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Epidemiology of breast cancer mortality in the Poznań region of Poland

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Objectives. Cancer of the breast continues to be the leading cause of death in woman in Poland. The share of breast cancer in cancer deaths in women in 1996 amounted to 14.1%. The Poznan province has belonged to the regions of Poland with the highest mortality rate for many years.
Material and methods. Mortality data collected by the Main Statistical Office on the basis of death certificates of women from this region were used. The analysis was carried out for the period between 1975-1996. The work was based on standardised age-specific mortality rates and standardised mortality ratio.
Results. The number of deaths due to breast cancer in the Poznan province increased from 160 in 1975 to 200 in 1996. The main risk factors in breast cancer presented in this study partially explain such high mortality rates. This province has for many years been characterised as the one with the higher standard of life than the rest of Poland. Perhaps it may also be of some importance, that the Poznan region is the area of stable number of inhabitants, with hardly any migration of people, therefore we have a very stable genome in this region.
Conclusion. The Poznań region has been an area of the highest breast cancer risk. The gap between Poland overall and the Poznań province has been decreasing with time. Geographical differentiation of the breast cancer mortality rate in the Poznań province during the analysed five-year periods does not show any regular pattern, either with respect to spatial distribution or changes over time.

Epidemiologiczna ocena umieralności z powodu nowotworów złośliwych sutka w województwie poznańskim

Cel. Nowotwory złośliwe sutka pozostają od wielu lat wiodącą przyczyną zgonów nowotworowych u kobiet w Polsce. Nowotwory sutka w 1963 roku stanowiły 9% (2. miejsce wśród zgonów nowotworowych) i ponad 14% w 1996 roku (1. miejsce). Celem pracy jest ocena fenomenu utrzymującej się od lat w województwie poznańskim najwyższej umieralności z powodu nowotworów złośliwych sutka.
Materiał i metody. Do analizy zmian zagrożenia nowotworami złośliwymi piersi populacji kobiet w województwie poznańskim w niniejszym opracowaniu posłużono się danymi o zgonach, gromadzonymi przez Główny Urząd Statystyczny (GUS) na podstawie świadectw zgonu kobiet zamieszkałych na terenie województwa poznańskiego. Struktura ludności województwa poznańskiego została udostępniona przez Główny Urząd Statystyczny.
Analizę przeprowadzono dla okresu obejmującego lata 1975-1996, kiedy obowiązywał podział administracyjny Polski z 1975 roku, dzielący Polskę na 49 województw. W niniejszym opracowaniu oparto się na standaryzowanych według wieku współczynnikach umieralności oraz standaryzowanych wskaźnikach umieralności (SMR).
Wyniki. Liczba zgonów u kobiet z powodu nowotworów złośliwych sutka w województwie poznańskim wzrosła z 160 w 1975 roku do 200 w 1996 roku. Główne czynniki ryzyka raka piersi częściowo wyjaśniają tak wysoką umieralność w województwie poznańskim. Poznańskie od lat charakteryzuje się wyższym poziomem życia w porównaniu z resztą kraju. Być może pewne znaczenie może mieć także fakt, że Poznańskie jest terenem o ustabilizowanej ludności, gdzie nie miały miejsca migracje ludności, a zatem mamy do czynienia z bardzo stabilnym genomem.
Podsumowanie. Województwo poznańskie od lat jest terenem o najwyższej umieralności z powodu nowotworów złośliwych sutka u kobiet. Wraz z upływem czasu różnica między wartościami współczynników umieralności dla Polski i Poznańskiego zmniejsza się. Zróżnicowanie geograficzne wskaźnika umieralności z powodu nowotworów piersi na terenie wo-

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jewództwa poznańskiego w analizowanych pięcioletnich okresach nie wykazuje żadnych prawidłowości, zarówno w rozkładzie przestrzennym, jaki i w przypadku analizy zmian w czasie.

Key words: breast cancer epidemiology, Poland, Poznan province, risk factors
Słowa kluczowe: epidemiologia nowotworów sutka, Polska, województwo poznańskie, czynniki ryzyka

Introduction

Breast cancer is the most frequent cancer in women almost everywhere (the only exception is lung cancer in the USA, since 1988).

Population registries of many countries estimate an incidence rate ranging from 3.4/100000 in the Gambia to 104/100000 among white women in the Bay Area of the USA (data refer to the period 1983-1987). Generally speaking, the highest incidence of malignant breast cancer is observed among white women in the USA, as well as other American women (e.g. black women: 84/100000 in Alameda, Chinese women in the Hawaii: 76/100000, and Japanese women in Los Angeles: 73/100000). High incidence rates are also noted in Jewish women, both those born in Israel (77/100000) and in Europe and America (72/100000). In Europe, the highest incidence rates are found in some areas of Switzerland (74/100000), in Holland (73/100000), Great Britain (72/100000), Iceland (70/100000), and Denmark (69/100000). Lower breast cancer incidence rates were observed by Chinese registries (10-20/100000), Indian registries (around 20/100000), Thai registries (10-14/100000) and African registries (up to 10/100000).

