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Government Healthcare Spending and Cancer Mortality: A Statistical Analysis Over 15 Years in 18 Countries

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ABSTRACT

This study examines healthcare spending in 18 countries in Asia, Europe and the Americas from 2001 to 2015 and finds notable variations in cancer mortality. Gender-specific effects were demonstrated by significantly lower mortality-to-incidence ratios in countries with more investment, particularly among women. Interestingly, despite more spending, male mortality remained higher, exposing unrecognized inequalities in healthcare consumption. This work reveals the critical relationships between public investment, policy efficacy, and cancer outcomes. This study offers policymakers helpful recommendations on how to enhance health outcomes and eliminate disparities in cancer treatment worldwide.

INTRODUCTION

The most important cause of mortality around the world is Cancer (Bray *et al.*, 2021). A study revealed that an increase of 6% in cancer mortality between the years 2001 to 2015 (ReFaey *et al.*, 2019). Additionally, as populations age worldwide, the burden of cancer is expected to increase more rapidly than of any other cause of disease (Zhu *et al.*, 2024). Nevertheless, cancer outcomes are significantly influenced by access to quality healthcare (Asensio & Amaral, 2024). It is evident that cancer is a pricey disease to manage, and individuals who cannot access quality medical attention have higher chances of succumbing to the disease (Sikora & Evans, 2025; Zlatareva *et al.*, 2017). There might be a strong health-centric focus on the availability of capable medical facilities and skilled medical professionals to diagnose and treat a high number of cancer patients. Although, advanced medical and supportive care measures have improved survival, still most cancers remain highly lethal (Olver *et al.*, 2020). The inherent lethality of many cancers is a critical issue that demands attention and innovation in the treatment field (Monnery & Droney, 2024). A critical determinant of health is healthcare expenditure by the Government, for the people (Dhungana, 2023). It is also important to increase the efficiency of relevant health care for preventing and treating the disease (Erlangga *et al.*, 2023). Recent research has pointed out how vital it is for national healthcare policies to offer equal access to cancer care. Government-led healthcare finance programs, based on public health academics, not only help patients overcome financial obstacles, but they are also essential to population-level cancer control activities (Amine El Mathari *et al.*, 2024; Min *et al.*, 2018; Stewart *et al.*, 2018). Additionally, differences in cancer death rates are illustrated by differences in healthcare spending between different regions, highlighting the significance of a coordinated strategy for healthcare financing in resolving these disparities (Keating *et al.*, 2018).

Our study aims to investigate whether increased government healthcare expenditure leads to a lower cancer mortality rate. The study was conducted between 2 groups with 9 countries each, which are named "higher healthcare expenditure" and "moderate or mixed healthcare expenditure" by the government. We hypothesized that countries with higher government healthcare expenditures will have significantly lower cancer mortality rates. Our research focuses on the importance of public health policies that will increase government investment in healthcare systems.

Objectives

To determine whether regional health policies are consistent with lower mortality outcomes in Europe, Asia, and the Americas, and to investigate how healthcare investment affects cancer outcomes differently across continental regions. The study also highlights the importance of government funding for public health programs and healthcare systems in enhancing cancer treatment and lowering mortality. In order to gain a deeper understanding of how healthcare financing impacts cancer outcomes and to support greater investment in healthcare as a way to improve public health, the study attempts to provide insights for future healthcare policy and funding choices by identifying trends related to public health outcomes based on varying levels of healthcare investment.

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Research Questions

The manuscript's research topics rely on the connection between cancer mortality rates and government healthcare spending.

1) What is the effect of government expenditures on healthcare on cancer mortality rates in different regions?

2) What are the variations in cancer mortality rates across nations with moderate or mixed healthcare spending and those with higher spending?

3) What is the relation between healthcare spending and patient outcomes and access to high-quality cancer care?

4) What part does government funding play in improving hospital facilities and cancer care providers' training?

Significance of The Study

The study's importance originates from its investigation of the connection between government healthcare spending and cancer mortality rates, which has major implications for healthcare financing and public health policy. The study offers important insights into how healthcare spending can affect health outcomes, especially when it comes to cancer treatment, through analyzing data from 18 nations over a 15-year period. First of all, the results demonstrate how important government funding is for raising cancer treatment standards and lowering death rates. According to the study, nations with greater healthcare spending typically had lower cancer death rates, indicating that greater healthcare spending may improve access to cutting-edge treatments, preventive initiatives, and early detection (Ahmad *et al.*, 2024; Hawkes, 2015). It provides insight into how economic considerations can impact access to high-quality cancer care and treatment outcomes by comparing nations with different levels of healthcare spending. This knowledge can help allocate resources and implement focused actions to address these inequities.

LITERATURE REVIEW

Our research may conclude that greater investment in healthcare systems results in better cancer outcomes. The results from the regions of North America investigated the correspondence between healthcare expenditure and lung cancer outcomes and revealed that increased healthcare investment positively impacts patient prognosis and lowers mortality rates (Sung *et al.*, 2021). Batouli *et al.* (2013) reported that across different continents, MIR was higher in moderate and low-income countries (0.64) than in high-income countries (0.47). Budhdeo *et al.* (2015) conducted an ecological cross-sectional investigation across the European Union and discovered that increases in several mortality categories correlated strongly with reductions in government expenditures on healthcare, including cancer. This finding concurs with the conclusion by Maruthappu *et al.* (2015) that higher government expenditures on medical services in Western European nations are associated with improved outcomes of cancer and increased survival rates. Furthermore, Keating *et al.* (2012) added that high-spending areas could offer the recommended healthcare that would enable enhanced cancer prevention and control. As such, overall, increasing spending does not mean that fewer cases will be reported since this goal can also be achieved by offering a better analysis service. Mays and Smith (2011) have reinforced the notion that greater public health spending can reduce mortality. Countries that have high healthcare expenditures are more likely to increase funding for comprehensive cancer care including early detection, preventive programs, and access to cutting-edge treatments. It helps to reduce the death rate of cancer with better healthcare facilities, more successful screening initiatives, and easier access to advanced treatments. The results of the study conducted in 2015 suggested that higher healthcare spending has been linked to new technology being implemented quickly which contributed to better outcomes for patients (Stevens *et al.*, 2015). Early detection and treatment options, which involve equitable access to healthcare services, were identified by Ghoncheh *et al.* (2016), reported that cancer mortality rates are higher in lower-income countries. Governments can implement effective cancer prevention measures through healthcare spending, such as financing public health campaigns (Amine El Mathari *et al.*, 2024; Brawley, 2017; Stewart *et al.*, 2018). This can increase community knowledge of the disease and facilitate early detection. Implementing a tailored educational program on cancer screening technology led to an increase in knowledge among its target population, which in turn increased the tendency of the population to engage in screening (Jandorf *et al.*, 2006). A paradigm shift should occur with respect to cancer control, and more money should be invested in strategies such as health campaigns that prevent the disease. It is only then that the incidence and death rates can be significantly reduced (Frieden *et al.*, 2008). More importantly, cancer research funding has been prospered over the years on the basis of the understanding that people value their quality of life and that Govt is willing to spend any available amount to enhance it (McIntosh *et al.*, 2023). By developing and increasing innovative treatments such as immunotherapy which are very costly, patients have access to fair trials and effective cancer management techniques. Increase in subsequent investment in systemic therapies, indicating the positive influence of funding in cancer research in enhancing cancer treatment options (Abudu *et al.*, 2021). Significant budget allocations by government agencies can contribute to the improvement of various cancer studies that focus on personalized medicine and cancer prevention (Torres *et al.*, 2017). Data from South Korea showed that an increase in government research funding is associated with a reduction in the cancer burden (Jung *et al.*, 2019). At the same time, in the UK, there has also been a substantial increase in government research spending; however, in this case, cancer receives a significant portion of the funds as compared to other health professions, and it allows development of new treatment methodologies (Luengo-Fernandez *et al.*,

