Original Research Article

The cost of newly diagnosed breast cancer in Lithuania, 2011

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A B S T R A C T

Background and objective: Although the cost of treating women with breast cancer (BC) is an important component for cost saving and effectiveness in relation to the benefits of BC treatment interventions, there is limited information on the direct cost reported for BC in Lithuania. Therefore the aim of this study was to evaluate annual direct medical cost for newly diagnosed BC in Lithuania in the year 2011.

Materials and methods: The retrospective incidence-based top-down direct cost analysis was used. From January 1 to December 31, 2011 incident cases of BC (N = 1142) registered by the National Health Insurance Fund, the stage determined by Lithuanian Cancer Registry were included in the study.

Results: The total average direct cost of BC amounted per patient was 2580 (95% CI 2444–2752) EUR in 2011. The main cost driver per BC patients was the inpatient hospital stay, respectively 1655 (95% CI 1478–2334) EUR. The average outpatient cost for one BC patient was 564 (95% CI 547–898) EUR. The dominant proportion of inpatient expenditures was assigned to BC surgery and chemotherapy treatment. The BC direct medical cost increased according to the diagnosed stage of diseases from 2409 (95% CI 2196–2621) EUR in stage 1 to 3688 (95% CI 2703–4672) EUR in stage 4. The direct medical cost was inversely proportional to age.

Conclusions: The direct BC medical cost estimates provided by this analysis can be used to determine priorities for the future research on BC treatment interventions.

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1.   Introduction

Breast cancer is the leading cause of mortality and morbidity among women in Lithuania. The Lithuanian Cancer Registry under the Institute of Oncology, Vilnius University, estimated that in 2009 Lithuanian breast cancer estimated age-standardized incidence and mortality rates (Europe) reached 67.9 and 24.8, respectively [1]. Approximately 1530 women are diagnosed with breast cancer every year in the country. Breast cancer imposes a substantial economic burden on a society and especially for the healthcare system [2,3]. Quantification of the economic burden of the disease needs the analysis of costs in each country. Cost of illness studies assess the allocation of health care resources across the disease categories and further evaluate the costs and benefits if public health interventions [4]. During the last decades, a great number of cost evaluation studies of chronic diseases have been performed worldwide using this classical approach. Although there have been a numerous studies published on the topic in Western countries [5–8], there is a lack of studies on the resources use and costs associated with newly diagnosed breast cancer patients in Eastern Europe countries.

To our knowledge, no comprehensive direct medical cost analysis has been carried out in Lithuania. Direct medical costs are defined as the resources used within the healthcare sector. Such analysis is important in emphasizing the importance of the disease to the healthcare system and determining the cost drivers as well as priorities of budget allocations in the country.

The aim of the study was to evaluate annual direct medical costs for newly diagnosed female breast cancer patients in Lithuania.

2.   Materials and methods

2.1.   Study design and study sample

The study is an incidence-based top-down cost of illness study. This retrospective study included a group of incident breast cancer patients. Since breast cancer almost exclusively affects females, we concentrated on the female breast cancer cases. We defined incident cases as all newly diagnosed female patients with main diagnosis of breast cancer (ICD-10 diagnosis codes C50.0-9) in Lithuania from January 1 to December 31, 2011 (N = 1820). Women who were diagnosed with the disease in the study year and died during 2011 with this diagnosis were included in the study sample as well. The study sample and annual resource used for breast cancer care were identified from National Health Insurance Fund (NHIF) database "Sveidra," taking all new cases of breast cancer being as the main diagnosis. Information on breast cancer disease stage was determined from Lithuanian Cancer Registry under Institute Oncology Vilnius University (LCR). Patients not included in the LCR database were excluded from the analysis, thus, subsequently the study sample was reduced to 1142 patients.

All costs are given in 2011 prices and presented in Euro. The exchange rate of Litas against Euro was 3.4528 on September 30, 2013.

2.2.   Evaluation of direct medical costs

The study captured the identification and quantitative evaluation of newly diagnosed breast cancer related resources in 2011. In order to evaluate disease direct costs, the individual data (identity code, birth date, date of diagnosis, date of death, health care services provided, quantity of each service, price of each service, administered covered drugs for BC treatment – general name, dosage, strength, drug form, amount, reimbursed sum) – were extracted from NHIF database. In order to evaluate the direct disease costs in different stages, the stage at the time of diagnosis was extracted from the LCR and linked with the rest of data. Cost analysis was conducted from the health care payers' perspective.

