8, 2009). For BC, there is universal health care and the majority of the population has geographically accessible cancer treatment.

Data collection

Study population

The International Classification of Disease for Oncology (ICDO) was used for coding cancer morphology and topography [11]. All newly diagnosed cases of breast cancer (ICDO C50.0-50.9) in women 20 years of age and older were identified in the Ardabil cancer registry for the period 2003-2005 and the BC cancer registry for the year 2003. A 3-year period was used in Ardabil because there are few cases of breast cancer in a single year and statistical results would be unstable.

Survival time was then determined from cancer diagnosis to death. In Ardabil province, information on survival status and the date of death (if deceased) was collected directly by interviewing the registered cases or their families. In addition, the death registry in Ardabil was used to confirm the collected information and to gather this data for registered cases who could not be contacted for interview. Information on the patient's age and date at diagnosis, gender and cancer site was obtained from the cancer registry.

In BC, the survival status of all registered cancer patients is routinely collected by the cancer registry from government vital statistics. Information on the patient's age and date at diagnosis, gender, cancer site, survival status and date of death (if deceased) was collected directly from the cancer registry.

Analysis

Adults were defined as people age 20 years and older. Age-specific one-year survival rates were calculated for adult women in the age groups 20-39 years, 40-49 years, 50-59 years and 60+ years. The relative survival rate [12] and a weighted standard error (SE) were calculated using life-tables for each country.

Results

Table 1 shows the number of adult women diagnosed with breast cancer during the study period in Ardabil and BC, and a one-year survival rate for each age group. Breast cancer patients in BC had greater one-year survival rates than patients in Ardabil overall and for each age group under 60. The median age of breast cancer diagnosis was 61 years (range 24-104 years) in BC and 44 years (range 21-86 years) in Ardabil. About 23% of BC patients and 64% of Ardabil patients were younger than age 50 at the time of diagnosis. The age-standardized one-year relative survival rates in BC was 0.99 (SE = 0.004) for adult women younger than age 50 years and 0.97 (SE = 0.012) for women age 50 and older. The age-standardized 1-year relative survival rate in Ardabil was 0.92 (SE = 0.020) for adult women younger than age 50 and 0.95 (SE = 0.037) for women age 50 and older.

Discussion

Patterns of cancer incidence and survival vary around the globe and demographic, ecologic, environmental, cultural, and genetic variables may all contribute to this heterogeneity. This first study comparing breast cancer survival between Iran and BC may contribute to this understanding. There are clear differences in survival between these two populations which reflect variations in severity of cancer, possibly resulting from policy and practices regarding screening and treatment, cancer biology, and cancer registration.

Stage of the disease is an important determinant of survival in patients with breast cancer, but stage is unavailable in both the Ardabil and BC registries. Based on experience, we estimate that about 30% of Ardabil patients and 70% of BC patients are diagnosed at an early stage of the disease. We hypothesize that the improved survival observed in BC patients is partly because of this

difference between Ardabil and BC regarding the distribution of disease stage. One of the reasons for lower survival rates in Ardabil province may be largely explained by differences in screening practices. In BC, a province-wide screening mammography program was established in 1988. Overall breast cancer survival rates were higher in BC because of screening mammography and the use of new adjuvant therapies following surgery for breast cancer [7,13-16].

Despite current evidence supporting population-based screening for breast cancer, there is no organized screening program for breast cancer in Iran. Lack of a screening program, low awareness of breast cancer, earlier age at diagnosis, structural barriers to accessing cancer treatment services, low income and lack of a usual source of care may all contribute to lower survival from breast cancer in Iran. We believe that early detection and better management using standard screening and treatment guidelines would contribute considerably to improving survival from breast cancer in these women. However, the introduction of a population-based breast cancer screening program or a change in the healthcare system may require additional information.

Various survival rates for breast cancer have been reported in the literature among different ethnic populations [7,17-23]. Asian American women are reported to have better survival from breast cancer as compared to other major ethnic minority groups [24]. South Asian women with breast cancer have inconsistent reports, with better survival than others in England [25] and California [26] but worse survival in BC [7].