2015). One of the ways in which increased government funding improves patient outcomes is the enhancement of hospitals' infrastructure (Luxon, 2015; Mankar *et al.*, 2024). For instance, according to Jena *et al.* (2024), increased participation of hospital staff in training is associated with better patient care and better public health practices. The establishment of cancer care hospitals by the government of Japan has reinforced collaboration between regional cancer care centers and increased the overall quality of cancer care in the nation (Numasaki *et al.*, 2011). Studies have revealed that employees with specific training and practices in cancer pain management receive better treatment for patients (Yu *et al.*, 2022). Countries that spend more fighting cancer can provide the necessary resources for further research in the medical sphere (Garton *et al.*, 2023). Significant progress in the field of molecular profiling and targeted therapies has allowed the development of individual approaches to cancer treatment and regular patient examinations (Doyle-Lindrud, 2022). Also the economic costs associated with cancer are due to an increase in the number of new cases and the length of survival of patients with cancer, which is achieved through significant investments in science and therapy (Wilking *et al.*, 2017). These results are identical to another research which demonstrated that the allocation of funds for the study of cancer can improve treatment methods and optimize the use of resources in oncological practice (Patafio *et al.*, 2016). An increase in budget allocation by the government towards cancer ensures equitable access to quality care, eventually reducing cancer treatment inequalities between rich and poor. Another research found that how strategic investments in the health system and interventions lead to a much better outcome in the treatment of cancer for the disadvantaged population (El Amine Youcef Ali *et al.*, 2023). The study conducted in India showed that some patients receive free care, but another substantial proportion of the patients still had a high out-of-pocket expenditure which pointed out widening inequalities between patients who could not afford expenditure on frequent admission (Basavaiah *et al.*, 2018).

Surprisingly, our data shows the genuine difference in the pattern that high expenditure has no effect on the reducing pattern of deaths caused by male cancer, but high expenditure has a negative impact on the incidence of deaths caused by female cancer. Crucially, there are several possible reasons for this, all of which are relevant to male cancer. It requires further exploration. Lung, prostate, and liver cancers are among the most common cancers in men, according to reports (Goodarzi *et al.*, 2019; Siegel *et al.*, 2023). These cancers in men tend to be diagnosed at a later stage with fewer treatment options and hence lower survival chances. Speak in particular about lung cancer, which causes 1.79 million deaths annually and is still connected with high death rates even with modern healthcare systems is also diagnosed at a later stage (Xu, 2024). Furthermore, smoking is still an important risk indicator for lung cancer, as seen by the 782% rise in tobacco-related lung cancer fatalities among Caucasians over a period of 21 years, which raises mortality rates in many regions among men (Bugazia & Boshnaf, 2023).

Moreover, healthcare utilization by gender may influence the incidence of these cancers. Some studies have reported that men are less likely to use regular health care or adopt preventive health behaviors. According to Oster *et al.* (2015), men in Western cultures are more likely to avoid treatment and take risks frequently. The stereotype of the stoic man who does not care about his own health is promoted by this tendency. Thompson *et al.* (2012) discussed how men feel pressured to acknowledge their health issues. Also, women consistently use more preventive health services than men, which makes men more vulnerable to health risks than women (Liu *et al.*, 2016). Thus, even with a higher number of healthcare expenditures, men's healthcare is not as accessible as women's, lowering the benefits of early diagnosis and treatment of cancers.

MATERIALS AND METHODS

This section describes the data sources, statistical methods that were used and data preprocessing techniques.

Data Sources

We collected our datasets from 2 different sites. The 1st dataset was collected from the IARC (International Agency for Research on Cancer) which is a part of the WHO (International Agency for Research on Cancer, 2016). We took 18 countries' total-male-female incidence rates, total-male-female mortality rates, and total-male-female mortality to incidence ratios from 2001 to 2015. The 2nd dataset includes Govt expenses in healthcare data from the year 2001 to 2015, which is available in the "Global Health Expenditure Database". It is also a part of the WHO (Global Health Expenditure Database, 2016). In order to evaluate regional inequalities, countries are further separated into "higher healthcare expenditure" and "moderate healthcare expenditure" groups based on continental groupings (Europe, Asia, and the Americas). The "Higher healthcare expenditure" group included Austria, Denmark, Finland, the Netherlands, Sweden, Scotland (United Kingdom), Northern Ireland (United Kingdom), Australia, and New Zealand. "Moderate and mixed healthcare expenditure" included Croatia, Czechia, Estonia, Latvia, Lithuania, Slovenia, Ireland, South Korea, and Costa Rica. The unit of government expenditure data was millions of USD. We could not find expenditure data for Sweden and Northern Ireland, but this did not affect the analysis. Therefore, we had expenditure data for 7 countries in the group 'Higher healthcare expenditure.' However, the other group had no missing values. The incidence and mortality of cancer are reported in the number of people.

