VALUE IN HEALTH REGIONAL ISSUES 4C (2014) 58–65

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The Cost of Melanoma and Kidney, Prostate, and Ovarian Cancers in Russia

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ABSTRACT

Objective: The objective of this study was to assess the total annual economic burden of melanoma and kidney, prostate, and ovarian cancers in Russia using the unified methods. **Methods:** The general prevalence-based cost-of-illness model was developed to evaluate the annual health and social care costs and value of lost productivity attributable to the following cancers: melanoma and kidney, prostate, and ovarian cancers from the perspective of the overall governmental budget. All costs were calculated using the "bottom-up" costing technique for the total population of patients with studied cancer, including both newly diagnosed patients stratified by cancer stage and patients diagnosed in previous years who were still alive in the study year. **Results:** The lowest aggregate annual cost was found for melanoma—€17.48 million (52.4% health care costs, 34.9% social care costs, 12.7% attributed to productivity loss) and the highest—€84.52 million—for prostate cancer (72.0%, 19.0%, and 9.0%, respectively). Estimations for kidney and ovarian cancers were €45.33 and €45.56 million, respectively, with a similar distribution (42.5%–45.2% health care costs, 39.0%–40.3% social care costs, 14.5%–18.5% lost productivity). Cost for a newly diagnosed patient was several times higher than for a patient diagnosed in previous years (€1144– €1947 vs. €145–€417, respectively). For patients in the first year after diagnosis, the major part of economic burden was attributed to health care costs, whereas for those diagnosed before the study year, costs not related to health were more prominent, except for prostate cancer. **Conclusions:** The economic impact of cancers is more prominent during the first year after diagnosis. A considerable part of the economic burden of cancer lies outside the health sector.

Keywords: cancer, cost-of-illness, economic burden, health care costs

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Introduction

According to federal statistics, by the end of 2012 there were almost 3 million cancer patients registered in Russia, approximately 2% of the total population. Cancer is the second leading cause of disability and mortality. More than 280,000 people die because of cancer every year in Russia, almost one third of them being younger than 60 years [1].

Despite the growing understanding of the magnitude of economic burden caused by cancer, data on its actual size in Russia are sparse and there is no unified methodology for accurate estimation. Few cost studies of specific types of cancer in Russia have been conducted; all of them used inconsistent methods and sources of information, especially for the assignment of unit costs or prices for the identified resource consumption [2–4]. This could be explained by difficulties in data collection resulting from the specifics of the federal surveillance system and health care financing in Russia [5,6]. Such discrepancies in research methods and data make comparison or combination of research findings almost impossible. Consequently, it hinders the process of health technology assessment, vitally important for rational decision making under the conditions of limited resources.

The objective of this study was to estimate the economic burden of melanoma and kidney, prostate, and ovarian cancers from the perspective of the government's overall budget using the developed standard methodology. These cancers were chosen to test the developed cost-of-illness model for several reasons. First, we were looking for diseases considered to be a public health problem with different epidemiologic and clinical characteristics to observe their effect on the results. Second, we expected our findings to be of use for health technology assessment; therefore, we selected cancers for which there were new treatments to enter the Russian market and no previous research on their costs has been done.

Thus, we selected melanoma as one of the cancers with the most rapidly growing incidence and with a similar impressive increase in mortality—36.39% and 39.75%, respectively, during 10 years (from 1999 to 2009). Prostate cancer is one of the most prevalent cancers among men (68.1 cases per 100,000) and is also

Conflicts of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

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http://dx.doi.org/10.1016/j.vhri.2014.07.002

characterized by the growing mortality rate—41.39% in 10 years. Ovarian cancer is one of the leading cancers killing women of working age. In 2009, almost 70% of ovarian cancers were diagnosed at advanced stages; hence, more than one quarter of the patients died during the first year after diagnosis. Kidney cancer was chosen as an example of cancer for which only incidence data are collected on the federal level.