The rates of malignant cancers in the Polish registries are in positions between 115 and 149 out of the 166 total registries listed in *Cancer Incidence on Five Continents* (vol. VI) [1]. Breast cancer incidence rates were as follows: in Cracow 40/100000, in Warsaw 39/100000, in Lower Silesia 34/100000, in Opole 29/100000, in selected rural areas around Warsaw 23/100000, and in Nowy Sącz 23/100000.

In comparison to other European women, Polish women face a low breast cancer risk, as confirmed both by the population registration data and data based on mortality statistics. Until the end of 1970s malignant breast cancer was the second cause of cancer deaths among women in Poland (after malignant stomach cancers) in Poland; now it is number one.

Materials and methods

In order to analyse the changes in breast cancer risk among women in the Poznan province, the present paper uses mortality data collected by the Main Statistics Bureau (GUS) on the basis of death certificates. The Main Statistics Bureau allowed access to a breakdown by sex and five-year age groups of the structure of the population of the Poznań province.

The analysis was performed for the period 1975-1996, when the 1975 administrative division of Poland into 49 provinces was still in force. This study concerns the region of the Poznań province. In 1975, 628700 women lived in the Poznań province and in 1996 there were 694900 female inhabitants.

The present work is based on standardised age-specific cancer mortality rates and standardised mortality ratio (SMR) [2].

The correlation between mortality and age was analysed. Mortality rate curves according to age were drawn for three five-year periods: 1975-1979, 1985-1989 and 1990-1994. Cohort analysis is also presented in graphic form. Mortality rates were estimated for every fifth calendar year, i.e. 1975, 1980, 1985, 1990, 1995, for five-year age groups, which were then assigned to birth cohorts, beginning with patients born between 1881--1885. Each cohort is marked by the birth period bracket of all patients within this bracket. This method allows for comparison of risk factors for patients born in different time brackets, at the same age.

The cumulative change in mortality rate for the respective birth cohorts (increase or decrease of death risk) was calculated. The expected value of the rate for all cohorts in neighbouring age groups was estimated, then the cumulative change in risk (as a %), using the oldest cohort (in this case women born between 1891-1895) as the basis (100%).

Diagrams illustrating time-dependent mortality trends present the rates of change in mortality between 1975-1996 for four categories: overall, and age brackets 20-44 years, 45-64 years, and over 65 years of age. No women under the age of 20 died due to malignant breast cancer during this 21-year period, therefore this age group was not analysed.

Maps present the geographical distribution of mortality rates due to malignant breast cancer in the Poznań province in the periods between 1975-1979, 1980-1984, 1985-1989, and 1990--1994. These maps were prepared based on the natural division of standardised mortality ratio (SMR) (minimisation of differences in a given class and maximisation of differences between classes) and drawn with the use of MapInfo program.

The paper was prepared on the basis of cancer death rate due to the fact, that only mortality statistics in Poznan region are complete and comparable in years. Unfortunately, in spite of considerable improvement in completeness of incidence recording (70% at the beginning of 70' s (Koszarowski, Gadomska et al.1987), 82% at the end of 80's (Zatoński et al. 1993), there is still no guarantee of full information. Additional cause of fixing on mortality data in Poznan district is wide territorial difference in completeness of disease occurrence registration.

Results

The number of deaths due to malignant breast cancer in the Poznań province increased from 160 deaths in 1975 to 200 deaths in 1996: an estimated 158 deaths a year (5.1% of deaths due to malignant breast cancer in Poland). In the years 1975-1979, approximately 170 deaths a year were observed (4.7% of deaths related to malignant breast cancer in Poland). In the years 1980-1984, an average of 184 deaths a year were observed (4.7% of deaths due to malignant breast cancer in Poland) and in the years 1985--1989, on average 195 deaths a year (4.5% of deaths due to malignant breast cancer in Poland) in the period 1990--1995. In the final two years, the mean number of deaths totalled 206 (4.4% of deaths due to malignant breast can-