2.2.1.   Health care service costs

Direct costs included the following resource components: inpatient hospital episodes, nursing services, physician/professional services, outpatient ambulatory clinic services, diagnostic procedures, home health care visits, and hospice care. In order to simplify the reporting of results, a regrouping of treatment services and costs was performed, by linking each individual's contact (with national health care institutions health care) with payment records. The records were consolidated and resulted in eight main health care service categories according to treatment profile (total amount of different services regrouped N = 145): services of diagnostic testing and following consultations, radiation therapy, surgery, chemotherapy, palliative care, intensive care, primary health care, other health care services. The data for each hospital inpatient episode included variables such as main diagnosis, date of admission, numerical code of inpatient episode and price for the episode. Data regarding ambulatory care were based on the amount of consultations, listed in NHIF database – the prices of ambulatory consultations were available from the same database and national legal documents, defining the prices of primary care services. Since "Sveidra" database does not include records on the prices of particular primary health care services (PHCS), identification and adoption of prices was based on Lithuanian legal acts, defining payment of particular PHCS, issued by the Ministry of Health of the Republic of Lithuania.

Average annual health care costs for 1 treated patient were estimated using the following formula:

$$\text{Costs } t = \frac{I1^x N_{i1} + I2^x N_{i2}^x + In^x N_{ik}}{N_p}$$

where I indicates unit health care cost, reimbursed by NHIF; N_{i1}; N_{i2}; $^x N_{ik}$, number of health care services provided to treated patients per 1 year; N_p, number of patients who used medical resources due to main diagnosis.

2.2.2.   Costs of reimbursed drugs

Reliable data on the type and quantity of drugs used in the outpatient settings and for hospitalized patients was available through retrospective analysis. Drugs used in hospital settings (for day care and inpatient hospital care) are included in the costs of medical services. Costs on covered drugs were evaluated by identifying the number of prescriptions in the ambulatory care according to anatomical therapeutic

Health care service category	Treated patients, no. (%)	Treatment services with diagnosis of breast cancer, no.	Annual costs of health care service category, EUR
Chemotherapy treatment	1049 (91.9)	15,936	783,422
Radiotherapy treatment	780 (68.3)	2943	158,843
Surgical treatment	981 (85.9)	2137	741,174
Primary health care consultations	1129 (98.9)	18,072	27,460
Diagnostic procedures and consultations	1136 (99.5)	15,306	212,153
Intensive care unit	945 (82.7)	1130	122,360
Palliative care	21 (1.8)	52	21,137
Mental health care	149 (13.0)	632	7022
Other treatment services	1074 (94)	8053	309,713
Total	1142	64,261	2,383,284

Table 1 – Proportions of breast cancer cases by health care service category in 2011.

chemical (ATC) code together with the data on the retail price, covered by NHIF during 2011. All the claims for reimbursed prescription drugs for target breast cancer population that were received in NHIF during the study period were included in the analysis. The precise ATC code using WHO Drug Statistics Centre database accessible in internet http://www.whocc.no/atc_ddd_index was attributed to all medicines administered (separating every active substance).

Claims on prescribed drugs to individual patient were pooled together to form the following groups of the Anatomical Therapeutical Chemical (ATC) classification according to their ATC codes: alimentary tract and metabolism drugs (A), antineoplastic and immunomodulating agents (L), nervous system drugs (N). The other drugs, that were prescribed and reimbursed, were not included in the analysis. In order to compare and combine drugs to form the drug groups, all dosage measurements (g, μg, mL) were unified and converted into milligrams (mg).

2.2.3. Total direct medical costs

The study estimated total direct medical costs (costs of treatment services (ambulatory and inpatient), costs of reimbursed drugs and total costs) for the whole population of Lithuania and costs in different disease stages. The Kruskal–Wallis test was used to assess the difference in cost among groups, and the Mann–Whitney U test was used to assess the difference between groups. The level of significance was set at 0.05.

3. Results

3.1. Direct medical health care costs

Data on direct costs were gathered from a sample of 1142 newly diagnosed breast cancer female patients from the whole country in 2011. Mean age of study subjects was 61.0 years (standard deviation, SD 13.1); majority of the studied patients were older than 50 years (80.9%), a half of patients (49.9%) were older than 60 years. The average patient tracking time since the diagnosis date during the study year was 6.23 months (SD 3.45). The distribution of women by stage of disease showed that two thirds of women have been diagnosed with stage 1 and stage 2 (389 (34.1%) and 377 (33.0%), respectively), the quarter – with stages 3 and 4 (246 (21.5%) and 52 (4.6%), respectively). On

average, 52.3 outpatient services (SD 26.2) were provided for one patient. Almost every case underwent primary health care consultations and diagnostic procedures. Women, who had surgery were referred to intensive care services. The average annual amount of inpatient hospital episodes per one person was 4.4 (SD 2.7). The least number of services accounted for palliative care – only 21 (1.8%) women utilized palliative care in hospice. Table 1 presents the utilization and cost of health care services categories in studied population.

