Evaluation of the national breast cancer screening program in Poland in 1999-2009.
National Cancer Registry overview.

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Abstract
Background: The Polish breast cancer screening program was initiated as part of National Cancer Control Program in July 2005 by establishing a network of accredited regional centers and the central coordination point. The changes in reproduction behaviors and lifestyle in Poland have contributed to rapid increase of breast cancer incidence and mortality. The aim of this article is to describe the results of the program after 7 years from its implementation and to advocate for its continuance.

Methods: Data on incidence and mortality due to breast cancer among women aged 50-69 were extracted from the National Cancer Registry. Annual reports of the National Cancer Control Program and other data provided by the Ministry of Health in Poland were analyzed.

Results: Between January 1999 and December 2009 there were 142,307 new cases of breast cancer and 54,927 deaths because of it reported in Polish females. Poland is a country with relatively low and dynamically increasing incidence of breast cancer compared to Western European countries. The coverage of the nationwide screening program was around 40%.

Conclusion: The late introduction of the screening program with a high recall rate resulted in dynamic increase of incidence. This leads to stabilization of the breast cancer mortality since more cases could be detected at early stage and treated more effectively. The Polish National Cancer Control Program which includes the breast cancer screening met the interim measures recommended in the European Guidelines and should be continued in the future with higher coverage on the target population.

Key Words: breast cancer, screening program, mortality, Poland.

Introduction

Breast Cancer (BC) is the major cause of cancer mortality among females in developed countries. According to the World Health Organization (WHO) in Europe cancer represents the second most important cause of death and morbidity. The population of Europe is 731 million which accounts for 10.7% of the total world population of 6,840 million, however with 3.2 million of new cancer patients and 1.7 million deaths due to cancer each year, Europe accounts for approximately 25% of all cancer worldwide. In the European Union (EU) cancer is responsible for 20% of all deaths and is the biggest killer of people aged 45-64 where it causes 41% of all deaths. Cancers of lungs and throat are the most common among men, while BC is the leading cause of female cancer death, causing 17% of all deaths from cancers in women in the EU.

Many researches were conducted in order to determine the risk factors of BC. It was found that maternal behaviors such as childlessness, abortions, late first pregnancies, early age at menarche, no breastfeeding and hormonal therapies were recognized as an important risk factor of BC. Other risk factors included fat diet, obesity and insufficient exercise. These risk factors are the characteristics of developed countries where females shift from family housewife to career-oriented lifestyles.

In order to control and prevent the continuous increase in mortality due to BC, from the late 1980s many countries started introducing early BC screening programs which were necessary for more accurate diagnosis and treatment of BC. Due to innovations such as mammography screening, chemotherapy, hormone treatments, innovations in radiotherapy and surgery, big improvements were observed in BC survival in Europe. In Central and East-European countries the small decreases or continued increase in BC mortality were correlated with low, usually non-organized, screening activities, low number of mammography machines, slow uptake of anticancer
drugs, and health expenditure below the European average. These patterns can also be linked to rapid changes in BC risk factors that took place in the countries after the collapse of the Soviet Union and the communist regime in 1990s, such as decreasing fertility and increasing age at first birth, no breastfeeding, hormonal therapies or abortions. We can observe that these behaviors are more frequent in West-European capitalist countries with open markets where women are more likely to sacrifice their family life for career.

In 2000-2004 the rate of BC mortality in Poland was 17% lower compared to the average of all European Union (EU) countries, 11% lower in 2007 and was predicted to be only 4% lower than in 2011, reflecting a long-term tendency toward leveling of BC rates in Europe, starting from rates 25% to 30% lower in Eastern than in Western Europe. Compared with other European countries, Poland has a relatively young population. Any currently observed epidemiological parameters, such as a relatively low incidence rate of cancer, should be considered in this context. However, the coming years will see rapidly rising numbers of the elderly along with the incidence of health events characteristic for this type of population. The BC incidence and mortality rates in Poland have been dynamically increasing compared to other European countries. According to the National Cancer Registry the prognosis for the years 2010-2025 indicates further increase of BC incidence. For women before menopause the increase of incidence will be probably slight (from 16 per 100,000 in 2006 to 19 per 100,000 in 2025). The highest increase in incidence is expected for the group of women aged 50 to 69 years old.