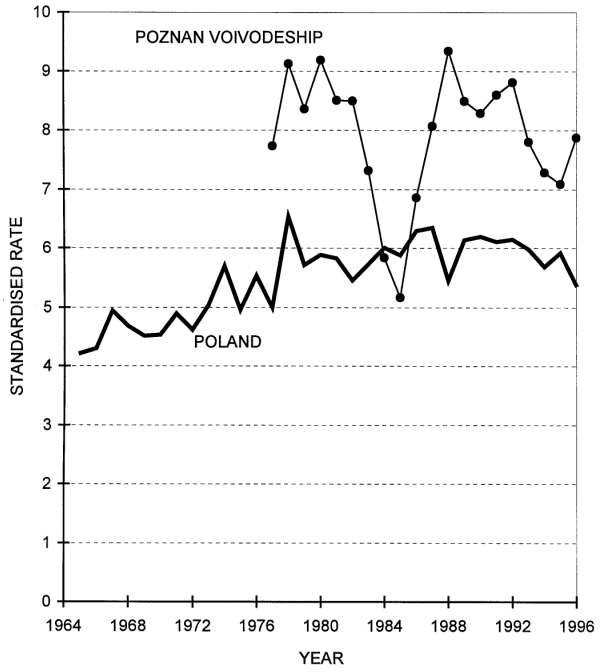

Figure 1. Breast cancer standardised mortality rates, females aged 20-44, Poland and Poznan voivodeship * 1965-1996
(*3-years moving average)

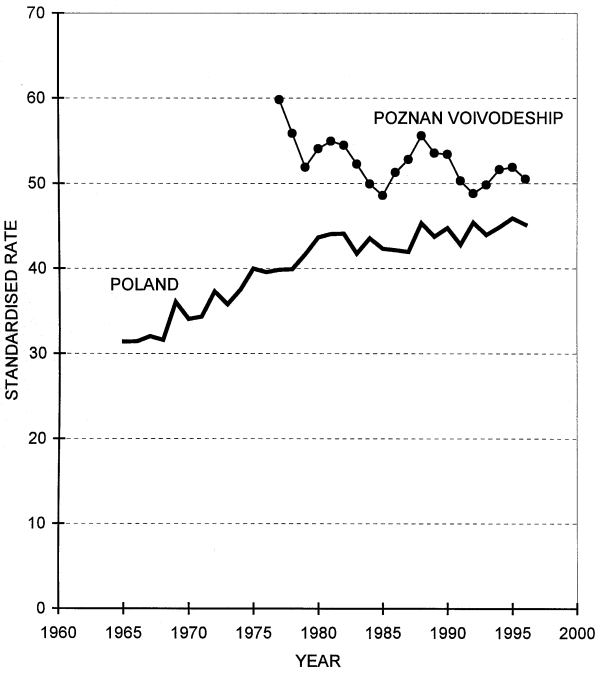

Figure 2. Breast cancer standardised mortality rates, females aged 45-64, Poland and Poznan voivodeship * 1965-1996
(*3-years moving average)

cer in Poland). The percentage of deaths connected with malignant breast cancer in the Poznań province is decreasing.

Periodical trends of the mortality rates

Agegroup 20-44 (Figure 1)

For young women from the Poznań province, the mortality rate due to malignant breast cancer varied between 5 and 11/100000 in the years 1975-1996. This variation is not due to any definable tendency; only an overall decreasing trend in the past decade (1986-1996) may be observed. The mortality rate rates are higher in the Poznań province than in the general population of young women in Poland. In the years 1990-1994, the mortality rate for young women in Poland was 6.0/100000 overall, and in the Poznań province it was 7.9/100000.

Agegroup 45-64 (Figure 2)

Mortality rate due to malignant breast cancer in middle-aged women in the Poznań province shows a decreasing trend. In the respective five-year periods the mortality rate was as follows: 1975-1979 57/100000, 1980--1984 53/100000, 1985-1989 53/100000, 1990-1994 51/100000, and in the years 1995-1996 50/100000. The decrease of the mortality rate in the Poznań province is a very interesting phenomenon, in view of the mortality rate in this age group for Poland in general, which increased the end of the 70s, but stagnated at the beginning of the 80s. It should be emphasised, however, that mortality rates for the whole period analysed were considerably higher in the Poznań province than the mean for Poland as a whole.

