The burden of breast cancer: A cross-national comparison including three European Union countries

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Abstract

Aim: Breast cancer is the most common cancer in women and a major contributor to female morbidity and mortality in the European Union (EU). The aim of this research was to assess potential differences in incidence and mortality, measured by the standardized death rate (SDR), in three EU countries with differing breast cancer rates in order to better understand the distribution of cancer in the EU.
Methods: Incidence and SDR data were extracted from the World Health Organization's European Health for All database and compared across three EU countries: Belgium, Romania and Sweden. Additionally, PubMed and Libsearch were searched to identify literature on breast cancer distributions in the EU countries.
Results: Belgium is the country with the highest SDR, whereas Sweden reports the highest rate of breast cancer incidence. However, SDR has decreased in both countries, indicating advances in cancer management and screenings. Romania's SDR lies between Belgium and Sweden; however, its incidence of female breast cancer is significantly lower.
Conclusion: Belgium and Sweden presumably are more advanced in screenings, diagnosis and management of female breast cancer. Under-reporting due to lack of screening in Romania and a "higher" incidence rate due to extensive screening in Sweden may also play a role in the observed differences. This aligns with the literature which reveals that breast cancer incidence is usually lower in Eastern European countries, whereas SDR is often higher due to lack of breast cancer screening and, thus, late stage diagnosis.

Keywords: breast cancer, European Union, incidence, mortality, screenings, standardized death rate, women.

Introduction

Breast cancer is the most common type of cancer in women causing approximately 15% of all cancer deaths in women worldwide (1). Although crude breast cancer rates are higher among women living in more developed countries, crude rates increase in almost every country globally. Early detection strategies such as early diagnosis through screening allow breast cancer to be treated more effectively while reducing death rates (1). Less developed countries report low survival rates as a result of lack of early detection programs and thus late-stage disease diagnosis and inadequate treatment facilities (2). Breast cancer incidence correlates positively with the availability of well-designed screening programs (3).

A family history of breast cancer as well as reproductive factors such as late age at first childbirth, oral contraceptive and hormone replacement therapy or late menopause are considered as important risk factors for breast cancer (2). Among the modifiable risk factors, several putative lifestyle factors have been reported: alcohol use, overweight and obesity and lack of physical activity. One reason for an increase in breast cancer incidence in low-income countries is an increased adoption of Western lifestyle habits (2).

Cancer does not only have a severe impact on health and quality of life, but also on the economy of countries. The total economic costs of cancer in the European Union (EU) were estimated to be more than 126 billion Euros in 2009, with breast cancer accounting for 15 billion of it (4). Costs do not only include healthcare, prevention and cancer management, but also economic loss due to lost productivity, lost earnings and costs of unpaid care provided by relatives and friends (4).

This paper aims to provide a better understanding of the distribution of breast cancer incidence and standardized death rates (SDR) of malignant neoplasm in the female breast in selected EU countries including Belgium, Romania and Sweden. Data was obtained from the World Health Organization's (WHO) European Health for All database (HFA-DB). Additionally, studies on breast cancer in the EU countries were examined.

A brief overview of the methodological methods used to generate information is presented, followed by an explanation of the data derived from the HFA-DB, a brief literature review and a discussion and conclusions based on the study findings.

Methods

A narrative literature review of studies published in the databases Libsearch and PubMed in combination with an analysis and evaluation of three health indicators reported in the WHO HFA-DB were conducted.

The WHO HFA-DB

To compare the three countries (Belgium, Romania and Sweden), the indicators 'incidence of female breast cancer' and 'SDR malignant neoplasm female breast' were chosen, whereas the SDR was selected twice: one group including 0-64 years, and one group including all ages. SDR describes breast cancer mortality measured by the SDR. The distinction between the two age groups was considered necessary as from the age of 30 years until 69 years the breast cancer incidence rate steadily increases, with the highest increase in those aged 65 to 69 years (5). Data from 2010 to 2014 was extracted as there is no data from 2014 onwards and a five-years-course somehow allows detecting trends in breast cancer incidence, or SDR.

The HFA-DB derived incidence statistics from the Belgian National Cancer Registry, Romania's National Center for Statistics and Informatics in Public Health and the Swedish Cancer Registry. It is not clearly indicated how SDR data was reported. These three countries were chosen as they represent

very diverging health systems from three different parts of the EU: the North, the West and the East. Furthermore, they entered the EU at different points in time. Belgium is part of the EU15 and thus member of the EU since its beginnings. It was selected due to its extremely high breast cancer incidence and mortality rate. Sweden was chosen as it is known for its good health system performance. Romania has entered the EU only in 2007.