Hypothesis Testing

Levene's test was conducted to check for equal variances in government expenditures and the mortality-to-

incidence ratio between the 2 groups. Our goal was to establish whether the variances in the 2 groups were equal or unequal (Shear *et al.*, 2018). Then, we conducted an independent t-test, which is used to compare the mean values of two groups to determine if they are different from each other.

Cancer Mortality and Healthcare Expenditure Comparison

Another type of t-test was used to differentiate government healthcare expenditures between the groups and the total, male and female mortality to incidence ratio. Each was used to compare the ratios between the higher healthcare expenditure group and the moderate or mixed healthcare expenditure group. This aspect allowed us to conclude that the difference in healthcare expenditure impacts cancer outcomes.

Effect Size and Power

Cohen's d was computed to determine the effect size for all results that proved to be significant (Chen *et al.*, 2021). The statistical power was calculated to ensure the strength of the tests.

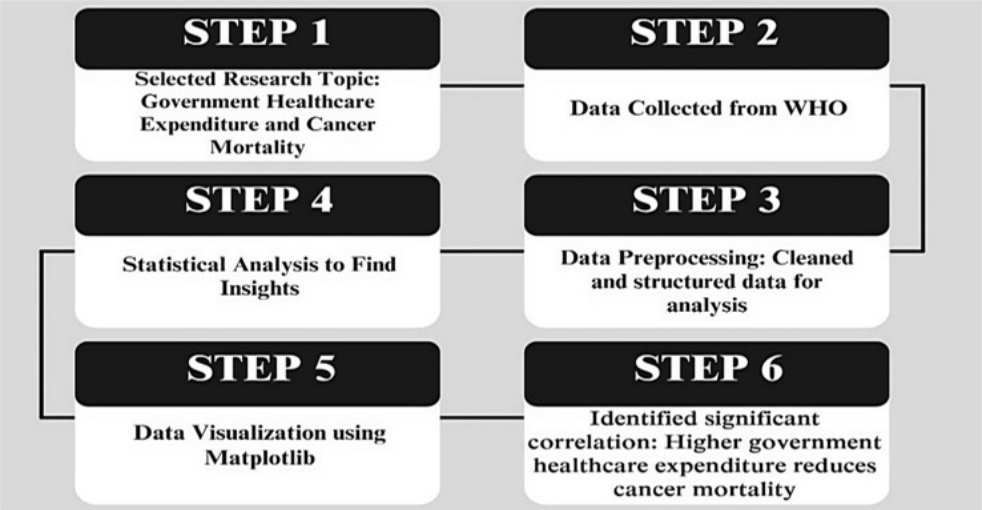

Figure 1: Cancer Research Flowchart

Figure 1 illustrates the systematic procedure used in the study of the relationship between cancer mortality and government healthcare spending

RESULTS AND DISCUSSION

Healthcare Expenditure Comparison

The independent t-test comparing government healthcare expenditures between the higher healthcare and the moderate healthcare groups was significant (T = 6.56, p = 4.12e-07). Though, we had expenditure data for only seven countries in the group 'Higher healthcare expenditure'. Still, over 15 years, the mean expenditure for the higher expenditure group was 2.6 times greater than that for the moderate expenditure group, revealing a considerable investment. Our findings align with a study conducted in Taiwan, which reported that colorectal cancer patients treated at low-spending hospitals had a 36% higher mortality risk compared with those treated at high-spending hospitals (Chang *et al.*, 2014). Also, higher financial expenditure by the government on healthcare can lower the mortality rates of breast cancer (Ciuba *et al.*, 2022).

Male Cancer Ratio Comparison

The difference between the variance of male mortality-to-incidence ratios was significant. Interestingly, the higher healthcare expenditures have higher mortality rates than the moderate expenditure group, (T= 6.5, p = 4.810513e-07) which was counterintuitive, which we defended the finding in the discussion section. The confidence interval of [0.06, 0.11] also suggested the result.

Total Cancer Ratio Comparison

The total mortality to incidence ratio was considerably lower in the higher healthcare expenditure group from 2001 to 2010, in contrast to the moderate group (T = -2.26, p = 0.0362). The confidence interval of [-0.08, -0.0] suggests that the mortality rate decreased modestly but significantly in the higher expenditure group. Although we observed an inverse result between 2010 and 2013, where the group with higher spending showed a higher ratio, than the moderate group.

Regression Analysis:

After the t-test, we conducted linear regression analysis for both groups. For higher expenditure group we get, y = -0.0059x + 0.4847 and the r2 score of 0.9454. For moderate expenditure group the equation became y = -0.013x + 0.5699 where the r2 score was 0.883. The analysis reveals that while the moderate expenditure group experiences a more substantial fall in cancer mortality, the higher expenditure group experiences a slower decline, suggesting greater marginal gains from spending, which concludes that the two groups have a strong negative connection.

Levene's Test

After performing Levene's test we confirmed that the variances in government expenditure (statistic = 10.82, p = 0.0027) and the female mortality to incidence ratio (statistic = 12.28151, p = 0.001558) between the two groups were different. This justified the use of unequal variance assumptions in the t-tests.

A comprehensive summary of cancer incidence and death-to-incidence ratios (MIR) for both sexes in nations with increased healthcare spending is given in Table 1. MIR of roughly 0.489 was obtained in 2001, for instance, when the overall cancer incidence was 338,443 and the mortality count was 165,645. By 2002, the MIR was 0.478 due to a modest decrease in death to 165,813 and an increase in incidence to 346,472. The MIR typically represents a lower mortality rate in comparison to incidence in nations with higher healthcare spending. Data on cancer incidence and mortality over a number of years is shown in Table 2 for nations with moderate healthcare spending. The mortality to incidence ratio (MIR) was roughly 0.736 in 2001. When the total cancer incidence among females was 105,448 and the mortality count was 77,635. The incidence and death numbers varied in the following years, with the incidence increasing to 110,000 in 2002 and the mortality somewhat declining to 75,000, resulting in a MIR of roughly 0.682. This suggests that cancer care and treatment efficacy may be problematic in nations with intermediate levels of healthcare.