During 2011, patients from this study population had a total of 4625 hospitalization episodes and involved 1052 patients. The total cost of these hospitalization episodes amounted to 1,739,574 EUR. The inpatient hospital stay with the main diagnosis of breast cancer incurred the average annual cost per one person of 1655 (95% CI 1477–2334) EUR. Ambulatory care with the total number of all hospital outpatient consultations and general practitioner consultations from January to December 31, 2011 was estimated at 643,711 EUR. The total number of ambulatory consultations was 59,636 and the average cost for one person per year was 564 (95% CI 547–898) EUR. Fig. presents the annual costs of medical resources use. It is obvious that the biggest proportion of NHIF expenditures was assigned to surgery and chemotherapy treatment categories. The smallest proportion in the structure of costs was estimated for mental health care and primary health care services.

Spending on prescription drugs for the drug categories most frequently prescribed was divided by the total number of prescriptions in order to estimate the average costs per one prescription. The more detailed result is given in Table 2. Total costs for covered drugs in ambulatory settings for studied population were estimated at 563,092 EUR. Almost 75% of these costs are attributed to antineoplastic drugs.

Total direct medical cost of breast cancer in Lithuania 2011 was estimated at 2,946,377 EUR. Major cost drivers in the whole pie of costs are chemotherapy treatment (26.6%), surgical treatment (25.2%) and antineoplastic drugs (14.2%).

Direct mean annual medical costs per patient reached 2580 (95% CI 2444–2752) EUR per one newly diagnosed patient. The average cost per person, attributed to the different health states increased gradually according to the diagnosed stage of disease: from 2409 (95% CI 2196–2621) EUR in stage 1 to 3688 (95% CI 2703–4672) EUR in stage 4 (Table 3). Though mean outpatient and inpatient costs differed not significantly among stages ($P = 0.763$), but covered drugs cost in higher stages was significantly higher ($P = 0.001$). Results affirmed our
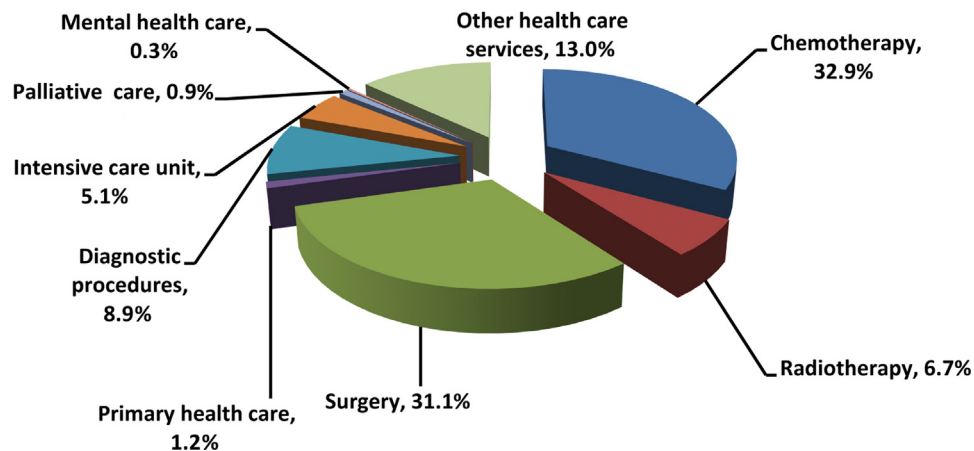
Fig. – The structure of annual costs of breast cancer medical resources use in 2011 (%).

expectations and showed that breast cancer costs for women with metastatic disease are higher than the costs for local disease. Table 4 demonstrates the distribution of direct medical costs by the state of disease. Although the average annual cost per person with distant metastatic disease is high, the positive finding of the study is the small proportion of cost

for stage 4, indicating the relatively low number of persons, diagnosed with distant metastatic disease.

Direct medical cost was estimated for several age groups as well. Health care service and drug cost were substantially higher for younger group of patients (≤60 years of age), compared to patients older than 60 years ($P < 0.001$) (Table 5).

Table 2 – Drug cost in outpatient care due to breast cancer in 2011.