Agegroup 65 and over (Figure 3)

In the Poznań province the mortality rate due to malignant breast cancer in women over 65, has been increasing during the past two decades, despite periodic variation of the rate value. As in other age groups, breast cancer mortality in the oldest women is considerably higher in the Poznań province than in Poland overall. In the years 1990-1994 the mortality rate in the Poznań provin-

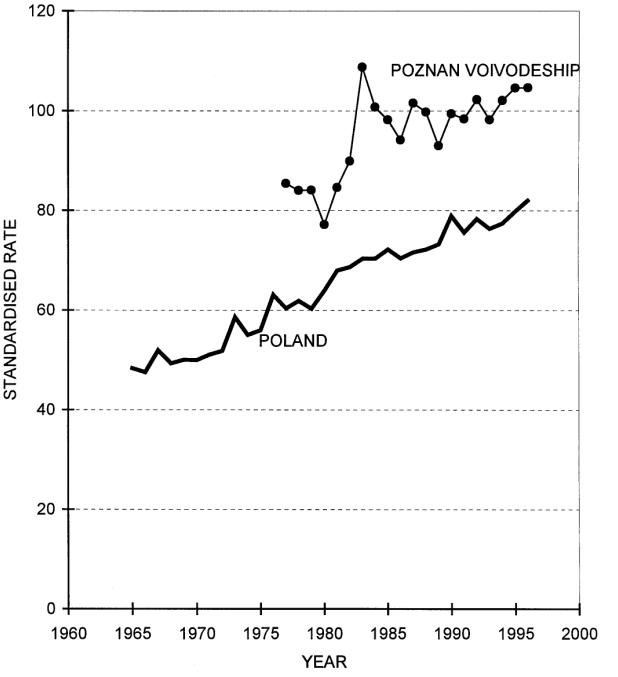

Figure 3. Breast cancer standardised mortality rates, females aged 65 and over, Poland and Poznan voivodeship * 1965-1996
(* 3-years moving average)

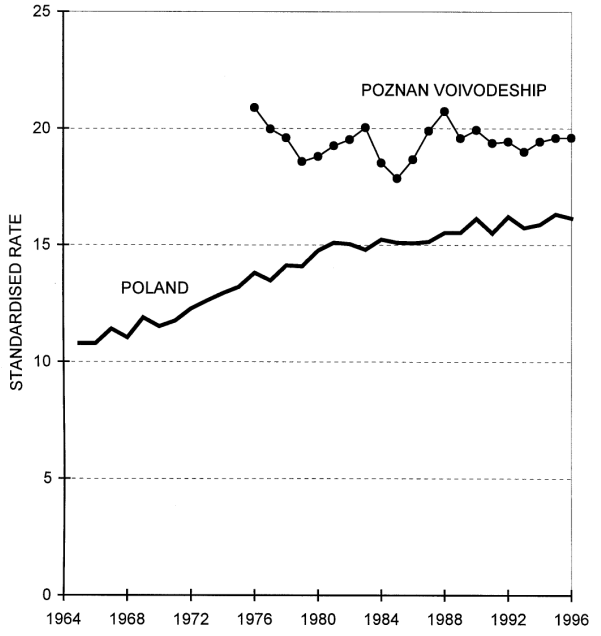

Figure 4. Breast cancer standardised mortality rates, females all age group, Poland and Poznan voivodeship * 1965-1996
(* 3-years moving average)

ce was 102/100000, and in Poland 77/100000, while in the last year of the study period they were 104/100000 and 82/100000, respectively.

Total (all age groups) (Figure 4)
In the Poznań province, mortality due to malignant breast cancer varied from 16/100000 to 23/100000 (in 1986), yet it remains on the level of approximately 19.5/100000, and since 1987 it has remained almost unchanged. In contrast to Poland overall, where the rate has been on the increase for the past thirty years, the Poznań province has been stable, but, as in the above-mentioned individual age groups, rates themselves have been higher (in 1996, by almost 20% of the Polish mean value).

Mortality rates by age (0-85 years) (Figure 5)
The mortality rate is very low (below1/100000) in the 25--29 year age group. Beginning with the 30-34 age group there is an increase in the frequency of malignant breast cancer depending on age. Mortality rates are highest for the oldest age group. A comparison of the correlation curves of mortality rate and age in different time brackets indicate that these curves overlap up to the age group 50-54, after which the curve is placed higher, and mortality rates for a given age group rise with time.

Mortality rates in age groups for respective birth cohorts (Figure 6)
Interpreting the cohort analysis for the Poznań province is extremely difficult, as the typical correlation between birth generation and value of the mortality rate due to malignant breast cancer does not exist. In Poland overall, the mortality rate for women of a given age, born in different years, has been increasing; i.e. the age when a certain level of risk is reached is shifting lower. This phenomenon does not occur in the population of women in the Poznań area; there, women born later had lower mortality rate values.