The narrative literature review

A review of studies explored the variability of breast cancer between the countries and possible reasons for these differences. The databases of LibSearch and PubMed were searched with the terms specified in Table 1. Both databases were also searched with the terms 'breast cancer AND Belgium/Romania/ Sweden' for each country, but the number of hits was very high and the headings of the suggested literature were only broadly related to the topic. A first selection of literature was based on the title; it had to refer to either breast cancer incidence or mortality and include a European or international perspective. A second selection was based on a review of the abstract. Studies focusing on breast cancer treatment or not specifically related to the EU regions relevant for this study were excluded. Published literature older than five years in any language other than English was excluded due to time restrictions and language barriers.

A manual search of the bibliography of the literature was employed and helped to identify the study by Carioli et al. (6) via the study by Curigliano and Cardoso (7). The study by Ferlay et al. (8) was found at GLOBOCAN, the webpage of the International Agency for Research on Cancer.

Table 1. Overview of the database search history

Database	Specifications	Search term	Hits	Included
Libsearch	Last 5 years	Breast cancer AND women AND European union	73	1
Libsearch	Last 5 years	Breast cancer AND standardized death rate and EU	166	0
Libsearch	Last 5 years	Breast cancer AND incidence AND European union	565	2
Pubmed	Last 5 years	Breast cancer AND European union	110	2 1 overlap
Pubmed	Last 5 years	Breast cancer mortality AND European union	33	1
Pubmed	Last 5 years	Breast cancer incidence AND European union	53	1

Results

The results are divided into the cross-country comparison of data extracted from the HFA-DB and an analysis of the reviewed literature.

Analysis of the health indicators across three EU countries (2010-2014)

The three health indicators SDR malignant neoplasm in the female breast among women aged

Table 2. A cross-country comparison of Belgium, Romania and Sweden based on the WHO HFA-DB

	SDR malignant neoplasm female breast 0-64 per 100,000	SDR malignant neoplasm female breast, all ages per 100,000	Incidence of female breast cancer per 100,000
Belgium			
-2010	15.12	27.35	179.19
-2011	15.04	27.36	187.36
-2012	12.89	25.41	186.24
-2013	13.33	25.37	188.25
-2014	-	-	-
Romania			
-2010	13.49	21.76	53.14
-2011	12.91	21.33	54.49
-2012	12.89	21.19	53
-2013	12.35	20.79	54.57
-2014	12.51	21.08	67.12
Sweden			
-2010	10.62	18.99	169.4
-2011	11	18.92	178.12
-2012	10.47	18.92	179.05
-2013	10.35	18.98	189.66
-2014	9.17	17.6	200.5
EU			
-2010	12.78	22.63	144.65
-2011	12.77	22.49	146.65
-2012	12.36	22.14	145.63
-2013	12.19	21.96	148.03
-2014	11.95	21.65	-

0-64 years and women of all ages, as well as the incidence of female breast cancer were first collected for the countries Belgium, Romania and Sweden individually and subsequently the indicators were compared across these three countries (Table 2). SDR describes the age-standardized death rate and portrays what the crude rate would have been if the population had the same age distribution as the standard European population. The incidence describes the number of newly diagnosed cases of female breast cancer in a given year (9).

Belgium
From 2010 until 2013, the SDR among women aged 0-64 years and among women of all ages has steadily decreased. From 2010 onwards, the incidence of female breast cancer has however substantially increased up to 188.25/100,000 in 2013. For 2014, no data is available.

Romania
In Romania, SDR in both age categories have decreased until 2013 and in 2014 a slight increase is visible again. The incidence of female breast cancer remains between 53 and 54.57 between 2010 and 2014 and peaks in 2014 with 67.12. The increase in all categories can be explained by the inclusion of data from the private sector since 2014. Prior to 2014, the private sector had not been included in national registries.

Sweden
The SDR in women below 64 years has dropped by 1.45/100, from 2010 to 2014. In women of all age groups, the rate decreased by 1.33. A strong increase in the incidence of breast cancer cases is observable: in 2014 it reached its highest figure with 200.5 per 100,000 females.

Cross-country comparison
Belgium is the country with the highest SDR in both age categories, whereas Sweden reported the highest incidence of breast cancer in 2014. The SDR has decreased in both countries, Belgium and Sweden, while Romania's SDR for both categories increased in 2014; probably as a result of the inclusion of the private sector in the data registry. According to the WHO HFA-DB, Romania's incidence of female breast cancer is less than one third of the cases in Belgium and Sweden throughout the whole period of 2010-2014. Belgium is the only country with no updated statistics for 2014. The SDR for both age groups lies below the EU average for Sweden in 2014. Although Romania's SDR for both groups is only slightly higher and close to the EU average, the rate is comparably high due to its low incidence of breast cancer. Figure 1 shows that breast cancer incidence has been increasing in all three countries ever since the registries started collecting the data; Romania's increase has however been slower than that of its comparison countries. Belgium's and Sweden's incidence rate of female breast cancer is above the EU average.