Table 1: Cancer MIR (Mortality to Incidence Ratio) Among Both Sexes in Higher Healthcare Countries

Year	MIR among both sexes	MIR among males	MIR among females
2001	0.489	0.501	0.477
2002	0.479	0.489	0.467
2003	0.47	0.475	0.465
2004	0.455	0.454	0.456
2005	0.453	0.451	0.454
2006	0.445	0.445	0.446
2007	0.437	0.436	0.437
2008	0.432	0.432	0.433
2009	0.419	0.418	0.42
2010	0.428	0.432	0.424
2011	0.421	0.423	0.419
2012	0.421	0.425	0.416
2013	0.41	0.416	0.403
2014	0.402	0.408	0.395
2015	0.403	0.41	0.396

Table 2: Cancer MIR (Mortality to Incidence Ratio) Among Both Sexes in Moderate Healthcare Countries

Year	MIR among both sexes	MIR among males	MIR among females
2001	0.569	0.428	0.736
2002	0.566	0.423	0.736
2003	0.546	0.414	0.7
2004	0.526	0.395	0.679
2005	0.501	0.382	0.639
2006	0.488	0.37	0.623
2007	0.462	0.353	0.584
2008	0.442	0.342	0.552
2009	0.425	0.33	0.53
2010	0.42	0.329	0.518
2011	0.402	0.319	0.49
2012	0.404	0.321	0.491
2013	0.402	0.321	0.488
2014	0.414	0.325	0.514
2015	0.417	0.326	0.521

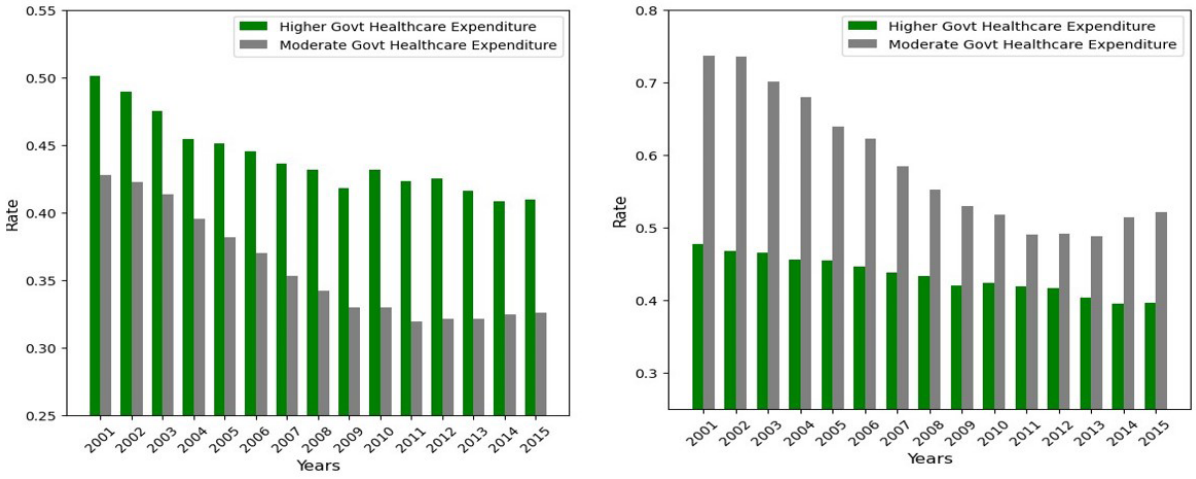

Figure 2: (a) Male cancer MIR in higher vs. moderate healthcare expenditure countries over 15 years, (b) Female cancer MIR in higher vs. moderate healthcare expenditure countries over 15 years

Figure 2 (a). Male and Figure 2 (b). female mortality rates by incidence ratio among regions with higher and moderate healthcare expenditures from 2001 to 2015. The male mortality rates are displayed on the left graph. Male mortality rates are higher in the higher healthcare expenditure group compared to the moderate expenditure group. However, mortality rates decreased over time in both groups. This may point to a problem with the male population's access to healthcare, which may be related to these groups' low usage of preventative treatments. The female mortality rate is displayed in the other graph on the right. In this instance, countries with higher healthcare spending indicate lower death rates. This suggests that women benefit significantly from increased healthcare investment.

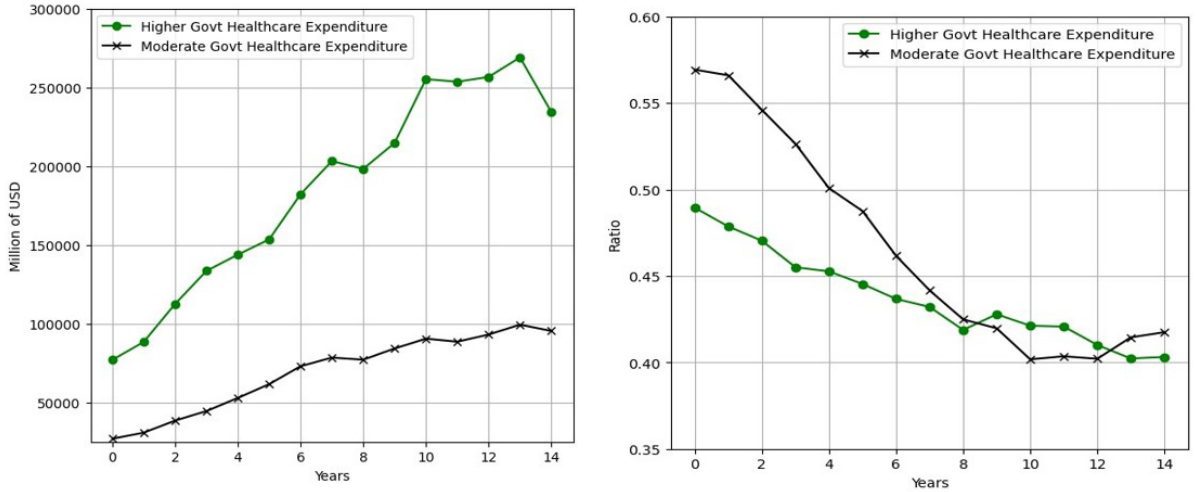

Figure 3: (a) Government healthcare expenditure over 15 Years, (b) Both sexes mortality by incidence ratio over 15 Years

Figure 3(a). shows govt expenditures over 15 years in the healthcare industry. The countries with higher expenditures have an increasing tendency to peak and then slightly decline. Though the rate is variable, the overall trend is increasing. On the other hand, countries with moderate levels of spending also exhibit a growing trend, although more slowly. However, the expenditure is lower than that in higher healthcare expenditure countries. Figure 3(b). shows the mortality by incidence ratio for both sexes over 15 years. The diagram shows a decreasing pattern for both groups over time. The higher expenditure ratio steadily decreases to 0.40 from a starting point just below 0.5. The ratio for the moderate expenditure line starts at 0.58 and continues to decrease, although more slowly. The data indicate that a decrease in the death-by-incidence ratio occurs over time when government spending on healthcare increases.