Cumulative mortality rate (change in risk) in % for successive birth cohorts (Figure 7)
Cumulative risk of death due to malignant breast cancer in the Poznań province had been increasing for consecutive generations for successive birth cohorts, up to the cohort of women born between 1926-1930. The genera-

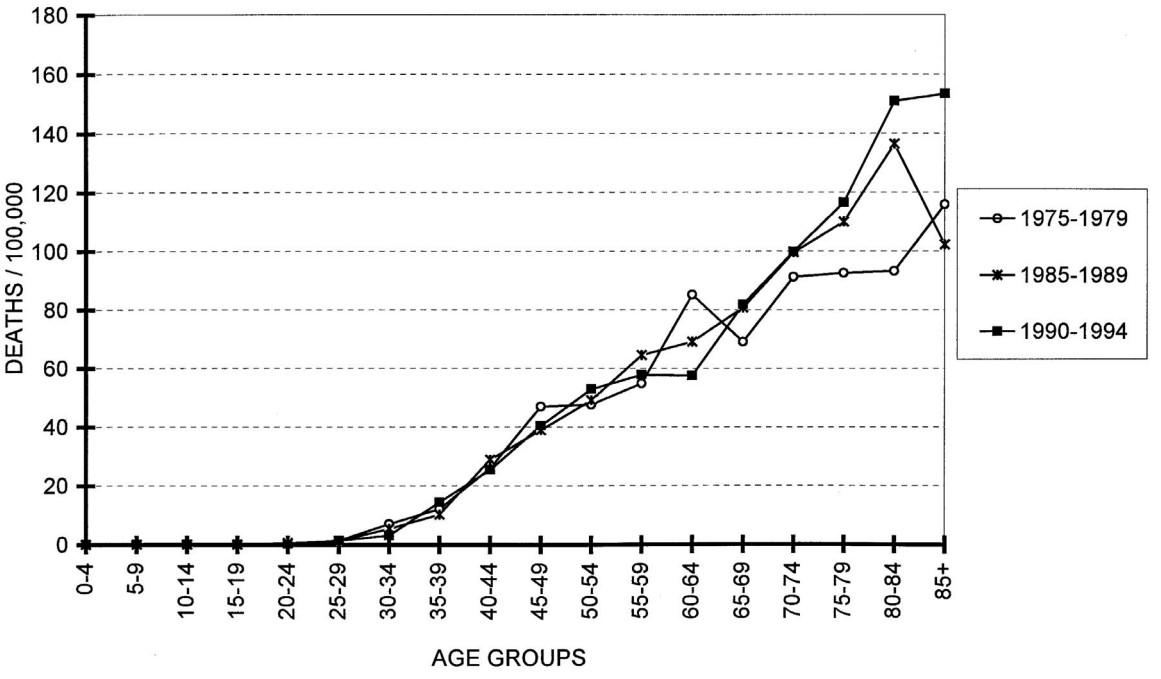

Figure 5. Female breast cancer mortality rates by age groups, Poznan voivodship, selected time periods

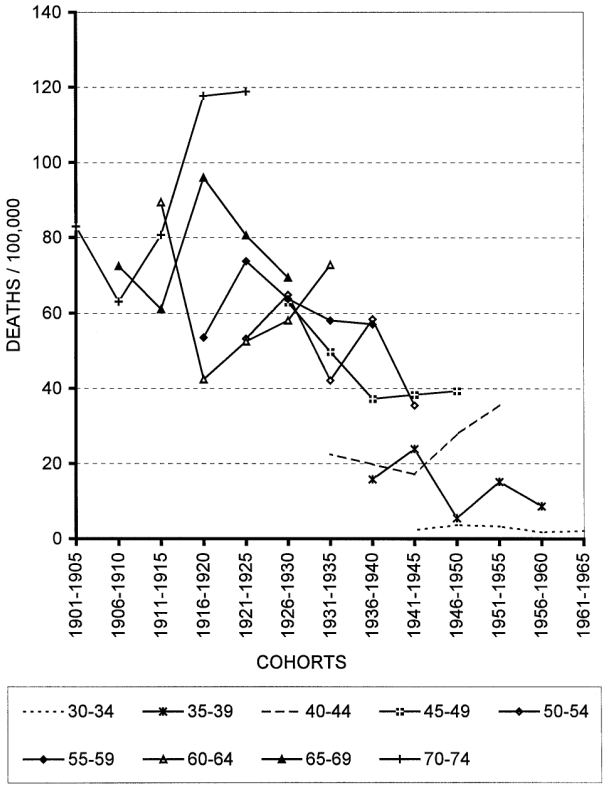

Figure 6. Female breast cancer mortality rates for subsequent birth cohorts by age groups, Poznan voivodship 1975-1995

tion of women born between 1926-1930 shows the highest risk for death due to breast cancer – approximately 1.7 times higher than women born between 1981-1985. For young women, born after 1930, death risk decreases slowly (although it is still higher for women born in the last century).

