

Economic burden of gastrointestinal cancer: estimation and importance

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Abstract: The economic burden of gastrointestinal (GI) cancer in the world is substantial and expected to increase significantly in the future due to expected growth the incidence rate of GI cancers especially in developing countries and the improvements in survival time and trends in treatment patterns, costs of care following cancer diagnosis and use of expensive technologies and medications. The rising cost of GI cancer treatment poses a significant challenge to health system, government and private insurers, and individual patients. In this paper, we describe how to measure the economic burden of GI cancer and also we discuss the importance of estimating the economic burden of GI cancer.

Keywords: Cost of illness; gastrointestinal (GI) cancer; health care expenditures; economic burden

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Introduction

Each year globally, about 14 million people have realized that they have cancer and eight million people of them die from the cancer. According to the World Health Organization (WHO), the global number of deaths from cancer will increase by nearly 80% by 2030, with most occurring in low- and middle-income countries (1). According to the International Agency for Research on Cancer (IARC), in 2012, approximately 1.4 million individuals were alive with a colorectal cancer (CRC) in the world (10% of all cancer diagnosed), and after the lung cancer (19% of all cancer deaths, 1.6 million people), gastric (9.6% of all cancer death, 0.8 million people) and liver cancers (8.6% of all cancer death, 0.7 million people) are the most common cause of cancer death in the world (2).

Gastrointestinal (GI) cancers are one of the most common cancers in some areas of the world (3) and one of the public health concerns in general (4,5). Despite a major decline in incidence and mortality, gastric cancer (GC) remains an important public health burden worldwide, especially in developing countries (6). GC is the fourth

most common cancer and the second common cause of cancer death (2,7,8). The incidence of GC is particularly high in East Asia, Eastern Europe, and parts of Central and South America (9).

CRC is another important public health problem (10), with an annual one million new cases and an annual half a million death (11). CRC is the second most common cause of cancer mortality (12). CRC contains 10% of the global cancer burden and is the most frequent in North America, Australia, New Zealand and parts of Europe (7,13). According to the American Cancer Society's reports; CRC is the third most common cancer found in men and women in the United States (14). The incidence of CRC in Iran has significantly increased over the last three decades (15,16). The incidence is still lower in older Iranians; however, it is close in young Iranians and Americans (17,18).

Esophageal cancer is the sixth most common cancer in the world, and its incidence is increasing (19). Some three to five males are affected for each female (19) and with a very low rate of survival (18). An "esophageal cancer belt", in which the incidence of esophageal is more than a hundred times that of adjacent areas, extends from northeastern

China through central Asia to northern Iran.

Pancreatic cancer is the fourth and fifth most common cancer in man and women, respectively, and has the lowest 5-year survival rate of any GI cancers (20). Over 250,000 people die annually of pancreatic cancer in the world (21). Developed countries have the highest rate of incidence and mortality due to pancreatic cancer (7). In Iran, pancreatic cancer is not ranked in the top 10 for newly diagnosed cases (22,23). Hepatocellular carcinoma (HCC) is the sixth most common cancer in the world and the third most common cause of cancer mortality (24,25).

In this paper, we describe how to measure the economic burden of GI cancer and also we discuss the importance of estimating the economic burden of GI cancer.

Estimates the economic burden of GI cancer

Economic burden, or cost-of-illness, studies provide insight into the economic impact that illness has on society as well as on individuals and families (26). This approach separates economic burden into disease-attributable direct costs, the use of resources for medical care; and indirect costs, resulting from the loss of resources and opportunities (27). The direct costs are also classified into the following cost categories; direct medical costs and direct non-medical costs (28).

Direct costs

Direct medical costs of GI cancer, are defined as the dollar value of all medical services that patients receive, including; physician visits, diagnostic and confirmatory tests, laboratory tests, hospitalization, surgery, medication, radiation and chemotherapy or immunotherapy, and are typically measured by insurance payments and patient out-of-pocket co-payments.

Direct non-medical costs of GI cancer refer to resources supporting the medical services delivered in the health care sector. For example, travel costs to medical interventions or the valued time spent by patients and their family caregivers in relation to their illness.

Process of direct medical costs estimation is based on four steps; identification of resource consumption, measuring resource consumption, valuation of resource units, calculating total costs of intervention options (29).

In principle, all four steps could be integrated and total costs derived in a single step. However, the four-step process is recommended because executing separate steps is more likely to support comprehensive cost estimations (30).

Indirect costs

Indirect costs of GI cancer are typically divided between morbidity and mortality losses. Time lost from work or other usual activities are defined as morbidity costs, and lost productivity due to premature death defined as mortality costs. These costs are incurred by patients as well as their caregivers and families (27,28). Because these lost opportunities are not typically reflected in dollar value, the value of lost time must be approximated. Two main methods for valuing time are the human capital and the willingness-to-pay (WTP) method.