Figure 4. shows the total 15-year distribution of government healthcare expenditures. There are two segments, the larger green segment is about "Government expense of higher healthcare countries" which constitutes 73%, and the other segment is the smaller gray segment "Government expense of moderate healthcare countries".

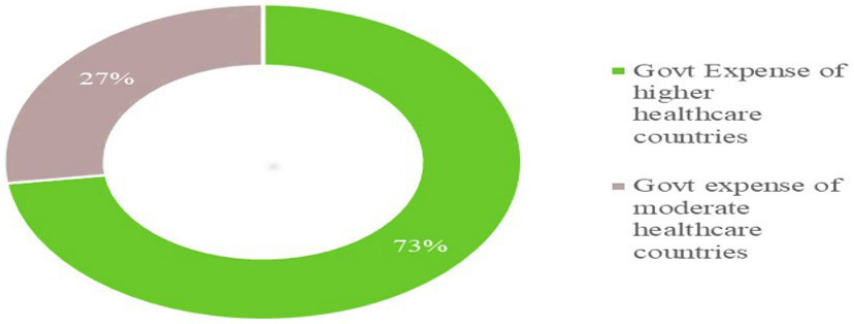

Figure 4: : Total 15 years distribution of Government healthcare expenditure

The following table 3 shows notable differences in investment levels by comparing government healthcare spending over a 15-year period between higher and moderate healthcare nations.

Table 3: Government Healthcare Expenditure in Higher vs. Moderate Healthcare Countries

Year	Govt expenditure in higher healthcare (in millions of USD)	Govt expenditure in moderate healthcare (in millions of USD)
2001	77041	26974
2002	88427	30831
2003	112551	38472
2004	133499	44531
2005	143808	52853
2006	153507	61613
2007	182137	72979
2008	203211	78469
2009	198269	77138
2010	214710	84241
2011	255257	90474
2012	253619	88544
2013	256617	93116
2014	269032	99348
2015	234320	95403

Summary of Key Findings

Our study might lead to the conclusion that improved cancer outcomes are a direct effect of increased investment in healthcare systems. Funding for comprehensive cancer care, including early diagnosis, preventive initiatives, and access to modern facilities treatments, is more likely to be increased in nations with high healthcare costs. Better medical facilities, more effective screening programs, and simpler access to cutting-edge treatments all contribute to a lower cancer death rate. Reducing cancer mortality rates has been found to depend on early identification and treatment choices, which include fair access to medical care. Expanding government spending on cancer guarantees fair access to high-quality care, which eventually lessens the disparity in cancer treatment between the rich and the poor. Surprisingly, our data demonstrates a real difference in the pattern, with greater expenditure having a negative influence on the incidence of deaths from female cancer but having no effect on the declining pattern of deaths from male cancer. Importantly, there are a number of potential causes for this, all of which are related to cancer in men. The incidence of these tumors may be influenced by the gender-specific healthcare consumption. Men's healthcare is therefore less accessible than women's, despite having higher healthcare costs, which reduces the advantages of early cancer detection and treatment.

Strengths and Limitations

The current research has diverse strengths. First, the dataset included the comprehensive information on cancer mortality and incidence in various counties and regions with distinct levels of healthcare budgets. Ramsey *et al.* (2016) discovered a clear correlation between financial insolvency and a higher chance of mortality for cancer patients. The variations in mortality-to-incidence ratio across countries reveal the hidden health disparities because the regions with low healthcare costs may have higher death rates than incidence rates (Lee *et al.*, 2018). The possible availability and financial accessibility of treatments for patients with oncology issues mainly

depend on economic factors (Eniu *et al.*, 2019). This broad focus offers a unique opportunity to compare the results of different healthcare investment levels. Also, the unique focus on comparing the total and female-specific cancer mortality makes our results more plausible because they clearly explain the manifestations of the phenomenon and suggest the potential implications for healthcare and additional research. Adequate access to healthcare services and early detection are essential for any successful healthcare policy aiming at reducing the death rate from cancer in women. Further studies should be conducted on the subject in order to determine the efficient way to allocate healthcare resources. This research has several limitations. One limitation is the restricted dataset, as the study included only a limited number of countries. Future research should incorporate more data from different regions, especially the ones with different healthcare systems. The limited localization of the sample can slightly impact the general conclusion due to the absence of diverse variables. There may be some other factors that influence cancer mortality, such as environmental or genetic factors. Another point is that the data is too coarse to make inferences about specific types of cancer or some particular healthcare policy. The broad category of "healthcare" includes certain crucial components or treatments, some of which we do not yet know are helpful. The field of medicine is always changing. Therefore, it is impossible to know in advance how long the results of this kind of research will hold.

CONCLUSION

This study has concluded a notable relation between the government healthcare expenditure and cancer mortality rate over the course of 15 years, specifically, it can be observed when comparing the countries with high government healthcare expenditure to the moderate level. As a result, it is clear that higher investments in health care not only enable a better facility with medical sources and technologies but also grant more favorable conditions for the patients. It can be argued as a conclusion that the countries that invest great sums in health care are indeed able to fight cancer. In particular, they show a considerable improvement in the situation with early detection, the availability of types of treatment, and the quality of patient care. Through our analysis, it can be noted that stronger health systems effectively handle chronic diseases, such as cancer, resulting in lower mortality rates. It is evident that the same relationship is observed when it comes to increased government healthcare expenditure. This work allows policymakers to make justified conclusions and assert that only continuous financial support leads to a lower incidence and mortality of cancer. Further research might investigate the effects of particular healthcare spending efforts on cancer death rates, including public health campaigns or screening programs. Also, longitudinal research on the long-term impacts of public spending on health might reveal more insight into these relationships. However, this study only serves to support the hypothesis that spending on healthcare lowers the death rate of cancer. Consequently, governments that invest in healthcare and promote public health also stand to benefit by reducing the societal and financial costs associated with cancer.