Geographical differentiation of mortality rate in the area of the Poznan province (Figure 8-11)

During 1975-1979, the distribution of the standardised mortality rate showed no regular pattern. The highest and lowest mortality rates were observed in the neighbouring boroughs, but there is a clear cluster of boroughs with a slightly higher ratio in the centre of the province. The geographical distribution does not indicate any pattern at all during 1980-84. During the successive two five-year periods (1985-1989 and 1990-1994), no large areas with distributions lending themselves to comparison can be distinguished. No borough permanently showed the highest or lowest mortality rate during the studied time.

Geographical differentiation of the breast cancer mortality rate in the Poznań province during the analysed five-year periods does not show any regular pattern, either with respect to spatial distribution or changes over time.

Discussion

In 1963, malignant breast cancers caused 9% of all cancer deaths in women, second place among all cancers in Poland. In 1996, the breast cancers amounted to 14.1% of all cancer death in women, the first place. Numerous studies since the beginning of the 70s on the geographical distribution of cancers in Poland have pointed to the Poznań region as an area with an increased mortality due to malignant breast cancers in women [3]. In consecutive studies from this period [4-8] the Poznań region has been an area of high breast cancer risk. In 1996 malignant breast cancer deaths in the Poznań province comprised about 5% of the total breast cancer de-

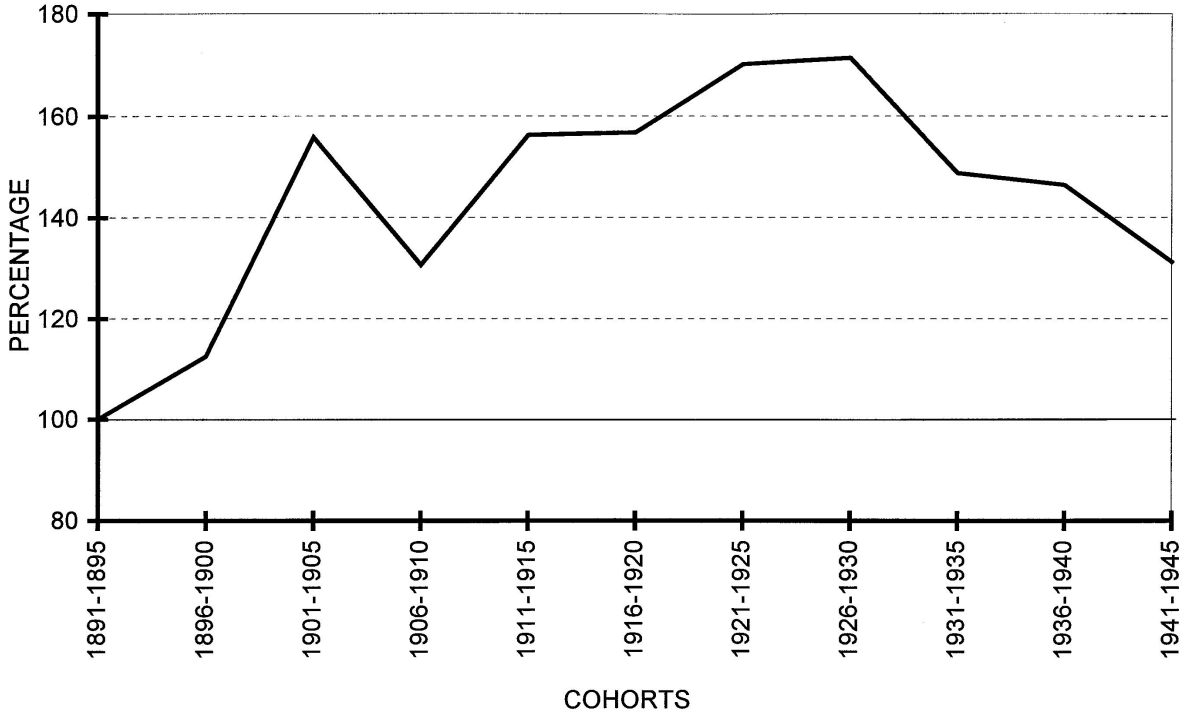

Figure 7. Change of cumulative death risk due to female breast cancer for subsequent birth cohorts, Poznan voivodship