Hislop reported [7] clear differences in breast cancer survival among Chinese, South Asian and the BC general populations. Survival was highest in Chinese women,

Table 1: One -year survival rates for female invasive breast cancer cases diagnosed in 2003 in Ardabil (Iran) and British Columbia (Canada) by age group.

| Age | Ardabil | | British Columbia | |
|-------|-----------------|--------------------------|------------------|-------------------------|
| | Number of Cases | One - year Survival rate | Number of Cases | One -year Survival rate |
| 20-39 | 39 | 0.92 | 124 | 0.99 |
| 40-49 | 36 | 0.92 | 430 | 0.99 |
| 50-59 | 27 | 0.89 | 597 | 0.97 |
| 60+ | 16 | 1.00 | 1290 | 0.92 |
| Total | 118 | 0.92 | 2441 | 0.95 |

which is interesting given that the proportions being screened were similar among the three ethnic groups. South Asian women, however, had the poorest survival. It was speculated that differences in treatment practices and possibly cancer biology affecting tumor progression may exist among these ethnic groups. It has been reported that Asian women with ductal carcinoma in situ of the breast were more likely to undergo mastectomy than lumpectomy [7,27]), a finding not seen in other groups.

Maskarinc [20] reported that ethnic variations in survival time among health plan members in Hawaii were not the result of different treatments, but primarily due to differences in early detection of breast cancer. When these investigators examined demographics, disease characteristics, co-morbidity, and treatment patterns, TNM stage was the strongest predictor of survival and explained the observed ethnic survival differences.

An earlier Hawaiian study by these investigators [28], however, had reported that socioeconomic status and marital status also affected survival in breast cancer patients. They proposed three possible explanations for the survival differences: utilization of health services, tolerance of treatment, and biologic variations in disease. Firstly, health services were not equally available to all residents. Many natives lived in remote areas with few health care providers, and cultural beliefs and practices (incompatible with the Western health system) discouraged them from accepting available health care. Secondly, ethnic differences in pre-existing conditions, such as diabetes, hypertension, obesity, and heart disease, gave some natives lower tolerance to surgery, chemotherapy, and radiotherapy, leading to shortened survival. Thirdly, there may be biologic differences at the genetic or molecular level resulting in more aggressive disease with faster progression in some native women as compared to the other ethnic groups. With a better understanding of the genetic characteristics of breast cancer, this explanation can be more fully explored.

Our study has several limitations, including the short follow-up period, giving only a very short-term view of prognosis; the lack of detailed clinical information in the cancer registries, such as staging and treatment information; and the small study population in Ardabil province, resulting in a relatively large variance. In addition, the limitations of this study include the shortcomings of Ardabil cancer registry as it is newly established. However, the Ardabil cancer registry covers the entire province. Data are collected from hospitals, pathology laboratories, diagnostic radiology clinics, outpatient public and private clinics, death certificate files and an annual health census. The number of breast cancer cases is low in Ardabil because the population is small and has a young age-structure. The

relatively young population is particularly important in our comparison to BC because pre-menopausal breast cancer patients often have more aggressive disease than other women. Furthermore, Ardabil has one of the lowest breast cancer incidence rates in the world; gastric and esophageal cancers are the most-common forms of cancer in Ardabil. This might be the result of women's late age at menarche, reproductive behaviors and increased breast-feeding (as part of religious beliefs). Our analyses assumed that patients from both registries were still living after 1 year if no death was reported, although this assumption depends largely on the sources of information regarding deaths in the respective populations. In any population, it is difficult to know whether a patient's death is due to their breast cancer. This issue is particularly relevant in a comparison of populations with very different healthcare systems. Our analysis concerns the overall mortality of breast cancer patients, although the causes of death and the veracity of reported causes might be substantially different in Ardabil and BC. Although the cases were diagnosed in 2003, we could not extend the length of follow-up beyond one year because survival data was only available in BC to the end of 2004.

There is need for interventions that specifically target women with low education. Fear and embarrassment contribute to the lack of use of screening services and breast self examination. To better understand these issues, and how screening and treatment decisions are made, qualitative information should be collected from breast cancer patients and their health care providers.

Community intervention programs aimed at better understanding known risk factors of breast cancer, healthy lifestyle, and the importance of early detection are needed to help reduce deaths from breast cancer. These educational sessions should also provide information on how to get a mammogram and the steps to take following a diagnosis of breast cancer.