REFERENCES

Abudu, R., Bouche, G., Bourougaa, K., Davies, L., Duncan, K., Estaquio, C., Font, A. D., Hurlbert, M. S., Jackson, P., Kroeskop-Bossenbroek, L., Lewis, I., Mitrou, G., Mutabbir, A., Pettigrew, C. A., Turner, L., Weerman, A., & Wojtanik, K. (2021). Trends in international cancer research investment 2006-2018. *JCO Global Oncology, 7,* 602–610. https://doi.org/10.1200/GO.20.00591

Ahmad, I., Jasim, S. A., Sharma, M. K., S, R. J., Hjazi, A., Mohammed, J. S., Sinha, A., Zwamel, A. H., Hamzah, H. F., & Mohammed, B. A. (2024). New paradigms to break barriers in early cancer detection for improved prognosis and treatment outcomes. *The Journal of Gene Medicine, 26*(8), e3730. https://doi.org/10.1002/jgm.3730

Asensio, M., & Amaral, E. (2024). Disparities in cancer outcomes: A comprehensive analysis of cancer incidence, mortality, and prevalence in Europe. *Global Health Economics and Sustainability, 2*(2), 3216. https://doi.org/10.36922/ghes.3216

Basavaiah, G., Rent, P. D., Rent, E. G., Sullivan, R., Towne, M., Bak, M., Sirohi, B., Goel, M., & Shrikhande, S. V. (2018). Financial Impact of Complex Cancer Surgery in India: A Study of Pancreatic Cancer. *Journal of Global Oncology, 4,* 1–9. https://doi.org/10.1200/JGO.17.00151

Batouli, A., Jahanshahi, P., Gross, C. P., Makarov, D. V., & Yu, J. B. (2013). The global cancer divide: Relationships between national healthcare resources and cancer outcomes in high-income vs. middle- and low-income countries. *Journal of Epidemiology and Global Health, 4*(2), 115. https://doi.org/10.1016/j.jegh.2013.10.004

Brawley, O. W. (2017). The role of government and regulation in cancer prevention. *The Lancet Oncology, 18*(8), e483–e493. https://doi.org/10.1016/S1470-2045(17)30374-1

Bray, F., Laversanne, M., Weiderpass, E., & Soerjomataram, I. (2021). The ever-increasing importance of cancer as a leading cause of premature death worldwide. *Cancer, 127*(16), 3029–3030. https://doi.org/10.1002/cncr.33587

Budhdeo, S., Watkins, J., Atun, R., Williams, C., Zeltner, T., & Maruthappu, M. (2015). Changes in government spending on healthcare and population mortality in the European union, 1995–2010: A cross-sectional ecological study. *Journal of the Royal Society of Medicine, 108*(12), 490–498. https://doi.org/10.1177/0141076815600907

Bugazia, S., & Boshnaf, M. (2023). 1739P Lung cancer mortality patterns of tobacco users in the United

States: A 21-year analysis (1999-2020). *Annals of Oncology, 34,* S944. https://doi.org/10.1016/j.annonc.2023.09.2693

Chang, T.-S., Huang, K.-Y., Chang, C.-M., Lin, C.-H., Su, Y.-C., & Lee, C.-C. (2014). The Association of Hospital Spending Intensity and Cancer Outcomes: A Population-Based Study in an Asian Country. *The Oncologist, 19*(9), 990–998. https://doi.org/10.1634/theoncologist.2014-0013

Chen, X., Trafimow, D., Wang, T., Tong, T., & Wang, C. (2021). The APP procedure for estimating the Cohen's effect size. *Asian Journal of Economics and Banking, 5*(3), 289–306. https://doi.org/10.1108/AJEB-08-2021-0095

Ciuba, A., Wnuk, K., Nitsch-Osuch, A., & Kulpa, M. (2022). Health Care Accessibility and Breast Cancer Mortality in Europe. *International Journal of Environmental Research and Public Health, 19*(20), 13605. https://doi.org/10.3390/ijerph192013605

Dhungana, B. R. (2023). Government Health Expenditure and Policy for Public Health Outcomes: A Systematic Literature Review. *MedS Alliance Journal of Medicine and Medical Sciences, 3*(6), 84–91. https://doi.org/10.3126/mjmms.v3i6.66615

Doyle-Lindrud, S. (2022). Personalized cancer care. *Journal of the American Association of Nurse Practitioners, 34*(11), 1184–1186. https://doi.org/10.1097/JXX.0000000000000793

El Amine Youcef Ali, M., Nusselder, W., Weiderpass, E., Corbex, M., Bray, F., & Vaccarella, S. (2023). Inequities in cancer outcomes. *Bulletin of the World Health Organization, 101*(09), 550–550. https://doi.org/10.2471/BLT.23.290661

El Mathari, A., Ouqassou, H. A., Sehhar, M. A., Chmitah, T., Soltani, S., Idrissi, K. S., & El Bouaiti, L. Effectiveness of public health measures in reducing the incidence and lethality of cancer: A systematic review and meta-analysis. *World Journal of Advanced Research and Reviews, 23*(2), 371–393. https://doi.org/10.30574/wjarr.2024.23.2.2354

Eniu, A., Cherny, N. I., Bertram, M., Thongprasert, S., Douillard, J.-Y., Bricalli, G., Vyas, M., & Trapani, D. (2019). Cancer medicines in Asia and Asia-Pacific: What is available, and is it effective enough? *ESMO Open, 4*(4), e000483. https://doi.org/10.1136/esmoopen-2018-000483

Erlangga, D., Powell-Jackson, T., Balabanova, D., & Hanson, K. (2023). Determinants of government spending on primary healthcare: A global data analysis. *BMJ Global Health, 8*(11), e012562. https://doi.org/10.1136/bmjgh-2023-012562

Frieden, T. R., Myers, J. E., Krauskopf, M. S., & Farley, T. A. (2008). A Public Health Approach to Winning the War Against Cancer. *The Oncologist, 13*(12), 1306–1313. https://doi.org/10.1634/theoncologist.2008-0157

Garton, E. M., Cheetham, M., Cira, M. K., Davies, L., Mitrou, P., Perin, D. P., Ross, A. L., Zafar, S. N., & Duncan, K. (2023). Cancer research funding data to drive collaboration and inform action. *The Lancet Oncology, 24*(6), 584–586. https://doi.org/10.1016/S1470-2045(23)00153-5

Ghoncheh, M., Pournamdar, Z., & Salehiniya, H. (2016). Incidence and Mortality and Epidemiology of Breast Cancer in the World. *Asian Pacific Journal of Cancer Prevention, 17*(sup3), 43–46. https://doi.org/10.7314/APJCP.2016.17.S3.43