Methods

Model Overview and Structure

We have developed a general prevalence-based cost-of-illness model to evaluate the annual health care and social care costs and value of lost productivity attributable to the following cancers: melanoma (*International Statistical Classification of Diseases, 10th Revision* [*ICD-10*] code C43), kidney cancer (*ICD-10* code C64), prostate cancer (*ICD-10* code C56), and ovarian cancer (*ICD-10* code C53). All costs were calculated using the "bottom-up" costing technique for the total population of patients with studied cancer, including both newly diagnosed patients stratified by cancer stage (i.e., localized, regional, distant, unstaged) and patients diagnosed in previous years who were still alive in 2009 (the study year). The model was built using Microsoft Excel 2010 software.

Our cost-of-illness calculations were performed using different data sources because detailed data sets containing all the necessary information are rarely available to researchers in Russia. When the parameters needed for calculations were not found in the data collected and published by the federal statistical services, we applied to regional registries, extrapolating the derived evidence to the whole country. Data unavailable both from federal and regional surveillance systems were extracted from published studies. Finally, to derive details not found in published sources, we held an expert survey of 21 participants from eight Russian regions.

All statistical information and prices were taken for the year 2009 (study year), the latest available year for all statistical data at the time the research was started. The national currency rubles was converted into euros by using the mean nominal exchange rate in 2009 [7].

Main rates and values used for cost calculations and their sources are listed in Appendix 1 in Supplemental Materials found at http://dx.doi.org/10.1016/j.vhri.2014.07.002.

Cancer Patient Populations

Incidence and prevalence data of studied cancers and distribution data of newly diagnosed cases by cancer stage were acquired from federal health statistics collected for the whole country [8,9]. Age and sex distribution data of patients and stratum-specific rates of cancer treatments were derived from six regional cancer registries, in total covering 8.3% of the Russian population.

For kidney cancer, the federal surveillance system collects only incidence data; therefore, we have estimated the total number of patients in Russia on the basis of the number of newly diagnosed patients from the federal data and the ratio of the total number of patients to newly diagnosed patients from regional cancer registries.

Estimates of the total annual social care cost and lost productivity were based on the number of individuals employed and permanently disabled because of cancer among the studied patient populations. We have assumed that the age-specific rate of employment for cancer patients at the time of diagnosis did not differ from that for the general population; therefore, we have used data from federal statistics [10–12]. Our estimation of the number of "potentially" employed persons included people of postretirement age because the rate of employment among them reaches 34.4% according to federal statistic surveillance.

The number of individuals permanently disabled because of cancer was calculated as the product of the total number of registered cases of disability due to cancer from federal statistics and rates attributable to specific types of cancer from Russian published research [13–16]. For persons newly registered as permanently disabled in 2009, all related costs were calculated for 6 months only.

Health Care Costs

Health care costs were estimated as the sum of payments made to health care providers for inpatient (hospital stay) and outpatient care (polyclinic/outpatient center visits and bed-days at outpatient day-care centers) for different types of cancer treatment and budget spending on the provision of medications to cancer patients in outpatient care.

The general modeling approach to calculate the cost of inpatient and outpatient care is presented in Table 1. Stratum-specific estimation of health care resource utilization expressed as the number of outpatient visits and inpatient days was obtained through combining data from different sources—number of patients from federal statistics, rates of different types of cancer treatments from regional cancer registries, and average number of inpatient days and visits for each type of cancer treatment studied through the expert survey. Average costs per hospital and outpatient day care center bed-day and outpatient visit costs were taken from the annual report of the Ministry of Health on the provision of medical care to citizens in 2009 [17]. In this report, all annual expenditures on medical care borne by governmental and public medical insurance budgets are attributed to the total number of hospital and outpatient days and outpatient visits provided by all medical institutions in the Russian Federation, despite their specialization or affiliation. Therefore, the average cost of amount of care derived from this source represents all costs related to diagnostics and treatment including laboratory testing, all types of manipulations, medications, and so forth.

According to federal and regional regulations, cancer patients have a right for the provision of all medications in outpatient care free of charge. The government covers all expenses. In our model, we assessed these budget spendings on medications for the whole country on the basis of data from four regional registries.

Social Care Costs

Social care costs were assessed as the budget spending on sick-leave payments and disability pensions attributable to cancer.