ATC group of drugs	Prescriptions due to main diagnosis of breast cancer, no.	Total costs of covered drugs in outpatient care, EUR	Average cost per one prescription, EUR
Analgesics (ATC group N02)	2447	31,446	13
Antineoplastics (ATC group L01)	8075	418,112	52
Antiemetics (ATC group A04)	3073	113,531	37
Total	13,595	563,092	41

Table 3 – Mean direct medical costs per person in disease stages, 2011.

Cost category	Mean cost per person (95% CI), EUR					P Kruskal–Wallis test
	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	
Outpatient and inpatient treatment cost	2251 (1136–3166)	2020 (1837–2205)	2010 (1855–2166)	2320 (2031–2308)	2377 (1681–3072)	0.763
Covered drugs cost	577 (193–962)	450 (450–547)	486 (371–601)	672 (492–852)	1663 (897–2428)	0.001
Total	2720 (1650–3792)	2409 (2196–2621)	2432 (2240–2623)	2899 (2557–2952)	3688 (2703–4672)	0.185

Table 4 – Direct medical costs in different disease stages, EUR, 2011.

Cost category	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Unknown
Outpatient and inpatient treatment cost	72,046	786,083	757,983	570,792	123,584	72,795
Covered drugs cost	150,211	151,015	158,654	142,488	68,182	27,731
Total	87,067	937,098	916,638	713,280	191,767	100,527

Table 5 – Annual direct medical costs in different age groups, EUR, 2011.					
Cost category	Total costs, age ≤60	Total costs, age >60	Mean cost per person (95% CI), age ≤60	Mean cost per person (95% CI), age >60	P Mann–Whitney test
Outpatient and inpatient treatment cost	1,331,032	1,708,288	2326 (2181–2636)	1846 (1585–2268)	<0.001
Covered drugs cost	377,247	185,836	765 (634–896)	382 (316–452)	<0.001
Total	1,708,288	1,238,089	2987 (2760–3200)	2157 (2028–2316)	<0.001

4. Discussion

There are few studies available that can be used for comparisons with our study and even in those cases, reported differences in cost estimates across countries should be interpreted with some caution given the heterogeneity of sources and the quality of data. Difficulties in obtaining accurate information include limitations in data consistency and quality, and potential confounding by differences in demography, cultures, health-care systems, and available resources. Proper assessment of the comparative value of cancer care needs high-quality, patient-level data [9]. This study calculated direct medical costs attributable to newly diagnosed breast cancer cases in Lithuania, 2011. According to the data obtained from National Health Insurance Fund database, 1820 newly diagnosed patients with the main diagnosis of breast cancer used medical resources during the study year. This number is higher than the number of new cases, received from the Lithuanian Cancer Registry: 1142 women were reported as having the diagnosis with the cancer stage confirmed during the study year. These discrepancies could be explained by different reasons, such as differences in diagnosis verification method, used by NHIF and LCR (NFIH uses data from ambulatory patient protocol, and LCR receives cancer verification details from pathological protocols), maybe incomplete register of cancers cases in Lithuanian Cancer Registry and some other unknown reasons. The limitation of the study includes the fact that some of chemotherapy medications, used for breast cancer treatment are not recorded in the database "Sveidra" that we used a source of data. Certain oncologic medications are purchased through the system of national public tenders and are distributed to health care institutions, treating cancer patients, where they are consumed in day care settings. Possibility to access the data is possible only via individual patient records in each hospital, but this was not performed in our study. Due to this the direct medical costs of breast cancer treatment might have been underestimated by about 86,886 EUR. Hospitalization accounted for two thirds (59.1%) of the total direct costs of the disease. These numbers are consistent with the findings from study in Sweden [7] where inpatient treatment cost was identified to be the largest share from all direct costs as well. In this study we included the patients who were diagnosed with the disease during one year and had the main diagnosis of the breast cancer. Of course, these criteria underestimated the cost. Health insurance costs on breast cancer care are significant in Lithuanian as well as in other countries, placing a significant burden on state budgets. It has become increasingly important to help health policy makers to quantify and understand the financial impact caused by the disease, as well as to inform state decisions on investments disease management programs [11,12].

To our knowledge, there is a lack of studies that could be compared with our analysis. A study by Bercez et al. [12] found that the cost of newly diagnosed patient with metastatic breast cancer was 21,680 EUR (in year 2000), while in our settings the cost for the same case was almost seven fold lower, reaching about 3687 EUR (in year 2011). Rao and colleagues published the study results about Medicare cost for metastatic BC patients: according to their study, the mean total cost per metastatic breast cancer patient was US$ 35,164 (in 2004) [13]. The study in Sweden found out that annual direct medical cost per patient with diagnosed metastatic disease was 5947 EUR (in 2007) [14]. The amount of health care resources utilized for treatment of disease, is an important issue as well. We found only one study, comparable to ours' which demonstrated that the average number of hospital episodes, falling to one treated patient in Sweden, was 0.9. According to our results, in Lithuania the amount of such inpatient services reached 4.4 (SD 2.7) [7]. Such data raise the question whether out-patient and in-patient health care services are distributed in the optimum mode in Lithuania.