Literature review
Most of the identified literature was not specifically related to the selected EU countries, but compared different regions in the EU. Therefore, studies comparing EU regions in addition to studies which analyse risk factors for breast cancer and contributors to different breast cancer rates were examined.

Comparison of breast cancer across EU countries: risk factors and breast cancer outcomes
There is a variety of factors affecting breast cancer development, diagnosis and outcomes as described in more detail in table 3. Demographic characteristics such as age may increase the chance of breast cancer or affect survival rates because older patients often have worse prognoses. Clinical characteristics such as co-morbidity can affect treatment options and treatment outcomes. Provider characteristics are associated with timely access to services and treatment outcomes. Population health is significantly related to cancer survival. Awareness of breast cancer symptoms may allow for diagnosis

at an earlier stage. Service delivery includes screening programs which increase the incidence of early stage cancer. The economic situation of a country and thus expenditure on health or public health significantly contribute to cancer diagnosis and successful treatment (10). Countries which allocate more resources to health usually report lower breast cancer mortality rates. Western European countries usually have a higher GDP per capita allowing them to allocate more resources to health (11). Breast cancer mortality rates are lower in Western European countries whereas incidence is higher (11,12). In Eastern European countries, on the contrary, cancer mortality is reported to be higher and cancer incidence is usually lower (11).

Figure 1. Breast cancer incidence from 1970-2014

Source: WHO/Europe, European HFA Database, July 2016
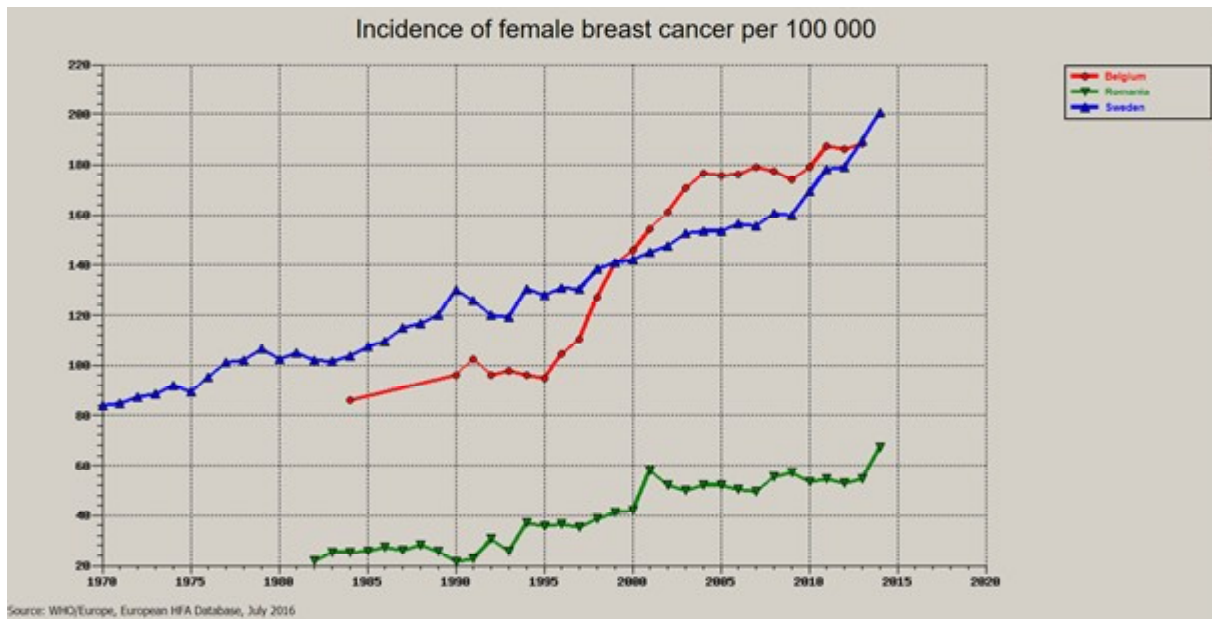
Table 3. Factors affecting breast cancer outcomes (Puig-Peiro et al., 2015)

Category	Factors
Demographic characteristics	Age, lifestyle (nutrition, physical activity, smoking, work), socioeconomic status
Clinical characteristics	Stage at diagnosis, co-morbidity, tumour pathology, genetics
Provider characteristics	Medical practices and treatment, availabilities and accessibility of treatment and care in general, data quality and comparability
Population health	Infant and total mortality, life expectancy at birth, unemployment rate, awareness of symptoms, distribution of tumour biology
Service delivery and organisation	Screening intensity and effectiveness
Economy	GDP and expenditure on health