Because there were no statistical data available on the number of working days missed by cancer patients and experts were unable to provide this information, we assumed the number of working days missed because of temporary disability caused by cancer to be equal to the number of inpatient days for employed individuals. This restrictive approach was chosen to avoid the overestimation of social costs. The average social payment for one missed working day because of illness was defined on the basis of statistical data on the total expenses and the number of sick-leave days paid in 2009 from the Social Insurance Fund [18].

The size of the average disability pension was derived from the Report of the Pension Fund for the year 2009 [17].

Value of Productivity Losses

Value of productivity losses was calculated as the amount of gross domestic product (GDP) unproduced by the employed

Table 1 – Example of calculating annual resource consumption related to the provision of cancer treatment (chemotherapy at stage III of cancer for newly diagnosed patients) using different sources of information.

Variable		Melanoma	Kidney cancer	Prostate cancer	Ovarian cancer	Reference
1	Number of all newly diagnosed patients in 2009 (N_{nd})	7,578	17,053	25,215	12,034	Federal statistics [8,9]
2	% of stage III cancer among all newly diagnosed (N_{ndIII})	19	24.14	34.9	40.5	Federal statistics [8,9]
3	% starting cancer treatment among newly diagnosed stage III patients (P_{tr})	93.4	76.55	92	82	Regional cancer registries
4	Annual per-person rate of chemotherapy (R_{ch})	0.2626	0.0282	0.14	1.06	Regional cancer registries
5	% undergoing chemotherapy in outpatient clinic (Ch_{outp})	0	50	100	0	Experts' survey
6	Average annual number of outpatient visits (V)	0	9	8	0	Experts' survey
7	Total number of outpatient visits provided because of chemotherapy	0	400	9068	0	Calculations ($N_{nd} \times N_{ndIII} \times P_{tr} \times R_{ch} \times Ch_{outp} \times V$)
8	% undergoing chemotherapy at hospital (Ch_{inp})	100	50	0	100	Experts' survey
9	Average hospital length of stay (LOS) (d)	21	21	0	22	Experts' survey
10	Total number of hospital days due to chemotherapy	7416	933	0	93199	Calculations ($N_{nd} \times N_{ndIII} \times P_{tr} \times R_{ch} \times Ch_{inp} \times LOS$)

Note. Full list of rates and values used for the calculation of economic burden of studied cancers is provided in Appendix 1 in Supplemental Materials found at http://dx.doi.org/10.1016/j.vhri.2014.07.002.

cancer patients during working days missed because of temporary or permanent disability associated with studied cancers. Thus, the value of one missed working day was assumed to be equal to the share of annual GDP produced by the employed person during one working day.

To avoid overestimation of productivity losses, expressed as the unproduced GDP, we followed principles of the friction cost approach, assuming that productivity loss occurs only during the period of time necessary to reestablish the initial production level (i.e., the friction period) and workers leaving employment are replaced by unemployed workers at an extremely low opportunity cost. Because there are no statistical or research data for Russia giving accurate estimate of the length of the friction period, in our calculations of the lost productivity we took into account only 10% of working days missed by cancer patients, based on experts' opinion.

Productivity losses associated with cancer mortality were not estimated because of the lack of data and intention to avoid double counting because there is a rather high probability that a cancer patient is registered as a disabled person before death.

As mentioned earlier, the number of working days missed because of temporary disability (i.e., time away from work to undergo treatment or recover from associated adverse effects) was assumed to be equal to the number of inpatient days. The number of working days missed because of permanent disability was assessed as half of the working days per year (we assumed that the registration of disability cases is distributed equally throughout the year) multiplied by the number of cancer patients registered for the first time in the study year as permanently disabled and by the age-specific employment rate.

The productivity losses of unpaid caregivers were not included in calculations because of the absence of data.

Sensitivity Analysis

We conducted various one-way sensitivity analyses to determine the sensitivity of results to key assumptions inherent in the analysis. Because our health care cost estimations were based on an expert survey, we varied the amount of hospital days and outpatient visits, as well as medication costs by 50%. Uncertainty in the number of working days missed because of temporary disability was accounted for by rerunning the analysis for numbers increased and decreased by 50%. The rates of permanent disability attributable to studied cancers were varied upwards and downwards by 50%.