Global Health Expenditure Database. (2016). *Government health expenditure data, 2001-2015* [Dataset]. Global Health Expenditure Database, World Health Organization. https://doi.org/10.6084/m9.figshare.27214161.v1

Goodarzi, E., Beiranvand, R., Mosavi-Jarrahi, A., Naemi, H., & Khazaei, Z. (2019). Epidemiology Incidence and Mortality Worldwide Common cancers in males and Their Relationship with the Human Development Index (HDI): An Ecological Study Updated in the World: Incidence and Mortality Worldwide Common cancers in males and Human Development Index (HDI). *Journal of Contemporary Medical Sciences, 5*(6), 281–303. https://doi.org/10.22317/jcms.v5i6.664

Hawkes, N. (2015). Many cancer deaths could be eliminated by greater awareness and access to latest treatments, report says. *BMJ, 350*(jan14 3), h223–h223. https://doi.org/10.1136/bmj.h223

International Agency for Research on Cancer. (2016). *Cancer incidence and mortality data, 2001–2015* [Dataset]. International Agency for Research on Cancer, World Health Organization. https://doi.org/10.6084/m9.figshare.27214161.v1

Jandorf, L., Fatone, A., Borker, P. V., Levin, M., Esmond, W. A., Brenner, B., Butts, G., & Redd, W. H. (2006). Creating alliances to improve cancer prevention and detection among urban medically underserved minority groups: The East Harlem Partnership for Cancer Awareness. *Cancer, 107*(S8), 2043–2051. https://doi.org/10.1002/cncr.22153

Jena, S., Epari, V., Sahoo, K. C., Pradhan, S. P., Agrawala, S., & Padhi, S. (2024). Learning from the Active Hospital-Based Cancer Registry in India: An Ethnography Study. *Discover Public Health, 21*(1), 2. https://doi.org/10.1186/s12982-024-00123-y

Jung, Y. L., Yoo, H. S., & Kim, E. S. (2019). The relationship between government research funding and the cancer burden in South Korea: Implications for prioritising health research. *Health Research Policy and Systems, 17*(1), 103. https://doi.org/10.1186/s12961-019-0510-6

Keating, N. L., Huskamp, H. A., Kouri, E., Schrag, D., Hornbrook, M. C., Haggstrom, D. A., & Landrum, M. B. (2018). Factors Contributing To Geographic Variation In End-Of-Life Expenditures For Cancer Patients. *Health Affairs, 37*(7), 1136–1143. https://doi.org/10.1377/hlthaff.2018.0015

Keating, N. L., Landrum, M. B., Lamont, E. B., Bozeman, S. R., & McNeil, B. J. (2012). Area-Level Variations in Cancer Care and Outcomes. *Medical*

Care, 50(5), 366–373. https://doi.org/10.1097/MLR.0b013e31824d74c0

Lee, H.-L., Peng, C.-M., Huang, C.-Y., Wu, S.-Y., Tsai, M.-C., Wang, C.-C., Chen, S.-L., Lin, C.-C., Huang, C.-N., & Sung, W.-W. (2018). Is mortality-to-incidence ratio associated with health disparity in pancreatic cancer? A cross-sectional database analysis of 57 countries. *BMJ Open, 8*(7), e020618. https://doi.org/10.1136/bmjopen-2017-020618

Liu, X., Li, N., Liu, C., Ren, X., Liu, D., Gao, B., & Liu, Y. (2016). Urban–rural disparity in utilization of preventive care services in China. *Medicine, 95*(37), e4783. https://doi.org/10.1097/MD.0000000000004783

Luengo-Fernandez, R., Leal, J., & Gray, A. (2015). UK research spend in 2008 and 2012: Comparing stroke, cancer, coronary heart disease and dementia. *BMJ Open, 5*(4), e006648. https://doi.org/10.1136/bmjopen-2014-006648

Luxon, L. (2015). Infrastructure – the key to healthcare improvement. *Future Hospital Journal, 2*(1), 4–7. https://doi.org/10.7861/futurehosp.15.002

Mankar, D., Sagar, N., & Patil, P. (2024). Enhancing hospital infrastructure: A comprehensive strategy for planning of supportive services. In K. N. Marimuthu, L. Kanagalakshmi, C. Vallabhapurapu, & K. R. Kumar (Eds.), *Futuristic trends in management Volume 3 Book 24* (1st ed., pp. 227–237). Iterative International Publisher, Selfypage Developers Pvt Ltd. https://doi.org/10.58532/V3BHMA24CH28

Maruthappu, M., Ng, K., Williams, C., Atun, R., Agrawal, P., & Zeltner, T. (2015). The association between government healthcare spending and maternal mortality in the E uropean U nion, 1981–2010: A retrospective study. *BJOG: An International Journal of Obstetrics & Gynaecology, 122*(9), 1216–1224. https://doi.org/10.1111/1471-0528.13205

Mays, G. P., & Smith, S. A. (2011). Evidence Links Increases In Public Health Spending To Declines In Preventable Deaths. *Health Affairs, 30*(8), 1585–1593. https://doi.org/10.1377/hlthaff.2011.0196

McIntosh, S. A., Alam, F., Adams, L., Boon, I. S., Callaghan, J., Conti, I., Copson, E., Carson, V., Davidson, M., Fitzgerald, H., Gautam, A., Jones, C. M., Kargbo, S., Lakshmipathy, G., Maguire, H., McFerran, K., Mirandari, A., Moore, N., Moore, R., … Head, M. G. (2023). Global funding for cancer research between 2016 and 2020: A content analysis of public and philanthropic investments. *The Lancet Oncology, 24*(6), 636–645. https://doi.org/10.1016/S1470-2045(23)00182-1

Min, H. S., Yang, H. K., & Park, K. (2018). Supporting Low-income Cancer Patients: Recommendations for the Public Financial Aid Program in the Republic of Korea. *Cancer Research and Treatment, 50*(4), 1074–1083. https://doi.org/10.4143/crt.2017.401

Monnery, D., & Droney, J. (2024). Enhanced supportive care. *British Journal of Hospital Medicine, 85*(3), 1–8. https://doi.org/10.12968/hmed.2023.0416