To resolve the problem in 2005 the Polish government introduced the National Cancer Control Program (NCCP), which included the first nationwide BC screening program. In previous studies it was found that the BC mortality rates in Poland will remain about double than those of five other countries from the Soviet Bloc, reflecting the delay observed in the adoption of effective preventive strategies and screening programs. Since the total budget spent on the Polish public healthcare is reviewed and reshaped on annual basis in order to meet the priorities of patients, preventive activities such as the BC screening program and its effectiveness have been questioned. The purpose of this study is to analyze the changes in temporal trends in BC incidence and mortality rates in women living in Poland based on the data extracted from the National Cancer Registry. This kind of analysis can be used to track the epidemics of BC, to focus attention on the quality of BC treatment and diagnosis as well as to emphasize the importance of BC screening program.

Materials and Methods

The BC mortality and incidence data for Poland was extracted from the National Cancer Registry’s website (http://85.128.14.124/krn/) accessed on 29 January 2012, whereas the BC incidence and mortality data for other European countries were extracted from the verified World Health Organization (WHO) database in December 2009.

This study includes data on new breast cancer cases and deaths caused by breast cancer among females in all 16 regions of Poland in 1999-2009. Incidence and mortality rates are calculated as mean annual numbers per 10,000 females of all age groups. The structure of the Polish population by sex and by 5-years age groups was presented on the basis of data received from the Central Statistical Office on the 30th June 2008.

Data collection

The new cases of cancer and cancer deaths in Poland are collected on the basis of the cancer registration forms (MZ/N-1a). The 16 regional (voivodeship) cancer registries receive the data in the registration forms from approximately 350 hospitals spread across Poland, validate them and reports to the National Cancer Registry in the Maria Skłodowska-Curie Memorial Cancer Centre - Institute of Oncology in Warsaw, where these data is verified in terms of logical and essential correctness and are joined into the national annual dataset and cancer report. The annual reports are created from the data submitted by the voivodship registries, which are supposed to send in the regional data no later than by 31st December of each next year.

Breast cancer screening program

The nationwide BC screening program has been officially introduced by the Polish government on 1st July 2005 with a legislation act as part of the National Cancer Control Program (NCCP). According to law the state budget designated to NCCP per annum cannot be less than 250 million PLN (approx. $72.14 million) and the amount designated to early cancer detection has to be the equivalent of at least 10% of the above sum. In order to maximize coverage, encourage women to breast check-ups and to spread awareness every year the Ministry of Health posts invitations to all women from the target group in Poland. Some endorsement techniques for breast checkups such as product placement in the Polish national television have been introduced. The NCCP recommends doing mammography and cytology screening tests every two years for all women aged 50-69. The mammography tests are done in line with the European Guidelines for Quality Assurances in Breast Cancer Screening and Diagnosis.
The BC screening program has been divided into two parts: basic mammography and advanced diagnosis. In the first stage – the basic mammography – all women who are screened are registered in the database and interviewed face-to-face with a predesigned survey. After the interview two mammography X-rays of each breast are taken and described. Based on the mammography results, doctors have to choose one of the following options:

a. In case of negative results with no risk factors, the complete results ought to be given directly to the patient or be posted to the patient’s address along with recommendation of another checkup after 24 months.

b. In case of negative results with minor risk factors defined by the program, the complete results ought to be given directly to the patient or be posted to the patient’s address along with recommendation of another checkup after 12 months.

c. In case of positive results of mammography done in the hospital, the complete results ought to be given to the patient directly while collecting results. If the patient does not turn up for the results in three months, a reminder letter to collect the results is sent to patient’s address and the patient is directed to the advanced analysis.

d. In case of positive results of mammography done in the mobile mammography unit (bus), the results ought to be informed to the patient via telephone or in writing. The complete medical documentation should be handed over to the patient or to the advanced diagnosis center which is chosen by the patient and noted in the complete medical documentation.

e. In case of positive results and inability to contact the patient, the copy of medical documentation is sent to the patient’s primary health-care doctor along with a request to visit the patient at their home address.