Results

According to the federal surveillance data, there were 68,200 patients with melanoma, 95,900 women with ovarian cancer, 110,400 men with prostate cancer, and 17,000 new cases of kidney cancer registered in Russia in 2009. On the basis of these data, we modeled the patient populations for further estimation of cancer costs (Table 2).

The lowest aggregate annual cost (€17.48 million) was found for melanoma and the highest (€84.52 million) for prostate cancer (Table 3). Table 4 provides estimates of the resource units' consumption per 1000 registered patients.

Although in general the structure of the economic burden was similar for all studied cancers, with health care costs constituting the main part, results of cost estimation for prostate cancer were markedly different. Health care costs accounted for more than 70% and loss of GDP for less than 10% of the total cost of illness for prostate cancer, although for other studied cancers, these shares were found to be 45% to 52% and 13% to 18%, respectively (Table 3). This finding could be partly explained by the older age of patients with prostate cancer—their mean age was 70 years at the moment of diagnosis; for other studied cancers, this parameter varied between 58 and 61 years. Consequently, the rate of employment was lower for this patient population. Also, we can expect that there might be more individuals already registered by social services as permanently disabled because of causes other than cancer in this older population.

Almost 50% of the total annual cost was attributed to the newly diagnosed patients, though they formed only 11% to 23% of

Table 2 – Patient populations in studied types of cancer (Russian Federation, 2009).

Type of cancer	Total number of patients registered*	Among all registered patients		
		Newly diagnosed	Registered by social services as permanently disabled†	Potentially employed‡
Melanoma (C 43)	68,161	7,578	5,434	34,178
Kidney cancer (C64)	96,893	17,053	17,132	46,242
Prostate cancer (C61)	110,430	25,215	14,582	36,451
Ovarian cancer (C53)	95,861	12,034	16,251	41,750

* Data collected by the federal surveillance system, except kidney cancer when the total number of registered patients was calculated by authors on the basis of federal statistics and data from regional cancer registries.
† Calculated by authors on the basis of federal statistics and published research data.
‡ Calculated by authors on the basis of federal statistics and data from regional cancer registries.

the studied population. The annual average cost per newly diagnosed patient started from €1144 for melanoma and reached €1947 for prostate cancer. The average cost per patient diagnosed in previous years was several times lower—€145 for melanoma and €417 for prostate cancer.

Marked differences were also found in the structures of total annual per patient costs depending on the time spent from the diagnosis. For patients in the first year after diagnosis, the major part of economic burden was attributed to health care costs; for those diagnosed before the study year, costs not related to health were more prominent. The only exception was prostate cancer probably due to the older age of the population, as explained earlier (Table 5).

Costs for newly diagnosed patients depended on the stage of disease at the diagnosis— distant stages were several times more expensive than localized, excluding ovarian cancer. The exception might be explained by aggressive treatment with consecutive courses of chemotherapy provided to the patients with ovarian cancer even at the early stage of disease (Table 6).

Several one-way sensitivity analyses were conducted to test the robustness of our findings. First, we tested the effect of varying costs of care and medications upwards and downwards by 50%. It resulted in 6% to 27% changes in total cancer costs, with results for prostate cancer being the most sensitive to changes in medication costs and ovarian cancer for changes in medical care costs. Varying the rates of permanent disability due to the studied cancer by 50% produced a variation in total annual cost by 12% to 27%, with results for prostate cancer being the least sensitive. Changes by 50% in the proportion of missed working days taken into account for the assessment of the GDP loss (used as a proxy measure for the friction period) resulted in 4% to 9% variation in total costs (Table 7).

Discussion

This was the first study to estimate the full economic burden, including costs related and not related to health care, for several cancers in Russia using unified methods and sources of information. We estimated that the total annual cost of studied cancers varied between €17.48 million and €84.52 million, more than 80% of which was direct budget spending on health and social care.

We have demonstrated that the main part of costs is during the first year after diagnosis—the average costs per newly diagnosed patient were several times higher than per patient diagnosed in previous years. Health care costs constituted the main part of burden during the first year, varying from €1004 (melanoma) to €1946 (prostate cancer). For instance, the per capita standard of health care financing approved by government in 2009 was €173 [20].