Numasaki, H., Shibuya, H., Nishio, M., Ikeda, H., Sekiguchi, K., Kamikonya, N., Koizumi, M., Tago, M., Ando, Y., Tsukamoto, N., Terahara, A., Nakamura, K., Mitsumori, M., Nishimura, T., Hareyama, M., Teshima, T., & And Of Committee, J. S. T. R. (2011). Japanese Structure Survey of Radiation Oncology in 2007 with Special Reference to Designated Cancer Care Hospitals. *Strahlentherapie Und Onkologie, 187*(3), 167–174. https://doi.org/10.1007/s00066-010-2205-3

Olver, I., Keefe, D., Herrstedt, J., Warr, D., Roila, F., & Ripamonti, C. I. (2020). Supportive care in cancer—A MASCC perspective. *Supportive Care in Cancer, 28*(8), 3467–3475. https://doi.org/10.1007/s00520-020-05447-4

Oster, C., McGuiness, C., Duncan, A., & Turnbull, D. (2015). Masculinity and men's participation in colorectal cancer screening. *Psychology of Men & Masculinity, 16*(3), 254–263. https://doi.org/10.1037/a0038154

Patafio, F. M., Brooks, S. C., Wei, X., Peng, Y., Biagi, J., & Booth, C. M. (2016). Research Output and the Public Health Burden of Cancer: Is There Any Relationship? *Current Oncology, 23*(2), 75–80. https://doi.org/10.3747/co.23.2935

Ramsey, S. D., Bansal, A., Fedorenko, C. R., Blough, D. K., Overstreet, K. A., Shankaran, V., & Newcomb, P. (2016). Financial Insolvency as a Risk Factor for Early Mortality Among Patients With Cancer. *Journal of Clinical Oncology, 34*(9), 980–986. https://doi.org/10.1200/JCO.2015.64.6620

ReFaey, K., Tripathi, S., Grewal, S. S., Quinones, D. J., Chaichana, K. L., Antwi, S. O., Cooper, L. T., Meyer, F. B., Dronca, R. S., Diasio, R. B., & Quinones-Hinojosa, A. (2019). Current Leading Cause of Death in the World: Cancer versus Cardiovascular Disease. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3396025

Shear, B. R., Nordstokke, D. W., & Zumbo, B. D. (2018). A Note on Using the Nonparametric Levene Test When Population Means Are Unequal. https://doi.org/10.7275/BWVG-D091

Siegel, R. L., Miller, K. D., Wagle, N. S., & Jemal, A. (2023). Cancer statistics, 2023. *CA: A Cancer Journal for Clinicians, 73*(1), 17–48. https://doi.org/10.3322/caac.21763

Sikora, K., & Evans, P. (2025). Future Organization of Cancer Care. In *International Encyclopedia of Public Health* (pp. 272–281). Elsevier. https://doi.org/10.1016/B978-0-323-99967-0.00155-1

Stevens, W., Philipson, T. J., Khan, Z. M., MacEwan, J. P., Linthicum, M. T., & Goldman, D. P. (2015). Cancer Mortality Reductions Were Greatest Among Countries Where Cancer Care Spending Rose The Most, 1995–2007. *Health Affairs, 34*(4), 562–570. https://doi.org/10.1377/hlthaff.2014.0634

Stewart, S. L., Hayes, N. S., Moore, A. R., Ii, R. B., Brown, P. M., & Wanliss, E. (2018). Combating cancer through public health practice in the United States:

An in-depth look at the National Comprehensive Cancer Control Program. In Md. A. A. Majumder, R. Kabir, & S. Rahman (Eds.), *Public health—Emerging and re-emerging issues*. InTech. https://doi.org/10.5772/intechopen.78582

Sung, W., Au, K., Wu, H., Yu, C., & Wang, Y. (2021). Improved trends of lung cancer mortality-to-incidence ratios in countries with high healthcare expenditure. *Thoracic Cancer, 12*(11), 1656–1661. https://doi.org/10.1111/1759-7714.13912

Thompson, L., Reeder, T., & Abel, G. (2012). 'I can't get my husband to go and have a colonoscopy': Gender and screening for colorectal cancer. *Health: An Interdisciplinary Journal for the Social Study of Health, Illness and Medicine, 16*(3), 235–249. https://doi.org/10.1177/1363459311403948

Torres, Á., Oliver, J., Frecha, C., Montealegre, A. L., Quezada-Urbán, R., Díaz-Velásquez, C. E., Vaca-Paniagua, F., & Perdomo, S. (2017). Cancer Genomic Resources and Present Needs in the Latin American Region. *Public Health Genomics, 20*(3), 194–201. https://doi.org/10.1159/000479291

Wilking, N., Karolinska Institutet, Solna, Sweden, Lopes, G., Sylvester Comprehensive Cancer Center, University of Miami, FL, US, Meier, K., HKK Soltau, Lower Saxony & Heidekreis-Klinikum GmbH, Soltau, Germany, Simoens, S., KU Leuven, Leuven, Belgium, Van Harten, W., University Twente, Enschede, The Netherlands, Rijnstate Hospital, Arnhem, The Netherlands, Vulto, A., & Erasmus University Medical Center, Rotterdam, The Netherlands. (2017). Can we Continue to Afford Access to Cancer Treatment? *European Oncology & Haematology, 13*(02), 114. https://doi.org/10.17925/EOH.2017.13.02.114

Xu, B. (2024). Progress in Therapy of Lung Cancer. *Highlights in Science, Engineering and Technology, 109,* 103–108. https://doi.org/10.54097/wxpa7677

Yu, Z., Li, W., Shangguan, X., Cai, Y., Gao, Q., Wang, X., Chen, Y., Liu, D., & Zhang, C. (2022). Knowledge, Practices, and Perceived Barriers in Cancer Pain Management at Oncology Units: A Cross-Sectional Survey of Medical Staff in China. *Journal of Pain Research, Volume 15,* 159–169. https://doi.org/10.2147/JPR.S339377

Zhu, J., Li, S., Li, X., Wang, L., Du, L., & Qiu, Y. (2024). Impact of population ageing on cancer-related disability-adjusted life years: A global decomposition analysis. *Journal of Global Health, 14,* 04144. https://doi.org/10.7189/jogh.14.04144

Zlatareva, A., Krahtova, K., & Kazak, Tch. (2017). The Cost of Oncology Medicines. *Acta Medica Bulgarica, 44*(1), 22–29. https://doi.org/10.1515/amb-2017-0004