Morbidity costs

Patient and caregiver time data, including travel to and from care, waiting for and receiving care, are not routinely collected. In the few studies of time costs that have been conducted, time estimates have been based on patterns of medical care use with service specific estimates of time (31) or retrospective surveys with questions about time spent receiving care or providing assistance (32,33), and then combined with human capital or WTP estimates of the value of that time. These time costs vary by the type of cancer (31,33,34), phase of care (31,34), and by stage of disease at diagnosis (33).

Mortality costs

Few studies have assessed the mortality costs associated with premature death from cancer. Mortality costs are the combination of estimates of the future person years of life lost among individuals who die in a specific year with a dollar value of time, yielding an estimate that reflects lost productivity in the future (35).

It is noteworthy that, most of studies in the field of economic burden of disease; estimated direct medical costs (36-38) and only a few studies estimated patient or caregiver time costs or productivity losses (35,39-41). Because most data sources were not developed for research in or developing estimates of the economic burden, and as a result have limitations associated with their use for estimating direct non-medical or indirect costs.

Importance the economic burden of GI cancer

Today, rapid scientific advances in early diagnosis and access to new technologies and medications led to survival

improved for many cancers, including GI cancers (42). This increasing number of cancer survivors will receive medical care during their cancer experiences (43,44). The average cost of treating the most common cancers rise due to increased use of health care services (45,46). The economic burden of cancer are expected to be greater in the future (47,48).

GI cancers and its treatment can cause to loss of economic resources and opportunities for patients, families, employers, and society overall. These losses include financial loss, morbidity, reduced quality of life, reduced work productivity, disability and premature death (49). Estimating and projecting the economic burden of cancer, including health care expenditures, productivity loss, and morbidity for patients and their families, are increasingly important issues for health care policy makers, healthcare systems, physicians, employers, and society overall (50).

In summary, incidence of GI cancers has been increasing in most regions of the world, but there is great difference between rich and poor countries. Incidence rates remain highest in more developed regions, but mortality is much higher in developing countries due to a lack of early detection and access to treatment facilities. And given that in developed countries the number of GI cancer survivors increased due to access treatment facilities so, is expected to increase direct medical costs in this region. While in developing countries morbidity and mortality costs are high.

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References

1. Cancer Prevention and Control, the World Health Organization, World Cancer Day. 2014. Available online: www.who.int/cancer/modules/en/
2. International Agency for Research on Cancer (IARC). Latest world cancer statistics 2013. Available online: <http://www.cdc.gov/cancer/dcpc/resources/features/WorldCancerDay/>
3. Kelsen D, Kernscoff E, Bernard L, et al. eds. Principles and practice of gastrointestinal oncology. ed. 2. Philadelphia: Wolters Kluwer and Lippincott Williams and Wilkins, 2008.
4. Hassanzade J, Molavi e vardanjani H, Farahmand M, et al. Incidence and Mortality Rate of Common Gastrointestinal Cancers in South of Iran, a Population Based Study. Iran J Cancer Prev 2011;4:163-9.
5. Aman U, Buzdar R. eds. Gastrointestinal Cancer. Springer Science + Business Media, 2005.
6. Brenner H, Rothenbacher D, Arndt V. Epidemiology of stomach cancer. Methods Mol Biol 2009;472:467-77.
7. Herszényi L, Tulassay Z. Epidemiology of gastrointestinal and liver tumors. Eur Rev Med Pharmacol Sci 2010;14:249-58.
8. The Global Economic Cost Of Cancer. American Cancer Society, Inc. 2010: No.005444.
9. Parkin DM, Bray FI, Devesa SS. Cancer burden in the year 2000. The global picture. Eur J Cancer 2001;37 Suppl 8:S4-66.
10. Boyle P, Langman JS. ABC of colorectal cancer: Epidemiology. BMJ 2000;321:805-8.
11. Sonnenberg A, Delcò F, Inadomi JM. Cost-effectiveness of colonoscopy in screening for colorectal cancer. Ann Intern Med 2000;133:573-84.
12. World Health Organization. Cancer incidence in five continents. Lyon: IARC Press, IARC Scientific Publication, 2002.
13. Hagggar FA, Boushey RP. Colorectal cancer epidemiology: incidence, mortality, survival, and risk factors. Clin Colon Rectal Surg 2009;22:191-7.
14. American Cancer Society, Inc. Colorectal Cancer Overview. 2014.
15. Hosseini SV, Izadpanah A, Yarmohammadi H. Epidemiological changes in colorectal cancer in Shiraz, Iran: 1980-2000. ANZ J Surg 2004;74:547-9.
16. Center for Disease Control and Prevention, Noncommunicable Deputy Cancer Office. Iranian Annual National Cancer Registration Report 2005 – 2006 [in Persian]. Tehran (Iran): Ministry of Health and Medical Education; 2007.
17. Moradi A, Khayamzadeh M, Guya M, et al. Survival of colorectal cancer in Iran. Asian Pac J Cancer Prev 2009;10:583-6.
18. Pourhoseingholi MA, Fazeli Z, Ashtari S, et al. Mortality trends of gastrointestinal cancers in Iranian population. Gastroenterol Hepatol Bed Bench 2013;6:S52-7.
19. Yang S, Wu S, Huang Y, et al. Screening for oesophageal cancer. Cochrane Database Syst Rev 2012;12:CD007883.
20. Lowenfels AB, Maisonneuve P. Risk factors for pancreatic cancer. J Cell Biochem 2005;95:649-56.
21. Hart AR, Kennedy H, Harvey I. Pancreatic cancer: a review of the evidence on causation. Clin Gastroenterol Hepatol 2008;6:275-82.
22. Iranian Annual of National Cancer Registration Report.