We have used conservative estimation of the cost of medical care—average cost of hospital day or outpatient visit according to statistics collected by the Ministry of Health. Although this decision underestimated the care provided to cancer patients, which could be much more expensive than the care provided to the patient with other type of disease, it was the only available option for the perspective of overall government budget and it guaranteed the comparability of results of the study.

The estimated burden seems small compared with other countries, mostly because of low public spending for health care

Table 3 – Annual costs of studied types of cancer in Russia in 2009.

Cost	Melanoma	Kidney cancer	Prostate cancer	Ovarian cancer
Total costs, € million	17.48	45.33	84.52	45.56
% of GDP of Russia in 2009	0.0020	0.0053	0.0098	0.0053
Total health care costs, € million (% of total costs)	9.16 (52)	20.48 (45)	60.88 (72)	19.35 (42)
Inpatient and outpatient care costs, € million	4.46	8.72	15.52	14.09
% of total spending on medical care in Russia in 2009	0.0143	0.0279	0.0497	0.0451
Medications costs, € million	4.70	11.77	45.37	5.27
Total social care costs, € million (% of total costs)	6.10 (35)	18.26 (40)	16.04 (19)	17.78 (39)
Sick-leave payments, € million	0.59	0.89	1.26	1.31
Disabiity pensions, € million	5.51	17.36	14.78	16.47
Total GDP loss, € million (% of total costs)	2.22 (13)	6.59 (15)	7.59 (9)	8.42 (18)
GDP lost because of temporary disability, € million	0.26	0.40	0.56	0.58
GDP lost because of permanent disability, € million	1.96	6.19	7.03	7.84

Notes. GDP in Russia in 2009—€86,219 billion [19]. Total spendings on medical care in the Russian Federation in 2009—€3124 billion [17].
GDP, gross domestic product.

Table 4 – Resource units per 1000 registered patients with studied cancers in Russia in 2009.

Resource unit	Melanoma	Kidney	Prostate cancer	Ovarian cancer
Days in the hospital				
Total	1,940.13	2,768.59	4,121.56	4,743.52
Surgery*	1,355.51	1,682.10	2,041.56	1,079.47
Immuno (hormone) therapy	0.00	29.57	0.00	0.00
Chemotherapy	544.49	96.97	27.02	3,300.34
Radiation therapy	27.07	194.80	1,161.73	256.62
Symptomatic (palliative) care	13.06	565.67	303.53	12.21
Diagnostics	0.00	199.48	587.71	94.89
Days in outpatient care				
Total	92.97	0.00	320.18	0.00
Surgery	2.98	0.00	0.00	0.00
Chemotherapy	81.86	0.00	0.00	0.00
Radiation therapy	8.13	0.00	320.18	0.00
Outpatient visits				
Total	2,084.24	2,433.22	4,542.99	2,626.21
Immuno (hormone) therapy	98.65	168.00	1 043.36	0.00
Chemotherapy	0.00	4.14	158.30	0.00
Radiation therapy	0.00	0.00	695.44	0.00
Symptomatic (palliative) care	119.51	322.57	357.29	70.30
Diagnostics	375.30	350.83	683.58	960.02
Follow-up	1,490.78	1,587.68	1,605.03	1,595.89
Number of persons registered as permanently disabled*	79.72	176.81	132.05	169.53
Number of sick-leave days (days of temporary disability)	1,049.90	1,115.25	1,383.28	1,655.24
Working days missed because of temporary disability	749.93	796.61	988.06	1,182.32
Working days missed because of permanent disability	5,598.36	12,465.04	12,424.07	15,951.31
Average budget spending on medication provision in outpatient care (€)	68,910.00	121,460.00	410,831.63	54,930.00

GDP, gross domestic product.

*The separation of types of treatment was predetermined by coding in regional cancer registries.

† For persons registered as permanently disabled in 2009 for the first time, all related costs were calculated only for 6 mo. Average cost of hospital day in Russia in 2009—€28.42. Average cost of day in outpatient care in Russia in 2009—€7.33. Average cost of outpatient visit in Russia in 2009—€ 4.62. Payment per 1 day of temporary disability—€8.26. Social pension for disability, monthly—€108.02. Average amount of GDP produced by employed person during working day in Russia in 2009—€151.26.