Direct medical costs for younger women are higher compared to older women – such results agree with the finding from other countries, such as Sweden, United States of America and Australia [7,10,13,15].

The proportion of resources, consumed for treatment of patients with distant metastatic disease, is relatively small. Deeper study would be very useful in order to answer the question whether such distribution of cost indicates the low number of patients diagnosed in stage 4 due to running breast cancer screening program.

Though it is very complicated to compare the cost of illness results across the countries due to different countries economic situation and health care system organizations, it may be generalized that resources used for well-organized preventing, early diagnostics and effective treatment may reduce the sick leave, early retirement and premature mortality associated with breast cancer.

In a country with limited resources, the results of this cost analysis may be used for determining the priorities for and to inform the future research in breast cancer field.

5. Conclusions

The direct BC medical cost estimates provided by this analysis can be used to determine priorities for the future research on BC treatment interventions and the efficient allocation of

health care resources across BC treatment categories. Future studies analyzing the possible budget savings due to improved early diagnostics and increased proportion of early stage breast cancer should be encouraged. The further assessment of the impact of new technologies should consider direct and indirect costs as well, and balance them against the benefits of new techniques.

Conflict of interest

The authors state no conflict of interest.

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REFERENCES

[1] Lithuanian Cancer Registry under Oncology Institute, Vilnius University [Internet]. Available from: http://www.vuoi.lt/index.php?-1413089819 [cited 31.10.13].

[2] Luengo-Fernandez R, Leal J, Gray A, Sullivan R. Economic burden of cancer across the European Union: a population-based cost analysis. Lancet Oncol 2013;14(November (12)):1165–74.

[3] Lidgren M, Wilking N, Jönsson B. Cost of breast cancer in Sweden in 2002. Eur J Health Econ HEPAC Health Econ Prev Care 2007;8(March (1)):5–15.

[4] Brown MM, Brown GC, Leiske HB, Lieske PA. Healthcare costs, buyer alert. Curr Opin Ophthalmol 2011;22(May (3)):149–51.

[5] Broekx S, Den Hond E, Torfs R, Remacle A, Mertens R, D'Hooghe T, et al. The costs of breast cancer prior to and following diagnosis. Eur J Health Econ HEPAC Health Econ Prev Care 2011;12(August (4)):311–7.

[6] Dahlberg L, Lundkvist J, Lindman H. Health care costs for treatment of disseminated breast cancer. Eur J Cancer Oxf Engl 1990 2009;45(July (11)):1987–91.

[7] Lidgren M, Wilking N, Jonsson B, Rehnberg C. Resource use and costs associated with different states of breast cancer. Int J Technol Assess Health Care 2007;23(2):223–31.

[8] Hassett MJ, Elkin EB. What does breast cancer treatment cost and what is it worth? Hematol Oncol Clin North Am 2013;27(August (4)):829–41. ix.

[9] Lyman GH. Counting the costs of cancer care. Lancet Oncol 2013;14(November (12)):1142–3.

[10] Mariotto AB, Yabroff KR, Shao Y, Feuer EJ, Brown ML. Projections of the cost of cancer care in the United States: 2010–2020. J Natl Cancer Inst 2011;103(January (2)):117–28.

[11] Perrier L, Philip T. Contribution of economic evaluation and budget impact analysis to public decision in health: the example of breast cancer. Bull Cancer (Paris) 2010;97(March (3)):397–402.

[12] Bercez C, Lebrun T, Bonneterre ME, Selke B, Lenne X, Bonneterre J. Advanced breast cancer: an evaluation of the cost of recurrence. Bull Cancer (Paris) 1999;86(June (6)): 585–90.

[13] Rao S, Kubisiak J, Gilden D. Cost of illness associated with metastatic breast cancer. Breast Cancer Res Treat 2004;83 (January (1)):25–32.

[14] Lidgren M, Wilking N, Jönsson B, Rehnberg C. Resource use and costs associated with different states of breast cancer. Int J Technol Assess Health Care 2007;23(2):223–31.

[15] Gordon L, Scuffham P, Hayes S, Newman B. Exploring the economic impact of breast cancers during the 18 months following diagnosis. Psychooncology 2007;16(December (12)):1130–9.