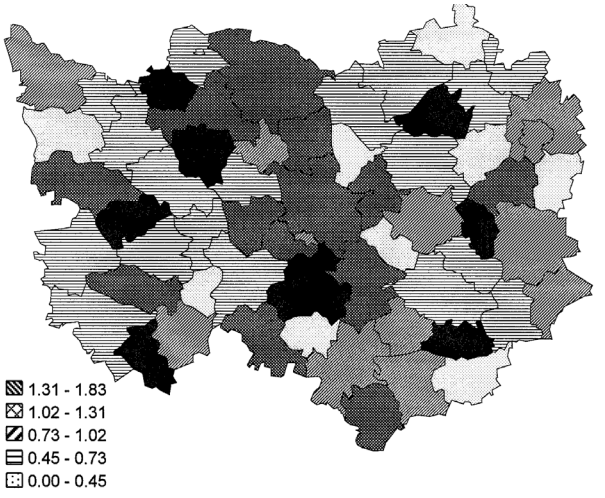

Figure 8. Geographical distribution of standard mortality rate (SMR) from female breast cancer, Poznan voivodship, 1975-1979

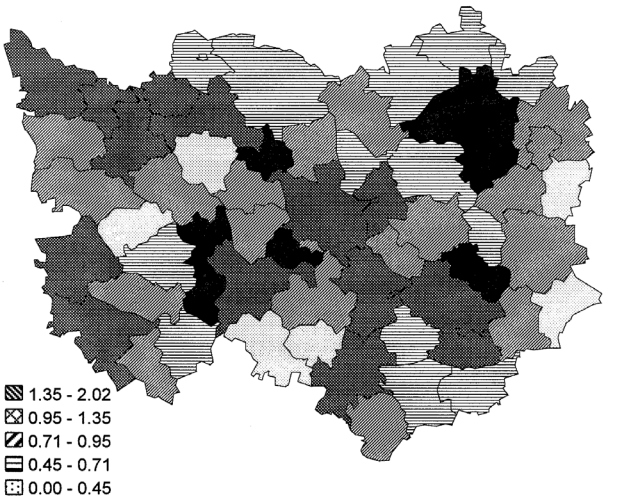

Figure 9. Geographical distribution of standard mortality rate (SMR) from female breast cancer, Poznan voivodship, 1980-1984

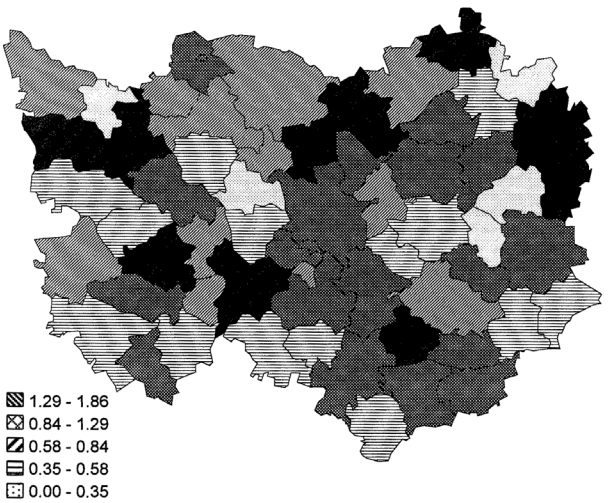

Figure 10. Geographical distribution of standard mortality rate (SMR) from female breast cancer, Poznan voivodship, 1985-1989

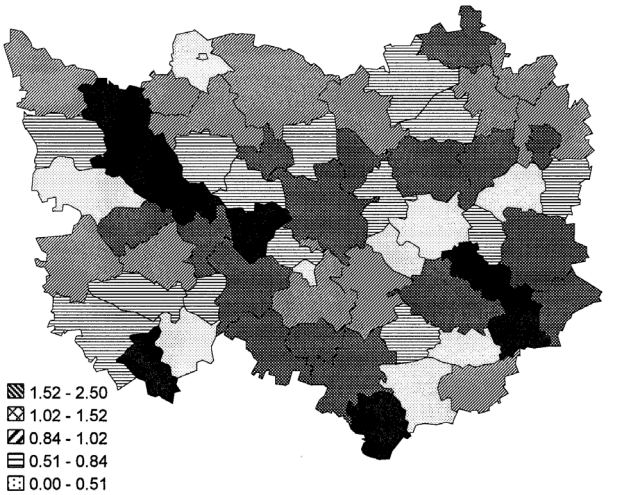

Figure 11. Geographical distribution of standard mortality rate (SMR) from female breast cancer, Poznan voivodship, 1990-1994

aths in Poland, although the Poznań province has 3.5% of the total population (1996). Although this difference held throughout the study period, the gap between Poland overall and the Poznań province has been decreasing with time.

Breast cancer mortality rates in women in the Poznań region have been increasing in all age groups. The mortality rates, especially for young adult (20-44) and middle-aged (45-64 years) women over the past 15 years, show a decrease in the rate of change. The rate for older women (over 65 years of age) has shown a consistent, rapid increase.