(3.5% of the GDP), low cost of health care resource units in Russia, and the conservative approach we used to avoid overestimation given the scarcity of available information. Still the observed trends are similar.

Several researches have demonstrated that a considerable part of costs is attributable to the first year after diagnosis. So, in European studies the costs in the first year after diagnosis of prostate cancer varied between €3,705 and €10,165 and costs for 5 years of disease were found to be between €8,158 and €12,794 [21]. Annualized mean net costs of initial care in the United States were estimated to be $98,788 for ovarian cancer, $46,048 to $46,077 for kidney cancer, and $6,057 to $6,524 for melanoma, and of continuing care were $8,296, $6,018 to $6,255 and $915 to $1,951, respectively [22]. Changes in costs corresponding to the cancer stage were also present in several studies. In US-based studies, annual melanoma direct medical per patient costs were rising from $992 to $31,032 for stages 0 to II to $34,103 to $152,244 for stage IV [23]. The annual per patient health care cost for the localized stage of renal cell carcinoma was found to be lower than that for regional and higher than that for distant and unstaged cancer—$36,968, $41,857, $26,573, and $19,693, respectively [24].

Social care costs, such as sick-leave payments and disability pensions, are not always included into estimations of the economic burden of disease. Definitely they could not be treated as costs when the researcher takes the societal perspective because these are costs for the government and income for patients. In our case, the initially taken governmental perspective justifies the inclusion of these costs. Also, social care costs are an important argument often used by politicians and decision makers in Russia.

Traditionally, lost labor productivity is measured in terms of wages foregone of people who have died or become disabled, or who have missed work for a period of time because of illness. In our case, we followed the approach commonly used by Russian researchers and estimated the loss of GDP. Thus, we achieved results comparable with other Russian-based studies. The other reason was the chosen perspective of the overall government budget, which did not allow using the lost personal income as the cost estimate.

Our study is subject to several limitations, with some of them being common to all cost-of-illness analyses performed in Russia and some specific for cancers [5]. Ideally, the cost-of-illness estimations should be done on the basis of information coming from the database linking epidemiologic, demographic, and health care utilization data, as is done in the Surveillance, Epidemiology, and End Results Program Medicare database, often used for estimating cancer costs in the United States. Unfortunately, we cannot expect to find data of such quality in Russia at the present time. Data needed for cancer cost estimation are sparse; therefore, we had to collect and synthesize data from different sources with their own limitations: official statistics provide only a limited set of data, often only as an aggregated result; information from the regional cancer registries might be

Table 5 – Distribution of annual mean cost (€) of studied cancers per patient depending on the time of diagnosis in Russia in 2009 (% of total costs).

Cost	Melanoma		Kidney cancer		Prostate cancer		Ovarian cancer	
	First year after diagnosis	Diagnosed in previous years	First year after diagnosis	Diagnosed in previous years	First year after diagnosis	Diagnosed in previous years	First year after diagnosis	Diagnosed in previous years
Total costs	1144	145	1322	285	1953	416	1724	296
Total health care costs	801 (70.0%)	51 (35.1%)	887 (67.1%)	67 (23.5%)	1618 (82.8%)	237 (57.1%)	1004 (58.2%)	87 (29.3%)
Inpatient and outpatient care	391 (34.2%)	25 (17.0%)	439 (33.2%)	15 (5.4%)	492 (25.2%)	37 (8.9%)	704 (40.8%)	67 (22.6%)
Medications	410 (35.8%)	26 (18.1%)	447 (33.8%)	52 (18.2%)	1126 (57.7%)	200 (48.2%)	300 (17.4%)	20 (6.7%)
Total social care costs	239 (20.9%)	71 (48.7%)	303 (22.9%)	164 (57.4%)	189 (9.7%)	133 (31.9%)	398 (23.1%)	155 (52.4%)
Sick-leave payments	57 (5.0%)	3 (1.8%)	47 (3.6%)	1 (0.4%)	41 (2.1%)	3 (0.6%)	55 (3.2%)	8 (2.6%)
Disability pensions	182 (15.9%)	68 (46.8%)	256 (19.3%)	163 (57.1%)	148 (7.6%)	130 (31.2%)	344 (19.9%)	147 (49.7%)
Total GDP loss	104 (9.1%)	24 (16.2%)	132 (10.0%)	54 (19.0%)	146 (7.5%)	46 (11.1%)	321 (18.7%)	54 (18.3%)
GDP lost because of temporary disability	25 (2.2%)	1 (0.8%)	21 (1.6%)	0.5 (0.2%)	18 (0.9%)	1 (0.3%)	24 (1.4%)	3 (1.2%)
GDP lost because of permanent disability	79 (6.9%)	22 (15.4%)	111 (8.4%)	54 (18.9%)	128 (6.5%)	45 (10.8%)	297 (17.2%)	51 (17.2%)