The guidelines for the advanced diagnosis have been established as part of the program. At the medical consultation doctor does a physical checkup and runs the necessary tests which end up with diagnosis. Based on the first mammography, the palpation results, the mammary gland structure, the applied hormone replacement therapy, the diagnosis as solid tumor or as a cyst of mastoid, the doctor decides whether the patient needs further the breast ultrasonography check. Thereafter additional mammography image is taken and either a fine needle aspiration or core biopsy is done. When the results arrive the patient is referred to treatment in a designated hospital which offers appropriate treatment financed by the National Health Fund. The exact procedure of patient’s treatment is illustrated in Fig. 1.

As breast cancer is often a hereditary disease the Ministry of Health decided to include in the risk group those women whose relatives had BC history or those who were identified as the carriers of the mutated cancer genes such as BRCA1 or BRCA2. Those included in the risk group are advised to do a self-checkup every month after menstruation as well as do a clinical checkup twice per year. Also those qualified to the risk group should do

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**Fig. 1. Flow chart of breast screening activities**

- **2x2 mammography**
  - **Results**
    - **Positive**
      - **Advanced diagnosis**
    - **Negative**
      - **Risk factors**
        - **No**
          - **Checkup in 24 months**
        - **Yes**
          - **Checkup in 12 months**

- **Results**
  - **Positive**
    - **Fine needle aspiration detects cancer**
      - **Treatment**
      - **Benign changes**
      - **Breast cancer**
    - **Ambiguous result Core biopsy**
  - **Negative**

breast cancer screening in Poland
Table 1. Breast cancer incidence and mortality in Poland in 1999-2009

| Year | Total population | Total incidence | Incidence per 10,000 | Age-standardized cancer incidence (per 100,000) | Total mortality | Mortality per 10,000 | Age-standardized cancer mortality (per 100,000) |
|------|-----------------|----------------|---------------------|-----------------------------------------------|----------------|---------------------|-----------------------------------------------|
| 1999 | 19,864,929      | 10,903         | 5.49                | 38.8                                          | 4,553          | 2.29                | 14.8                                          |
| 2000 | 19,868,732      | 11,853         | 5.97                | 41.8                                          | 4,712          | 2.37                | 15.0                                          |
| 2001 | 19,872,476      | 12,118         | 6.10                | 42.4                                          | 4,825          | 2.43                | 15.0                                          |
| 2002 | 19,715,122      | 12,132         | 6.15                | 42.0                                          | 4,825          | 2.45                | 15.0                                          |
| 2003 | 19,702,235      | 11,733         | 5.96                | 40.2                                          | 4,942          | 2.51                | 15.0                                          |
| 2004 | 19,701,881      | 12,049         | 6.12                | 40.6                                          | 4,887          | 2.48                | 14.5                                          |
| 2005 | 19,700,583      | 13,385         | 6.79                | 44.5                                          | 5,112          | 2.59                | 14.9                                          |
| 2006 | 19,696,176      | 13,322         | 6.76                | 44.2                                          | 5,212          | 2.65                | 14.8                                          |
| 2007 | 19,698,893      | 14,484         | 7.35                | 47.7                                          | 5,255          | 2.67                | 14.5                                          |
| 2008 | 19,707,504      | 14,576         | 7.40                | 47.2                                          | 5,362          | 2.72                | 14.8                                          |
| 2009 | 19,730,046      | 15,752         | 7.98                | 50.4                                          | 5,242          | 2.66                | 14.1                                          |

A mammography or ultrasonography check every year. This is also recommended to all women with adipose breast structure aged 30 plus.

Doctors are obliged to report all newly detected cases of breast cancer as well as the benign changes on a designated cancer registration forms (Mz/N-1a) with annotation “S” which stands for screening.

All patients should also sign the consent for personal data processing. Information such as home phone, mobile phone and email address are gathered along with patients’ personal information so that the negative results can be emailed or sent via text along with the reminder to redo the checkup after 24 months.

Quality Assurance

In order to guarantee the quality of the BC screening program, all participating hospitals need to meet the requirements for hospital staff (doctors with specialty in radiology and image diagnostics, who analyzed at least 500 mammography images and X-ray technicians who attended the official training of the Polish Medical Imaging Association and did at least 1000 mammography images) and for the diagnostic equipment which passed the quality tests.

