A descriptive study of prostate cancer mortality in the state of São Paulo, from 1980 to 2007

Um estudo descritivo da mortalidade por câncer de próstata no Estado de São Paulo no período de 1980-2007

Ary Serpa Neto[1], Marcos Tobias-Machado[2], Marcelo Langer Wroclawski[3], Marco Akerman[4], Antônio Carlos Lima Pompeo[5], Auro Del Giglio[6]

ABSTRACT

Objective: Prostate cancer is the second most common neoplasm among men worldwide. This study aimed to examine the trend in mortality rates of prostate cancer among the population in the state of São Paulo, Brazil, from 1980 to 2007. **Methods:** a descriptive study of temporal series was conducted using mortality data due to prostate cancer between1980 and 2007 in the state of São Paulo. Mortality rates were obtained from the SUS Information System on Mortality (SIM/SUS – DATASUS). The age-specific mortality rates were calculated as well as linear regression and temporal trend analysis. **Results:** It could be observed that mortality increased according to age, being very similar only between the age group 70-79 years and ≥ 80 years (p = 0.047). The mortality peak in the age group 50-79 years occurred at the same time; however, the drop in mortality rates since then has been much more pronounced in the group of 50-59 years. There was a linear increase and direct association between the number of biopsies and the incidence of prostate cancer (r = 0.714, p = 0.024). **Conclusions:** Prostate cancer is a major cause of mortality in São Paulo and effective screening and treatment measures should be adopted to improve this scenario.

Keywords: Prostatic neoplasms/mortality; Epidemiology, descriptive; Mortality rate

RESUMO

Objetivo: O câncer de próstata é a segunda neoplasia mais comum entre homens em todo o mundo. O presente estudo teve como objetivo examinar a tendência das taxas de mortalidade por câncer de próstata entre a população do Estado de São Paulo, nos anos de 1980 a 2007. **Métodos:** Realizou-se um estudo descritivo de séries temporais, utilizando-se dados de óbitos por câncer de próstata (CaP) no período de 1980 e 2007 no Estado de São Paulo. As taxas de mortalidade foram obtidas dos dados do Sistema de Informação de Mortalidade do SUS (SIM/SUS – DATASUS). Foram calculados os coeficientes de mortalidade específicos por idade, regressões lineares e análises de tendência temporal. **Resultados:** Pode-se observar que a mortalidade aumenta de acordo com o aumento da faixa etária, tornando-se similar somente entre a faixa etária de 70-79 anos e ≥ 80 anos (p = 0,047). O pico de mortalidade entre os grupos etários de 50 a 79 anos ocorreu em época semelhante; entretanto, a queda nas taxas de mortalidade desde então foi muito mais pronunciada no grupo entre 50 e 59 anos. Houve um crescimento linear e diretamente proporcional entre o número de biópsias e a incidência do câncer de próstata (r = 0,714; p = 0,024). **Conclusões:** Podemos concluir que o câncer de próstata é uma importante causa de mortalidade no Estado de São Paulo e que medidas efetivas de rastreamento e tratamento devem ser adotadas para a melhora desse quadro.

Descritores: Neoplasias da próstata/mortalidade; Epidemiologia descritiva; Coeficiente de mortalidade

INTRODUCTION

Prostate cancer is the second most common cancer in men worldwide[1]. In 2005, in the United States, there were 2,106,499 live men with a history of prostate cancer and the incidence of this disease was of 163/100,000 men per year. Previous studies showed that the mean age upon diagnosis is 68 years and the mortality rate is 26.7/100,000 men per year[2].

Study carried out at Faculdade de Medicina do ABC – FMABC, Santo André (SP), Brazil.

[1] Master's degree at Faculdade de Medicina do ABC – FMABC, Santo André (SP), Brazil.

[2] PhD at Faculdade de Medicina do ABC – FMABC, Santo André (SP), Brazil.

[3] MD at Faculdade de Medicina do ABC – FMABC, Santo André (SP), Brazil.

[4] Post-doctorate degree at Faculdade de Medicina do ABC – FMABC, Santo André (SP), Brazil.

[5] Post-doctorate degree at Faculdade de Medicina do ABC – FMABC, Santo André (SP), Brazil.

[6] Post-doctorate degree at Faculdade de Medicina do ABC – FMABC, Santo André (SP), Brazil.