GDP, gross domestic product.

Table 6 – Annual mean total cost (€) per patient depending on the time of diagnosis and stage of disease in Russia in 2009.

Group of patients	Melanoma	Kidney cancer	Ovarian cancer	Prostate cancer
Diagnosed in previous years	145	285	296	416
Newly diagnosed, all stages	1144	1322	1724	1946
Local stage	801	930	1718	1067
Regional stage	2007	1716	1791	2724
Distant stage	2137	1946	1794	2802
Unstaged	295	125	297	54

skewed because of different interpretation of registered events; and experts' opinion surveys are known for their deviations.

We have not studied the costs borne by cancer patients, though there are limited data that they often have to pay themselves for the medications and provided treatment [25]. There is no full-scale research on this issue in Russia because it is very difficult to collect data on it. Patients and physicians reluctantly provide information on out-of-pocket payments because according to the existing regulations all services should be provided to cancer patients free of charge.

It is still necessary to mention that the cost-of-illness method in itself implies using assumptions because it is impossible to register and account for all costs in every detail. Most of the assumptions in this study most likely lead to an underestimation of the economic burden of cancers, resulting in minimal estimation of associated costs.

Conclusions

Our study provides the first estimation of the economic burden of melanoma and prostate, ovarian, and kidney cancer in the Russian Federation. Almost 40% of the costs lie outside the health sector, despite the small size of social payments and conservative approach to productive losses measurement.

Source of financial support: These findings are the result of work fulfilled in the frames of the project supported by the Russian Presidential Academy of National Economy and Public Administration.

Supplemental Materials

Supplemental material accompanying this article can be found in the online version as a hyperlink at http://dx.doi.org/10.1016/j.vhri.2014.07.002: or, if a hard copy of article, at www.valueinhealthjournal.com/issues (select volume, issue, and article).

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Table 7 – Results of sensitivity analysis.

Variation	Melanoma		Kidney cancer		Prostate cancer		Ovarian cancer	
	Estimate, € million	% of change	Estimate, € million	% of change	Estimate, € million	% of change	Estimate, € million	% of change
Baseline estimation	17.48	–	45.33	–	84.52	–	45.56	–
+50% of the cost of hospital day and outpatient visit	19.71	+12.77%	49.68	+9.61%	92.28	+9.18%	52.60	+15.46%
−50% of the cost of hospital day and outpatient visit	15.25	−12.77%	40.97	−9.61%	76.76	−9.18%	38.51	−15.46%
+50% of the cost of medications provided in outpatient care	19.82	+13.44%	51.21	+12.98%	107.20	+26.84%	48.19	+5.78%
−50% of the cost of medications provided in outpatient care	15.13	−13.44%	39.44	−12.98%	61.83	−26.84%	42.92	−5.78%
+50% of rate of permanent disability due to studied cancer	21.21	+21.35%	57.10	+25.98%	95.43	+12.90%	57.71	+26.68%
−50% of the rate of permanent disability due to studied cancer	13.74	−21.35%	33.55	−25.98%	73.87	−12.60%	33.40	−26.68%
+50% of working days missed because of studied cancer taken into account for the calculation of GDP losses	18.59	+6.35%	48.62	+7.27%	88.31	+4.49%	49.77	+9.24%
−50% of working days missed because of studied cancer taken into account for the calculation of GDP losses	16.37	−6.35%	42.03	−7.27%	80.72	−4.49%	41.35	−9.24%

GDP, gross domestic product.

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