All digital mammography imaging should be done in line with the European guidelines for quality assurance in breast cancer and diagnosis. The mammography imaging devices should be tested at least once per year. Should the device go under maintenance, additional tests are required.

Results

In the analyzed period between January 1999 and December 2009 there were 142,307 new cases of BC reported in Polish females of all ages. Throughout the analyzed period the incidence has been increasing every year. The number of those who died because of BC in that period was 54,927. The annual BC incidence, mortality as well as their age-standardized rates are presented in Table 1.

Total number of incidents shifted from 10,903 in the year 1999 to 15,752 in 2009 which is an increase by 44.5%. In the same time the BC mortality increased by 15% from 4,553 in 1999 to 5,242 in 2009.

The total population of women in Poland in the analyzed period was used as the reference to calculate the BC incidence and mortality per 10,000. In 1999 there were 19,864,929 females in Poland compared to 19,730,046 in the year 2009 which is a decrease of 0.7%. The trend of the BC incidence and mortality per 10,000 females of all ages in Poland is presented in Fig. 2.

In Poland each year the Minister of Health presents in the Parliament the summary of the annual activities included in the NCCP. According to these summaries the number of breast screenings among Polish women aged 50-69 has been gradually increasing from 934,777 in the year 2007 (which is 38.15% of the target population), up to 1,008,942 in 2011 (which is 41.51% of the target population). Coverage data for the first year of the nationwide BC screening in 2005-2006 was 23.37%. The number of mammography checks per annum is shown in Fig. 3.

The annual reports on NCCP show the numbers of detected breast cancers, benign lesions in breast as well as the number of BC suspicions which in the year 2010 were 4,341, 245,059 and 38,116 respectively compared to 1,762, 228,353 and 10,564 in the year 2007. The data on incidence and mortality trends per 10,000 women from the target population were extracted from the National Cancer Registry and are showed in Fig. 4.

The mortality trend in the studied period among the target group is stable, whereas the incidence is increasing. The increasing trend in incidence can be noticed after 2005 when the nationwide breast screening program was introduced.

Discussion

The intensity of the debates regarding BC screening programs has exceeded any other medical controversy in the past three decades. The debate has addressed the
Fig. 2. Breast cancer incidence and mortality per 10,000 women in Poland

Fig. 3. The number of mammography checks per annum.

Fig. 4. Breast cancer incidence and mortality per 10,000 women aged 50-69.
benefits, cost-effectiveness and adverse consequences such as false positive findings leading to unnecessary excision biopsies. To assure the optimal level of quality of the screening program a continuous quality control is necessary. Population-based BC screening has been proposed as an effective control method for certain types of cancer and in this respect it has been recommended by numerous scientific organizations and societies. Europe is a model for implementation of organized population-based programs and the European quality guidelines for cancer screening programs have been instrumental in the development of BC screening program in most European countries, including Poland. This fact has been extremely relevant in discussions held at the screening program network and has enabled consensus to be reached on indicators, quality criteria and assessment of regional programs. The adherence to European guidelines and standards as well as the other European countries’ experiences with BC screening programs have been very helpful in justifying the budget for this preventive program in Poland.

In many developed countries which introduced organized early screening programs in the 1980s and 90s, the number of deaths caused by BC is decreasing, however, this is happening at a lower rate in Central and Southern Europe. In Poland the number of deaths due to BC has been rising since the beginning of the analyzed period in 1999. Standardized death rates (SDR) for BC indicate a slightly lower mortality due to BC screening programs in Western European countries in comparison with those in Central and Eastern Europe. A drop in SDR has been observed also in Poland, however, it has been significantly slower in comparison with other countries.

In this study we compared the reported rates of BC incidence and mortality before and after introduction of the nationwide breast cancer screening program. The BC incidence among women aged 50-69 increased by 31%, from 14.54 new cases per 10,000 women in 2005, when the program was started, up to 19.16 in the year 2009. In the same period the mortality due to BC in this age group decreased by 2% from 5.38 to 5.27 per 10,000.