Corresponding author: Ary Serpa Neto – Rua Ossian Terceiro Telles, 220, casa 03 – Jardim Prudência – CEP 04649-000 – São Paulo (SP), Brasil – Tel.: 11 9960-1184 – E-mail: aryserpa@terra.com.br

Received: Jan 04, 2010 – Accepted: Jul 15, 2010

Recent studies suggest that mortality due to prostate cancer has declined in the United States and in the United Kingdom since 1990 and this improvement is largely due to screening by PSA and more effective treatment of advanced disease. On the other hand, it is believed that the benefit of early diagnosis of prostate cancer on mortality rates only occurs in the cases in which prostate specific antigen (PSA) screening identifies patients with more aggressive disease, who are the minority of all screened men. Therefore, while the benefit for a minority may cause impact on global mortality rates, most screened men may get unnecessary treatment and diagnosis that interfere in their quality of life[3].

In Brazil, little is known about the behavior of prostate cancer in the population.

OBJECTIVE

The present study aimed to examine the trend of mortality rates due to prostate cancer among the population of the State of São Paulo between the years 1980 and 2007, analyzing, as well, proportional mortality in this period.

METHODS

Data collection

A descriptive study of temporal series was conducted using data of deaths due to prostate cancer (PCa) in the state of São Paulo, between 1980 and 2007. Mortality due to PCa and to all cancers (1980 to 2007) was obtained from data of the Information System on Mortality of the Single Health System (SIM/SUS – DATASUS) and the incidence of this disease from the National Cancer Institute (INCA). The estimate of the resident population was obtained from the Brazilian Institute of Geography and Statistics (IBGE).

The number of prostate biopsies from 1995 to 2003 was obtained from the SIH/SUS – DATASUS. Population at risk was considered as men aged over 50 years.

Statistical analysis

The age-specific mortality rates were calculated with a standard equation. The temporal trend analysis was carried out using dispersion diagrams, which depicted the relation between the PCa mortality rate and the years of study, and in all cases the evolution along time was linear. For the construction of the linear regression model, the PCa mortality rate was considered as the dependent variable (Y) and the years of study as independent variable (X). The variable was chosen to be used in a centralized manner (X-1993) to avoid auto-correlation between the terms of the equation. The estimated model was $Y = \beta_0 + \beta_1 (X\text{-}1993)$, in which Y is the PCa mortality rate, β_0 is the mean coefficient in the period, β_1 is the annual mean increment, and X is the year.

The analyses were performed using the SPSS v.16.0 for Windows, and the significance of the trends was established as $p < 0.05$.

RESULTS

The proportional mortality due to PCa, according to the age group, is shown in Table 1. It can be observed that mortality rises as the age group increases and becomes similar only between the age groups of 70-79 years and ≥ 80 years ($p = 0.047$). Percent increase in proportional mortality due to prostate cancer was different in diverse age groups. While in the population aged between 50-59 years there was a 58.7% increase, in the 60-69-year age group the increment was approximately 75.7%. In the age group of 70-79 years, the increment was roughly 80.5%, whereas in those aged 80 years or more this percent came up to 85.3%.

Table 1. Proportional mortality (%) due to prostate cancer in the population aged 50 years. State of Sao Paulo, 1980 to 2007

Year	Age group (years)			
	50-59	60-69	70-79	≥ 80
1980	0.3590	1.0174	1.7642	2.0137
1981	0.3325	1.0524	1.8091	2.3258
1982	0.3764	1.2893	1.8681	1.7794
1983	0.4198	1.0783	1.8927	2.0558
1984	0.3823	1.1896	2.1749	2.2955
1985	0.3131	1.1090	1.9942	2.3944
1986	0.4468	1.1786	2.0839	2.3888
1987	0.3563	1.0677	2.1116	2.2935
1988	0.4199	1.1634	2.0986	2.0126
1989	0.3778	1.3095	2.2213	2.2004
1990	0.4382	1.3152	2.3959	2.4408
1991	0.4081	1.5409	2.3968	2.6771
1992	0.5414	1.4997	2.4912	2.7974
1993	0.4609	1.3527	2.5326	2.5494
1994	0.5609	1.5573	2.6644	3.0453
1995	0.5344	1.5990	2.7289	3.1746
1996	0.5178	1.6384	3.0045	3.5331
1997	0.5592	1.7889	3.1791	3.7671
1998	0.6715	1.7518	3.2752	3.9037
1999	0.5368	1.6894	3.2404	3.6468
2000	0.5454	1.8924	3.1337	3.5993
2001	0.6294	1.8230	3.3405	4.0682
2002	0.5301	1.8951	3.3357	3.9665
2003	0.5674	1.8986	3.2652	3.9108
2004	0.5655	1.8933	3.3481	3.8908
2005	0.6120	2.0322	3.4848	4.2586
2006	0.6022	1.8352	3.0652	3.9233
2007	0.5696	1.7873	3.1842	3.7312

Source: Information System on Mortality of the Single Health System (SIM/SUS)
One-way ANOVA among groups: $p < 0.0001$;
Linear trend test: $p < 0.0001$;
One-way ANOVA among groups:
60-70 *versus* 70-80 years ($p < 0.0001$);
60-70 *versus* ≥ 80 years ($p < 0.0001$);
70-80 *versus* ≥ 80 years ($p = 0.047$).

The annual mortality rates specific for prostate cancer according to age group is shown in Figure 1. The age-specific mortality peak at each age group is displayed in Table 2. The mortality peak among the age groups of 50-79 years occurred at similar times; however, the drop in mortality since then was more pronounced in the age group of 50-59 years.

The rate of prostate biopsies performed between 1997 and 2003, corrected for the population at risk (100,000) is shown in Figure 2. A directly associated linear increase between the number of biopsies and the incidence of prostate cancer (r = 0.714; p = 0.024) was observed.

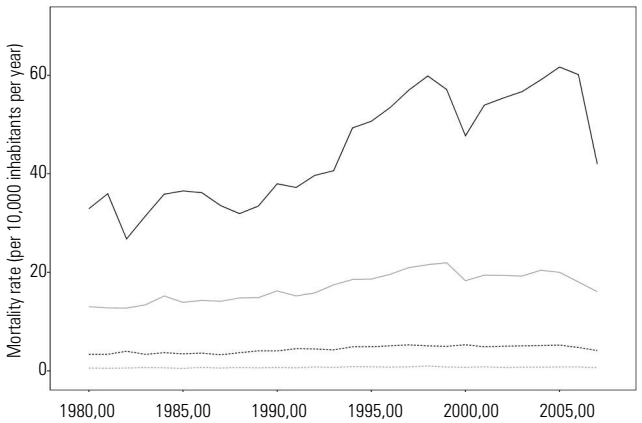

Figure 1. Specific mortality rates of prostate cancer (per 10,000 inhabitants) according to age groups. São Paulo, 1980 to 2007. Age group: ≥ 80 years (black line); 70-79 years (gray line); 60-69 years (dotted black line); 50-59 years (dotted gray line)

Table 2. Peak age-specific mortality due to prostate cancer and percentage decrease after peak

Age group (years)	Year of the peak	Peak of Mortality (per 10,000 individuals per year)	Fall since the peak (%)
50-59	1998	67.15	35.7
60-69	2000	189.24	22.2
70-79	1999	324.03	26.7
≥ 80	2005	338.80	31.9
Total	2005	269.54	21.4

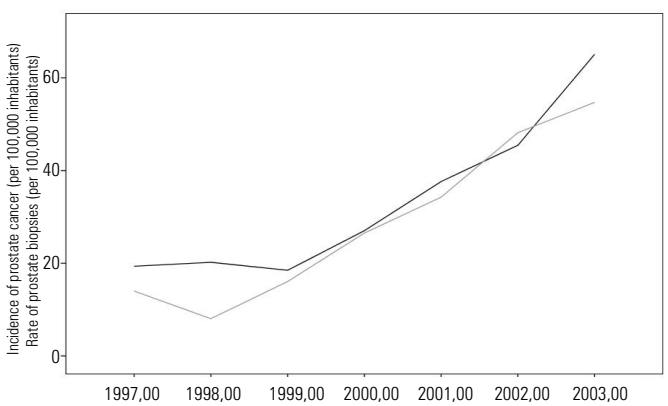

Figure 2. Incidence of prostate cancer and rate of prostate biopsies (per 100,000 inhabitants at risk). Sao Paulo, 1997 to 2003. Incidence of prostate cancer (black line); rate of prostate biopsies (gray line)

Table 3 shows the results of the trend analysis of mortality rates due to prostate cancer according to the age groups. There was a statistically significant trend for increase in all age groups. The mean coefficient of the period (β_0) was higher in the 80 years or more age group, as in the mean annual increase. Lastly, in Figure 3, the relation between the mortality rate and the incidence of prostate cancer in the state of São Paulo between 1997 and 2003 is shown.