In both Ardabil province and BC, there is ongoing need for public education and awareness regarding early detection of breast cancer. This requires the use of communication media such as radio and television advertisements and programs for a mass education program. In addition to educating the public, it is also important to educate health care providers, especially those with whom are most likely to have contact. There is a need for establishment and implementation of screening programs for breast cancer, including regular breast examination, clinical breast exam and mammography, so that early lesions can be detected with a better survival and reduction of mortality. However, the introduction of a population-based breast cancer screening program or a change in the healthcare system may require additional information.

Continued research into the causes of the disease, its prevention and improved methods of detection and treatment are essential if we are to make inroads into the control of this important cancer on a global scale.

Conclusion

Breast cancer patients in BC had greater one-year survival rates than patients in Ardabil overall and for each age group under 60. These findings support the need for breast cancer screening programs (including regular clinical breast examinations and mammography), public education and awareness regarding early detection of breast cancer, and education of health care providers

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

AS performed the statistical analysis and drafted the manuscript. TGH conceived of the study, and participated in its design and revision of the manuscript. CB conceived of the study, and participated in its design and statistical analysis. MB participated in design and statistical analysis. AG participated in coordination. MN participated in the design of the study. AG participated in data collection. RM conceived and supervised of the study. PY conceived of the study, and participated in its design, coordination, and drafted and revised the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We would like to thank Colleen Wong and Norm Philips in BC for providing registry data from these analyses. This work was supported by the Digestive Disease Research Center, Tehran University of Medical Sciences. Chris Bajdik and Morteza Bashash are supported by the Michael Smith Foundation for Health Research. Morteza Bashash also is supported by the BC Cancer Foundation and the Canadian Cancer Society.