The results of this study demonstrate an increase in impact of mammography screening on the prevention of BC attributed death over time. There have been significant improvements in mammographic screening and treatment over the last 30 years thanks to which early detected BC can be cured or treated effectively as never before. Incidence of malignancies in Poland has been increasing as in almost all post-Soviet countries. Poland presently has an aging society and the elderly population is generally more likely to develop cancer. However, the differences in standardized incidence rates (SIR) indicate the existence of factors, besides age, that strongly affect the incidence of cancer. The main factors identified in Poland are reproduction-related such as late first pregnancy, childlessness, hormone therapies, lack of breast feeding; lifestyle-related such as fatty diet, obesity, low physical activity, alcohol intake, smoking, red meat consumption; and the family history of BC. According to the recent evidence more than 50% of cancer incidence could be prevented if a knowledge of risk factors would be applied to behavior changes. Even though the incidence of developing neoplasms measured with the SIR in Poland is among the lowest in the European Union, it has very fast dynamics and therefore should not be ignored. The number of new cases of breast cancer in women has been growing every year throughout the analyzed period from 10,903 new cases in 1999 to an estimate of 19,000 by the year 2020. This could mean an increase by 75% in barely two decades.

Therefore the early BC detection in Poland should be continued and intensified in order to minimize the social damage caused by cancer. The challenge that is to be faced is how to maximize the coverage of breast checkups among the target population. The current Polish system of recruitment through written invitations, reinforced by independent non-governmental organizations’ media campaigns and recall for subsequent screenings by screening centers was able to achieve a modest coverage of approximately 40%. This is still rather low compared with the participation rates in other successful European population-based programs such as those in Spain, Denmark or United Kingdom, where the coverage approaches the European Guidelines target of 70% or even exceeds it, i.e. Finland. However, the invitation may also fail to achieve the stated target i.e. due to decentralized invitation in Hungary or invitation without appointment in Luxembourg. It is therefore necessary to properly plan, implement and monitor the invitation process. The weak point of the Polish setup is the insufficient involvement of primary health care physicians in the promotion of BC screenings. They get to see the full knowledge of the patient’s medical history and preferences, which enables the proper tailoring of an individual preventive strategy.

Given that the official implementation of the program was in 2005, it is still hard to accurately estimate the expected annual incidence in Poland for the future years. However, judging by the results of the last seven years, the detection rate can be estimated to lie below the expected European range. With almost 20 new BC cases per 10,000 women participating in the program, the incidence looks much more optimistic compared to other European countries i.e. Spain with 34 or UK with over 67 new cases per 10,000 women.

From the data provided by the Polish Ministry of Health we can see that between 2007 and 2010 the number of newly detected thanks to the national BC screening program, the incidence of malignant BCs increased.
by 146.4% from 1,762 up to 4,341, whereas the incidence of benign lesions in breast in that time increased only by 7.3% from 228,353 up to 245,059\(^{[5]}\). Such discrepancies between the dynamics of malignant tumors and benign lesions suggest that the screening program should be continued and monitored in order to provide more reliable results and reveal more accurate expected incidence rate for the future years. The types of tumor detected in the reported years ought to be consistent in order to enable the Ministry of Health to plan their policies and estimate budget for fighting cancer in subsequent years. All indicators extracted from the National Cancer Registry follow the European guidelines and suggest that the incidence of BC in Poland will continue to increase, however it will remain below the average European level in the next decades.

The weak point of this study comes from the analysis of differences between the numbers detected malignant BCs, benign lesions and BC suspicions between years 2007 and 2010. The discrepancies in the above data (especially the malignant BCs) can result from the fact that the NCCP was started in the middle of 2005 and the reporting system was not fully established by 2007 when first reports were submitted. Another limitation of this study is that no data on the amount of false positive cases of BC have been found.

Conclusions

The nationwide mammography screening program has been introduced relatively late in Poland compared to the other European countries. The incidence of BC in Poland is still below the European average but increases every year. The screening program leads to stabilization of the breast cancer mortality since more cases could be detected at early stage and treated more effectively. The types of tumor detected in the reported years ought to be consistent in order to enable the Ministry of Health to plan their policies and estimate budget for fighting cancer in subsequent years. All indicators extracted from the National Cancer Registry follow the European guidelines and suggest that the incidence of BC in Poland will continue to increase, however it will remain below the average European level in the next decades.

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