Table 3. Trend analysis of age-specific mortality rates due to prostate cancer. State of Sao Paulo, 1980 to 2007

Age group (years)	β_0	β_1	P value	r^2	Trend
50-59	0.705	0.009	< 0.0001	0.373	Increase
60-69	4.353	0.070	< 0.0001	0.676	Increase
70-79	16.858	0.282	< 0.0001	0.645	Increase
≥ 80	44.212	1.141	< 0.0001	0.722	Increase
Total	6.143	0.158	< 0.0001	0.831	Increase

Source: Information System on Mortality of the Single Health System (SIM/SUS).
β_0: mean coefficient in the period (per 10,000 inhabitants); β_1: mean annual increase.

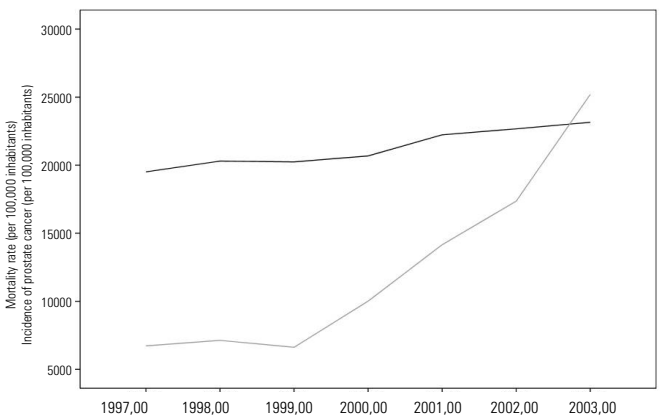

Figure 3. Specific total mortality rate of prostate cancer (per 10,000 inhabitants) and incidence of prostate cancer (per 10,000 inhabitants x 10) from 1997 to 2003. Total mortality rate of prostate cancer (black line); incidence of prostate cancer (grey line)

DISCUSSION

By observing the mortality rates along time, there was a real increment in mortality due to prostate cancer in the state of São Paulo, from 1980 to 2007. There was a significant increase in mortality rates due to prostate cancer in the age groups, with annual increase more impressive among the older population (above 70 years). Certainly, besides aging of the population with consequent increase of the proportion of people aged 70 years or more, this cohort presented different inheritance patterns and was subjected to different previous exposures, which could also influence the mortality rates.

The trend for a drop in mortality rate due to prostate cancer in the different age groups in the state of São Paulo, from 2005, may be explained by different factors besides the diagnosis of a less advanced disease. To what extent screening and other factors (such as

better treatment) are responsible for the drop in the mortality rate is a subject open for debate. An example is the observation of the meeting of the incidence line (new registered cases) with the mortality line, found in Figure 3. A possible explanation for this is more effective treatments adopted to control both localized and advanced disease.

The rate of performed radical prostatectomies (curative treatment for localized tumors) has been constant and similar to those found in the United States since 1999; thus, it would hardly explain by itself the drop in mortality due to prostate cancer. Radiation therapy is another treatment modality used for localized disease and, in Brazil, there is no information about the number of radiation therapy prescribed. In the United States, radiation therapy is performed more frequently than radical surgery[3,4].

In the United States, the mortality rate due to prostate cancer is declining since the mid-1990s at an average rate of 4.17% per year[3]. In the present study, an average rate of decline of 7.1% per year was found, which is slightly higher than that found in the United States. However, the mortality rate in Brazil is still higher than that found in the United States, suggesting that we are still beginning to control the disease (in average, ten years behind the Americans)[5].

In Brazil, there is no control in the amount of PSA tests performed currently; nevertheless, in the United States, 54% of men aged between 50 and 69 years reported having done a PSA test in the last year, which partly explain the trend of earlier diagnosis and detection of a localized disease with higher curative potential[6-11].

In the State of São Paulo, due to a difficult access to health system and preventive Medicine, several cases of prostate cancer should be diagnosed in more advanced stages, in which hormone therapy is the only therapeutic option. The greater use of such treatment in São Paulo in the past years, because of availability of high-cost drugs to the deprived population, may be largely responsible for the drop in mortality rate due to prostate cancer. In Brazil, however, we have no access to the number of prescriptions for androgen deprivation therapy; thus, this is still an assumption. Elsewhere in the world, the role of this therapy is known in reducing mortality due to this disease[12-16].