References

- Parkin M, Bray F, Ferlay J, Pisani P: **Global Cancer Statistics, 2002.** *Ca Cancer J Clin* 2005, **55**:74-108.
- Ferlay J, Bray F, Pisani P, Parkin DM: **Globacan 2002: Cancer Incidence, Mortality and Prevalence Worldwide.** IARC Cancer Base. No. 5. Version 2.0 2004 [<http://www-dep.iarc.fr>]. Lyon, France: IARC press
- Potosky AL, Merrill RM, Riley GF, Taplin SH, Barlow W, Fireman BH, Ballard-Barbash R: **Breast cancer survival and treatment in health maintenance organization and fee-for-services settings.** *J Natl Cancer Inst* 1997, **89**:1683-1691.
- Gordon NH, Crowe JP, Brumberg DJ, Berger NA: **Socioeconomic factors and race in breast cancer recurrence and survival.** *Am J Epidemiol* 1992, **135**:609-618.
- Ragland KE, Selvin S, Meerrill DW: **Black-White differences in stage specific cancer survival: analysis of seven sites.** *Am J Epidemiol* 1991, **133**:672-682.
- Chuang SC, Chen W, Hashibe M, Li G, Zhang ZF: **Survival rates of invasive breast cancer among ethnic Chinese women born in East Asia and the United States.** *Asian Pac J Cancer Prev* 2006, **7**:221-226.
- Hislop TG, Bajdik CD, Regier MD, Barroetavena MC: **Ethnic differences in survival for female cancers of the breast, cervix and colorectum in British Columbia, Canada.** *Asian Pacific Journal of Cancer Prevention* 2007, **8**:1-6.
- Mahboubi E, Kmet J, Cook PJ, Day NE, Ghadirian P, Salmasizadeh S: **Oesophageal Cancer studies in Caspian littoral of Iran.** *Br J Cancer* 1973, **28**:197-214.
- Sadjadi AR, Malekzadeh R, Derakhshan MH, Sepehr A, Nouraei M, Sotoudeh M, Yazdanbod A, Shokoohi B, Mashayekhi A, Arshi S, et al.: **Cancer occurrence in Ardabil: results of a population-based cancer registry from Iran.** *Int J Cancer* 2003, **107**(1):113-118.
- Statistics Canada: **Profile of Citizenship, Immigration, Birthplace, Generation Status, Ethnic Origin, Visible Minorities and Aboriginal peoples, for Canada, Provinces, Territories, Census Divisions and Census Subdivisions, 2001 Census.** *British Columbia* [<http://www12.statcan.ca/english/census01/products/standard/profiles/>]. [Accessed April 6, 2004]
- Fritz A, Percy C, Jack A, Shanmugaratnam K, Sobin L, Parkin DM, Whelan S: **International Classification of Diseases for Oncology.** 3rd edition. Geneva: World Health Organization; 2000.
- Black RJ, Swaminathan R: **Statistical methods for the analysis of cancer survival data.** In *Cancer Survival In Developing Countries* Edited by: Sanaranarayanan R, Black RJ, Parker DM. IARC Scientific Publications. No. 145, Lyon, France; 1998.
- Olivotto IA, Bajdik CD, Plenderleith IH, Coppin CM, Gelmon KA, Jackson SM, Ragaz J, Wilson KS, Worth A: **Adjuvant systemic chemotherapy and survival after breast cancer.** *N Engl J Med* 1994, **330**:805-810.
- Olivotto IA, Mates D, Kan L, Fung J, Samant R, Warren Burhenne LJ: **Prognosis, treatment and recurrence of breast cancer for women attending or not attending the Screening Mammography Program of British Columbia.** *Breast Cancer Res Treat* 1999, **54**:73-81.
- Joensuu H, Lehtimäki T, Holli K, Elomaa L, Turpeenniemi-Hujanen T, Kataja V, Anttila A, Lundin M, Isola J, Lundin J: **Risk for distant recurrence of breast cancer detected by mammography screening or other methods.** *JAMA* 2004, **292**:1064-73.
- Hebert-Croteau N, Brisson J, Latreille J, Rivard N, Abdelaziz , Martin G: **Compliance with consensus recommendations for systemic therapy is associated with improved survival of women with node-negative breast cancer.** *J Clin Oncol* 2004, **22**:3685-3693.
- Canadian Cancer Society/National Cancer Institute of Canada: **Canadian Cancer Statistics 2007.** Toronto, Canada 2007:65.
- National Cancer Institute: **Surveillance, Epidemiology, and End results (SEER). SEER relative survival rates by race and sex for all cancer sites, all ages, all stages, SEER 9 registries for 1988-2002 2007** [<http://seer.cancer.gov/faststats/sites.php?sites=All+Canada+Sites&stat=survival#rel>]. [Accessed February 16, 2007]
- Coleman MP: **Trends and socioeconomic inequalities in cancer survival in England and Wales up to 2001.** *Br J Cancer* 2004, **90**:1367-1373.
- Maskarinec G, Pagano IS, Yamashiro G, Issell BF: **Influences of ethnicity, treatment, and comorbidity on breast cancer survival in Hawaii.** *Journal of Clinical Epidemiology* 2003, **56**:678-685. (8)
- Shavers VL, Brown ML: **Racial and ethnic disparities in the receipt of cancer treatment.** *J Natl Cancer Inst* 2002, **94**:334-357.
- Aziz NM, Rowland JH: **Cancer survivorship research among ethnic minority and medically underserved groups.** *Oncol Nurs Forum* 2002, **29**:789-801.
- Institute of Medicine: **The unequal burden of cancer: an assessment of NIH research and programs for ethnic minorities and the medically underserved.** Edited by: Hayes MA, Smedley BD. Washington, DC: National Academy Press; 1999.
- Clegg LX, Li FP, Hankey BF, Chu K, Edwards BK: **Cancer survival among US whites and minorities: SEER (Surveillance, Epidemiology, and End Results) program population based study.** *Arch Intern Med* 2002, **162**:1985-1993.
- Velikova G, Booth L, Johnston C, Forman D, Selby P: **Breast Cancer outcomes in South Asian population of West Yorkshire.** *Br J Cancer* 2004, **90**:1926-1932.
- Parikh-Patel A, Mills PK, Jain RV: **Breast cancer survival among South Asian women in California (United States).** *Cancer Causes Control* 2006, **17**:267-272.
- Innos K, Horn-ross PL: **Recent trends and racial/ethnic differences in the incidence and treatment of ductal carcinoma in situ of the breast in California women.** *Cancer* 2003, **97**:1099-1106.

28. Meng L, Maskarinec G, Wilkens L: **Ethnic differences and factors related to breast cancer survival in Hawaii.** *Int J Epidemiol* 1997, **26**:1151-1158.

Pre-publication history

The pre-publication history for this paper can be accessed here:

<http://www.biomedcentral.com/1471-2407/9/381/prepub>

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp

