Prostate cancer incidence review with emphasis on publications from the American Cancer Society & the International Agency for Research on Cancer

Richard F. Mould

Prostate carcinoma is one of the most important male cancers with, in various regions of the world, including the USA, a very high incidence. It is though, one of the cancers with a good prognosis with a range of treatment modalities available including radiotherapy and surgery. This review is based on the most recent data from the IARC and the American Cancer Society and presents a worldwide survey with representative data from Africa and central & south America, north America, Asia, eastern & western Europe including Scandinavia, and Australia & New Zealand. The etiology of this cancer is summarised with a commentary on factors including genetic predisposition, life-style, race and ethnicity, sex hormones, marital status, familial factors, diet, ionising radiation, socioeconomic status, smoking, and chronic exposure to cadmium oxide. Age-standardised as well as age-specific and crude rates are included in this review.

Key words: prostate cancer, incidence, risk factors
Słowa kluczowe: rak prostaty, czynniki ryzyka, występowanie

Introduction

Cancer of the prostate is the neoplasm with the highest incidence in the United States, although not the neoplasm with the highest mortality, as seen in Table I. This has been taken from the year 2001 American Cancer Society Cancer Facts & Figures publication [1] for comparisons between cancers of the prostate, lung & bronchus and colon & rectum. In the same publication [1] it is estimated that there will be 188,000 new cases of prostate cancer in the USA in 2001 and an estimated 30,000 deaths. The comparable estimates, for males and females combined, for cancer of the lung and bronchus are respectively 168,500 new cases and 27,400 deaths.

Table I. Incidence and mortality in males in the USA 1990-97 by site and race [1]. The rates are per 100,000 population age-adjusted to the 1970 USA standard population. The incidence data is from the 11 SEER (Surveillance, Epidemiology and End Results program) areas and the mortality data is from all states

<table>
<thead>
<tr>
<th>Site</th>
<th>White population Incidence</th>
<th>White population Mortality</th>
<th>Black population Incidence</th>
<th>Black population Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>145.8</td>
<td>23.3</td>
<td>225.0</td>
<td>54.1</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>71.9</td>
<td>69.5</td>
<td>111.1</td>
<td>99.5</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>52.7</td>
<td>21.3</td>
<td>58.3</td>
<td>27.7</td>
</tr>
</tbody>
</table>

Table II. Prostate cancer age-adjusted incidence rates per 100,000 males, USA 1988-92, by race and ethnicity [3]

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>Incidence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>African-American</td>
<td>180.6</td>
</tr>
<tr>
<td>White</td>
<td>134.7</td>
</tr>
<tr>
<td>Hispanic</td>
<td>89.0</td>
</tr>
<tr>
<td>Japanese</td>
<td>88.0</td>
</tr>
<tr>
<td>Filipino</td>
<td>69.8</td>
</tr>
<tr>
<td>Hawaiian</td>
<td>57.2</td>
</tr>
<tr>
<td>American-Indian</td>
<td>52.5</td>
</tr>
<tr>
<td>Alaska Natives</td>
<td>46.1</td>
</tr>
<tr>
<td>Chinese</td>
<td>46.0</td>
</tr>
<tr>
<td>Vietnamese</td>
<td>40.0</td>
</tr>
<tr>
<td>Korean</td>
<td>24.2</td>
</tr>
</tbody>
</table>

Etiology

Relatively little is known about the etiology of prostate cancer, although the data on the black population of Africa and the USA provides some evidence of a genetic component to prostate cancer risk, the geographical and temporal variations and the results of migrant studies indicate that life-style comprises a large fraction of the causes of prostate cancer [2]. At all ages, African-American men are more likely than whites to develop prostate cancer but cancer incidence rates have increased for both American white and African-American men with the rates for the latter rising from 106 per 100,000 in 1973 to 234 per 100,000 in 1994 [3].

Incidence rates vary among racial and ethnic groups and Table II shows the rates in the USA for the different racial and ethnic groups.
Asian-American populations. The highest rate is for Japanese-Americans and the lowest for Korean-Americans [3].

Sex hormones have also been implicated in the etiology of this cancer, primarily on the basis that the growth and development of the prostate gland requires the presence of sex hormones. It has been reported [3] that men with high plasma testosterone levels may be at an increased risk of developing prostate cancer. However, the hormonal hypothesis has received only equivocal support from epidemiological studies and clinical observations. Prostatic cancer mortality rates are associated with marital status, increasing in the following order: single, married, widowed, divorced [2].

Some studies have shown an overall twofold to threefold increase in the risk of prostate cancer in men with a positive family history. The number of affected family relatives and younger age at diagnosis appear to be influential familial factors [3] and strong familial pre-disposition may be responsible for some 5-10% of prostate cancers [1].

Diet has also been suggested as a risk factor with a diet high in animal fat approximately doubling the risk. Alternatively, the consumption of lycopene, an antioxidant found in tomatoes and tomato-based products may be associated with a decreased risk [3].

Other risk factors which have been studied but which have failed to show any statistically significant correlation with the incidence of prostate cancer, include ionising radiation, socioeconomic status, benign prostatic hyperplasia, vasectomy, smoking and farming & agricultural work [4-9]. As well as farming, occupational risks have also been studied from chronic exposure to cadmium oxide dust over a period of 10 or more years [10] but the results are conflicting.

To conclude this short summary on etiology the following statement is reproduced from a discussion [11] on latent disease versus clinically manifest disease. 'The projected lifetime risk of developing histologic evidence of cancer of the prostate in a 50 year old man is 42%, of the clinical disease 9.5% and of dying from the disease is 2.9%'.

Age-Standardised & Crude Incidence Rates

The pattern of occurrence of prostate cancer is not similar in all countries. Figure 1 is reproduced from an IARC publication in 1990 on Patterns of Cancer in Five Continents [12] where the age-standardised incidence rates per 100,000 population are ranked from highest to lowest with the maximum and minimum rates at the base of the bar chart: 91.2 for the black population of Atlanta, USA and 1.2 for Tianjin in the Peoples' Republic of China. The population used for the standardisation is the 'world' population: not the 1970 US standard population used for the incidence rates in Table I. However, the ratio of Mortality/Incidence for black and white US populations

Figure 1. Age-standardised incidence rates per 100,000 population for selected populations in five continents [12]. Courtesy IARC.
Table III. Crude incidence rates per 100,000 males for selected populations, the age-standardised rate per 100,000 (ASR) and the percentage of all cancers which are prostate cancer [13]. When the absolute numbers of registered prostate cancer cases are small, the standard errors associated with the rate per 100,000 will be large. It should also be noted that not all cancer registries outside North America and Europe are as efficient and comprehensive as those for example in the USA, and there may be a significant element of missed registrations. Nevertheless, this IARC publication [13] gives the best available incidence estimates towards the end of the 20th century. Notation: *Skin other than Kaposi's sarcoma or melanoma is not considered: ICD 9th 173. **Includes all skin.

<table>
<thead>
<tr>
<th>Population</th>
<th>Total cases registered</th>
<th>Period of registration</th>
<th>Crude rate</th>
<th>ASR</th>
<th>% of all cancers**</th>
<th>Cancer with the highest ASR incidence*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Africa</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Setif, Algeria</td>
<td>12</td>
<td>1990-93</td>
<td>0.5</td>
<td>1.8</td>
<td>1.2</td>
<td>Bronchus, lung</td>
</tr>
<tr>
<td>Bamako, Mali</td>
<td>33</td>
<td>1988-92</td>
<td>2.0</td>
<td>0.5</td>
<td>3.3</td>
<td>Liver</td>
</tr>
<tr>
<td>Kyadondo, Uganda</td>
<td>86</td>
<td>1991-93</td>
<td>5.7</td>
<td>27.7</td>
<td>7.9</td>
<td>Kaposi's sarcoma</td>
</tr>
<tr>
<td>Harare, African, Zimbabwe</td>
<td>112</td>
<td>1990-92</td>
<td>6.9</td>
<td>29.2</td>
<td>7.0</td>
<td>Kaposi's sarcoma</td>
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<td>Concordia, Argentina</td>
<td>48</td>
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<td>16.2</td>
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<td>17.9</td>
<td>8.2</td>
<td>Stomach</td>
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<tr>
<td>Goiania, Brazil</td>
<td>291</td>
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<td>16.5</td>
<td>35.2</td>
<td>15.2</td>
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<td>Cola, Colombia</td>
<td>693</td>
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<td>19.8</td>
<td>32.7</td>
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<td>767</td>
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<td>95.9</td>
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<td>USA Black Populations</td>
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<td>141.5</td>
<td>32.3</td>
<td>Prostate</td>
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<tr>
<td><strong>Table IIIc. Asia</strong></td>
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<td>Shanghai, China</td>
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<td>Hong Kong</td>
<td>1185</td>
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<td>8.1</td>
<td>7.9</td>
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<td>Bombay, India</td>
<td>764</td>
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<td>4.1</td>
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<td>Hiroshima, Japan</td>
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<td>Stomach</td>
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<td>Osaka Prefecture Japan</td>
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<td>1988-92</td>
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<td>2.5</td>
<td>Stomach</td>
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<td>Kangwa County, Korea</td>
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<td>1986-92</td>
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<td>0.5</td>
<td>Stomach</td>
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<tr>
<td>Manila, Philippines</td>
<td>632</td>
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<td>17.6</td>
<td>5.9</td>
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<td>Singapore-Chinese</td>
<td>415</td>
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<td>7.8</td>
<td>9.8</td>
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<td>Chiang Mai, Thailand</td>
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<td>4.1</td>
<td>2.6</td>
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<tr>
<td>Hanoi, Vietnam</td>
<td>24</td>
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<td>0.8</td>
<td>1.2</td>
<td>0.7</td>
<td>Bronchus, lung</td>
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</table>
Figure 2. Incidence and mortality rates per 100,000 population, by race and five-year age group, USA 1990-94. [3]. These rates are age-adjusted to the 1970 US standard population. The data source is the NCI, Surveillance, Epidemiology, and End Results Program, 1997. Courtesy American Cancer Society.

Figure 3. Incidence and mortality rates per 100,000 population, by race and registration year, USA 1973-94. [3]. These rates are age-adjusted to the 1970 US standard population. The data source is the NCI, Surveillance, Epidemiology, and End Results Program, 1997. Courtesy American Cancer Society.

<table>
<thead>
<tr>
<th>Table IIId. Europe: Eastern &amp; Western. Notation: The six states are Berlin, Brandenburg, Mecklenburg-Vorpommern, Sachsen-Anhalt, Sachsen and Thuringen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td><strong>Eastern Europe</strong></td>
</tr>
<tr>
<td>Belarus</td>
</tr>
<tr>
<td>Czech Republic</td>
</tr>
<tr>
<td>Estonia</td>
</tr>
<tr>
<td>Latvia</td>
</tr>
<tr>
<td>Cracow, Poland</td>
</tr>
<tr>
<td><strong>Western Europe</strong></td>
</tr>
<tr>
<td>Somme, France</td>
</tr>
<tr>
<td>6 States, Germany</td>
</tr>
<tr>
<td>Southern Ireland</td>
</tr>
<tr>
<td>Florence, Italy</td>
</tr>
<tr>
<td>The Netherlands</td>
</tr>
<tr>
<td>Asturias, Spain</td>
</tr>
<tr>
<td>Basel, Switzerland</td>
</tr>
<tr>
<td>England &amp; Wales, UK</td>
</tr>
<tr>
<td><strong>Table IIIe. Europe: Scandinavia</strong></td>
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<tr>
<td>Population</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td><strong>Scandinavia</strong></td>
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<td>Finland</td>
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<tr>
<td>Iceland</td>
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<tr>
<td>Norway</td>
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<tr>
<td>Sweden</td>
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</tbody>
</table>

<p>| <strong>Table IIIf. Australia &amp; New Zealand</strong> | | | | | | |</p>
<table>
<thead>
<tr>
<th>Population</th>
<th>Total cases registered</th>
<th>Period of registration</th>
<th>Crude rate</th>
<th>ASR</th>
<th>% of all cancers**</th>
<th>Cancer with the highest ASR incidence*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Australia</strong></td>
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<tr>
<td>New South Wales</td>
<td>10870</td>
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<td>74.8</td>
<td>53.5</td>
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<td>2904</td>
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<tr>
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<td>Prostate</td>
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<td>52.8</td>
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<tr>
<td>Non-Maori</td>
<td>4192</td>
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<td>Maori</td>
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<td>1988-92</td>
<td>17.3</td>
<td>44.4</td>
<td>9.1</td>
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</tr>
</tbody>
</table>
are of the same order of magnitude, 1.54 in Table I [1] and 1.95 in Figure 1 for Atlanta/Connecticut. The crude incidence rates per 100,000 males for selected populations in the 1997 IARC publication on Cancer Incidence in Five Continents [13] are given in Table III. The highest rates are observed amongst the USA black population, see also Figure 1, and the lowest rates in the countries of south-east Asia. It should also be noted that the incidence of prostate cancer is increasing in many European countries [2].

Age-Specific Incidence Rates

Age is the single most important risk factor for the development of prostate cancer [3] with this cancer being very rare before the age of 50 years. Figures 2 and 3 compares incidence and mortality rates for the African-American and USA white populations by five-year age group and by year. Figure 4 shows USA incidence and mortality rates by race and ethnicity. Figure 5 compares age-specific incidence rates for selected populations in north and south America, eastern Europe and Asia.

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References


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