The major limitations of the current study are the fact that it is a descriptive study and the comparisons of trend in mortality, diagnosis and treatment were restricted to those related to the SUS, which although trustworthy, represent only part of the population of the state. The changes in the disease code may have influenced our findings because the oldest known records were not well standardized. However, since the introduction of the ICD-9, in 1979, the analysis of data has improved. Lastly, some analyses were restricted to short periods of time, because of the lack of information regarding the proposed time in the beginning of the study.

CONCLUSION

It can be concluded that the mortality rate due to prostate cancer has been declining since 2005, but this neoplasm is still an important cause of death in the State of São Paulo.

REFERENCES

1. Grönberg H. Prostate cancer epidemiology. Lancet. 2003;361(9360):859-64.
2. Ries LAG, Melbert D, Krapcho M, Stinchcomb DG, Howlader N, Horner MJ, et al. SEER Cancer Statistics Review, 1975-2005 [Internet]. 2008 [cited 2010 June 8]. Bethesda (MD): National Cancer Institute;2009. Available from: http://seer.cancer.gov/csr/1975_2005/
3. Collin SM, Martin RM, Metcalfe C, Gunnell D, Albertsen PC, Neal D, et al. Prostate-cancer mortality in the USA and UK in 1975-2004: an ecological study. Lancet Oncol. 2008;9(5):445-52.
4. Auclerc G, Antoine EC, Cajfinger F, Brunet-Pommeyrol A, Agazia C, Khayat D. Management of advanced prostate cancer. Oncologist. 2000;5(1):36-44.
5. Brasil. Ministério da Saúde. Instituto Nacional de Câncer. Atlas de mortalidade por câncer no Brasil: 1979-1999 [Internet]. 2002 [citado 2009 Out 9]. Rio de Janeiro (RJ): Ministério da Saúde, Instituto Nacional do Cancer;2002. Disponível em: http://www.inca.gov.br/atlas/
6. Sirovich BE, Schwartz LM, Woloshin S. Screening men for prostate and colorectal cancer in the United States: does practice reflect the evidence? JAMA. 2003;289(11):1414-20.
7. Paquette EL, Sun L, Paquette LR, Connelly R, Mcleod DG, Moul JW. Improved prostate cancer-specific survival and other disease parameters: impact of prostate-specific antigen testing. Urology. 2002;60(5):756-9.
8. Penson DF, Chan JM; Urologic Diseases in America Project. Prostate cancer. J Urol. 2007;177(6):2020-9.
9. Cooperberg MR, Lubeck DP, Meng MV, Mehta SS, Carroll PR. The changing face of low-risk prostate cancer: trends in clinical presentation and primary management. J Clin Oncol. 2004; 22(11):2141-9.
10. Draisma G, Boer R, Otto SJ, van der Cruijsen IW, Damhuis RA, Schröder FH, et al. Lead times and overdetection due to prostate-specific antigen screening: estimates from the European Randomized Study of Screening for Prostate Cancer. J Natl Cancer Inst. 2003;95(12):868-78.
11. Telesca D, Etzioni R, Gulati R. Estimating lead time and overdiagnosis associated with PSA screening from prostate cancer incidence trends. Biometrics. 2008;64(1):10-9.
12. Demers RY, Tiwari A, Wei J, Weiss LK, Severson RK, Montie J. Trends in the utilization of androgen-deprivation therapy for patients with prostate carcinoma suggest an effect on mortality. Cancer. 2001;92(9):2309-17.
13. Messing EM, Manola J, Yao J, Kiernan M, Crawford D, Wilding G, et al. Immediate versus deferred androgen deprivation treatment in patients with node-positive prostate cancer after radical prostatectomy and pelvic lymphadenectomy. Lancet Oncol. 2006;7(6):472-9.
14. Bolla M, Gonzalez D, Warde P, Dubois JB, Mirimanoff RO, Storme G, et al. Improved survival in patients with locally advanced prostate cancer treated with radiotherapy and goserelin. N Engl J Med. 1997;337(5):295-300.
15. [No authors listed]. Maximum androgen blockade in advanced prostate cancer: an overview of the randomised trials. Prostate Cancer Trialists' Collaborative Group. Lancet. 2000;355(9214):1491-8.
16. Shahinian VB, Kuo YF, Freeman JL, Orihuela E, Goodwin JS. Increasing use of gonadotropin-releasing hormone agonists for the treatment of localized prostate carcinoma. Cancer. 2005;103(8):1615-24.