An additional factor contributing to strong differences in breast cancer rates is the usage of prevention and treatment services: Eastern European immigrants living abroad showed little knowledge about prevention, low health motivation and reliance on provider initiative with regard to cancer screening resulting in underutilization of services. Eastern European immigrants also showed a relatively high prevalence of chronic conditions such as overweight and heart diseases which represent risk factors for breast cancer (13). The decline in breast cancer mortality which was visible in the above reported data but also in the reviewed literature is considered to be a result of improvements in diagnosis, management and treatment of the disease in the past years (6,11). Carioli et al. (6) predict that EU breast cancer mortality will decline even more: from 15.2/100,000 in 2012 to 13.4/100,000 in 2020. Nevertheless, the authors highlight that breast cancer management should be high on the agenda, particularly in Central and Eastern Europe.

Discussion

Belgium, Romania and Sweden show significant differences in the incidence of female breast cancer and SDR of women aged 0-64 years and women of all ages. Belgium has been and still is a country with very high SDR; higher than the comparison countries Sweden and Romania. Even though its incidence rate has been surpassed by Sweden in 2013, Belgium's breast cancer incidence is also far above EU average which highlights the need for not only improved cancer management but especially prevention and awareness raising on breast cancer risk factors and the importance of screening services. This equally applies to Sweden. In comparison to Sweden's SDR, the incidence is extremely high. This indicates good cancer management and early detection but it leads to the assumption that prevention of breast cancer could be improved. Another possible explanation for Sweden's high incidence of female breast cancer

could be extensive screening activities.

Romania's incidence and SDR of female breast cancer confirms the reviewed literature which states that incidence is usually lower and mortality is higher in eastern European than in western European countries. The SDR of both age groups is close to the EU average but appears to be high given that the incidence is relatively low. The breast cancer SDR of the age group 0-64 years is almost as high as in Belgium which shows an almost triple amount of incidence cases. Consequently, in comparison to its rather low breast cancer incidence rate, the SDR for both age groups is very high.

A review of screening programs as of March 2014 revealed that Romania has no screening programs in place. In Belgium screening is offered every two years to women above 50. Similarly, in Sweden women above 50 are offered screening every two years but in more than 60% of the country, women aged above 40 are also invited to get tested every 18 months (14). This could possibly explain that Romania's breast cancer incidence is comparably low; many cases might not have been detected or only at a late stage which increases the risk of fatal outcomes.

When comparing the data of the WHO HFA-DB, differences in data quality need to be considered. Incidence can be biased by screening programmes and population's access to healthcare (11). Sweden already started collecting data on breast cancer incidence from 1970 onwards which indicates that they might be more experienced in breast cancer screening, data collection and reporting. The database did not give any information on the stage of breast cancer diagnosis which could have given more insight into reasons for incidence variations. Although some researchers assume mortality data is more precise since it is directly related to the disease outcome, mortality registries do not always cover the complete population which consequently results in under-reporting and false interpretation of data. Under-reporting or failure to diagnose

cancer can bias registries and is especially common in less developed countries (8). It is unclear to which extent under-reporting plays a role in the WHO HFA-DB. Romania's data before 2014 is very likely to be under-reported as data from the private sector has only been included since 2014. The website of the HFA-DB stated that they obtained their data from national governmental or health registries; however, it was not possible to check this for correctness due to language barriers. The HFA-DB did not describe where the SDR data was obtained from. The collected data was not compared to other databases and examined for consistency.

It was not feasible to discuss literature comparing the selected EU countries as most studies focused on European regions instead of specific countries. A further, more detailed analysis with a specific review of country databases and reports is necessary to understand the full scope and the underlying determinants of the topic. A revision of national up-to-date cancer strategies and more information on screening programs could help in understanding reasons for differing incidence and SDR rates.

Conflicts of interest: None declared.

Conclusion

In conclusion, all of the three countries included in this analysis (Belgium, Romania and Sweden) should develop better strategies for prevention, planning and management of breast cancer and evaluate their effectiveness. Planning should include comprehensive national or regional cancer control (12). The collected data can only be interpreted with caution as it is unclear whether Sweden's extremely high breast cancer incidence is a result of good screening practices or the presence of various risk factors. Similarly, Romania's low incidence rate could either be an indicator for lower breast cancer in the country or under-reporting and thus incomplete data collection. Sweden is the country with the lowest SDR of malignant neoplasm in the female breast which leads to the conclusion that many breast cancer cases are detected at an earlier stage and that the country performs well in breast cancer management, including treatment. Ultimately, breast cancer incidence and mortality rates are also a reflection of how well a health system is performing in managing cancer and specifically in preventing and diagnosing cancer at an early stage.

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