Etiological factors

The risk of cancer in women is apparently connected most strongly with the female hormonal system, although environmental factors (e.g. place of residence) and lifestyle factors (e.g. diet) are also of importance. Recently, there has been a substantial amount of literature discussing the importance of genetic factors.

Epidemiological studies show correlation between breast cancer risk and reproductive events (early first period and late last period, first child at a later age, higher risk with fewer births). International studies show that first childbirth at a young age (before age 25) is a protective factor against breast cancer. [9] Women who give birth for the first time after age 35 have a higher risk of developing breast cancer than women who have never given birth. The risk of developing breast cancer may decrease with the number of births [3]. However, recent studies suggest that women giving birth to their second or third child after age 35 (even if the first childbirth was at under age 25) are potentially at more risk than women who never gave birth at all [10]. Many authors confirm that the age of a woman at the time of her first childbirth is one of the major breast cancer risk factors connected with pregnancy [11].

Miscarriage in the first trimester of pregnancy may also be a significant risk factor in malignant breast cancer [12, 13]. It has been proved that the protective effect of

first pregnancy occurs only when the pregnancy is carried to term [14]; the risk of breast cancer may increase when pregnancy lasts less than 5 months. [15] The role played by termination of pregnancy both natural and induced and breast-feeding is still controversial in the aetiology of breast cancer. It seems, though, that abortion, especially before the birth of the first child, increases cancer risk.

The influence of oral contraceptives on breast cancer risk has been systematically tested since their introduction, and they have been considered a potential risk factor for cancer. So far, almost all scholars studying this phenomenon are of the opinion that there is no definite proof confirming or rejecting the thesis of an increased cancer risk due to using oral contraceptives [12, 16]. However, it seems that a prolonged use of oral contraceptives leads to an increase in breast cancer risk, especially in pre-menopausal women. The use of hormone replacement therapy during the menopausal period is also a risk factor (in Poland this applies to only a very limited number of women, approximately 3%). The use of high doses of contraceptives for a prolonged period, from a young age, and before the first pregnancy, has been confirmed to be connected with breast cancer [17].

Alcohol consumption, according to a growing number of epidemiological studies, is connected with breast cancer in women. Although the risk seems to be rather small, the custom of drinking is so widespread that it can be an important risk factor [18, 19]. It is estimated that in the US around 13% of cancers of all sites are related to alcohol consumption [20]. Recent studies in Poland also show that drinking alcohol even in small doses is a risk factor for breast cancer [21], but these results are not unambiguous.

Standard dietary factors have become a very important element in epidemiological considerations of cancer, as not only fat consumption but also the protective effect of vegetable and fruit consumption has a significant influence on breast cancer. Dietary routines have been analysed in many countries [22, 23], with the most advanced studies being those on the relation between fat consumption and cancer incidence. In 1942 Tannenbaum observed that a diet rich in fat increases the frequency of malignant breast cancer in animals [24]. The continuation of these studies allows the statement that a diet rich in fat acts as a promoter of malignant cancers, but not as their initiator [22]. A number of studies associate breast cancer risk with the consumption of fat and other food products (milk, eggs, beef etc.) Fat cells may be the source of aromatase enzyme, which after menopause becomes the source of estrogens by converting androgens to estrogens [25, 26]. Recent studies on post-menopausal women confirm the statistically significant correlation between risk of malignant breast cancer incidence and consumption of saturated fats. The direct conclusion of these studies is the relation between being overweight and obese and an increased risk of breast cancer. These studies have also confirmed the protective activity of many substances (mainly vitamin C and beta-carotene) in fruit and vegetables [26].

Genetic and family susceptibility to cancer is among the main risk factors for malignant breast cancer. It applies mainly to women whose mother and sister(s) have suffered from this type of cancer. Of course, the prevalence of breast cancer is most often connected not with genetic factors but rather with the family lifestyle. At present it is believed that the criterion for hereditary breast cancer is the presence of the mutation of the suppressor gene *BRCA1* and *BRCA2*. Mutation of the gene *BRCA1* is associated with an about 90% risk of developing breast cancer. Also, the so-called Li Fraumeni syndrome connected with *p53* gene mutation is associated with a hereditary type of breast cancer. In patients with this syndrome, breast cancer accompanies leukaemia, brain tumours, and cancer of the adrenal cortex [27].

These main breast cancer risk factors partially explain the high mortality rates in the Poznań province. This province has been characterised for many years by a higher standard of living than the rest of Poland, with all the changes in lifestyle implied by prosperity (eating habits, number of calories consumed, decrease in family size, late motherhood). It may be important that the Poznań region is an area with a stable number of inhabitants, hardly any migration, and therefore a very stable genome.

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