- Tehran: Ministry of Health and Medical Education, Center for Disease Control & Prevention, Noncommunicable Deputy, Cancer Office, 2008.
23. Pourhoseingholi MA, Pourhoseingholi A, Vahedi M, et al. Decreased trend of pancreatic cancer mortality in Iran. *Asian Pac J Cancer Prev* 2011;12:153-5.
 24. Franceschi S, Raza SA. Epidemiology and prevention of hepatocellular carcinoma. *Cancer Lett* 2009;286:5-8.
 25. Schütte K, Bornschein J, Malfertheiner P. Hepatocellular carcinoma--epidemiological trends and risk factors. *Dig Dis* 2009;27:80-92.
 26. Sullivan SD, Ramsey SD, Lee TA. The economic burden of COPD. *Chest* 2000;117:5S-9S.
 27. Drummond MF, Sculpher MJ, Torrance GW, et al. eds. *Methods for the economic evaluation of health care programmes*. Oxford: Oxford University Press, 2005.
 28. Kobelt G. eds. *Health economics: an introduction to economic evaluation*. London: Office of Health Economics, 2002.
 29. Center for Disease Control and Prevention. Cost analysis: Introduction/CDC Econ Eval Tutorials. Available online: <http://www.cdc.gov/owcd/eet/Cost/3.html>
 30. Luce BR, Manning WG, Siegel JE, et al. Estimating costs in cost-effectiveness analysis. In: Gold MR, Russell LB, Siegel JE, Weinstein MC. eds. *Cost-effectiveness in health and medicine*. New York: Oxford University Press, 1996:176-213.
 31. Yabroff KR, Davis WW, Lamont EB, et al. Patient time costs associated with cancer care. *J Natl Cancer Inst* 2007;99:14-23.
 32. Stommel M, Given CW, Given BA. The cost of cancer home care to families. *Cancer* 1993;71:1867-74.
 33. Yabroff KR, Kim Y. Time costs associated with informal caregiving for cancer survivors. *Cancer* 2009;115:4362-73.
 34. Van Houtven CH, Ramsey SD, Hornbrook MC, et al. Economic burden for informal caregivers of lung and colorectal cancer patients. *Oncologist* 2010;15:883-93.
 35. Bradley CJ, Yabroff KR, Dahman B, et al. Productivity costs of cancer mortality in the United States: 2000-2020. *J Natl Cancer Inst* 2008;100:1763-70.
 36. Ashtari S, Vahedi M, Pourhoseingholi MA, et al. Estimation of average diagnosis and treatment costs of hepatitis C. *Gastroenterol Hepatol Bed Bench* 2012;5:139-45.
 37. Ghamar Chehreh ME, Vahedi M, Pourhoseingholi MA, et al. Estimation of diagnosis and treatment costs of non-alcoholic fatty liver disease: a two-year observation. *Hepat Mon* 2013;13:e7382.
 38. Ashtari S, Vahedi M, Pourhoseingholi MA, et al. Direct medical care costs associated with patients diagnosed with chronic HCV. *Hepat Mon* 2013;13:e8415.
 39. Ekwueme DU, Chesson HW, Zhang KB, et al. Years of potential life lost and productivity costs because of cancer mortality and for specific cancer sites where human papillomavirus may be a risk factor for carcinogenesis--United States, 2003. *Cancer* 2008;113:2936-45.
 40. Yabroff KR, Bradley CJ, Mariotto AB, et al. Estimates and projections of value of life lost from cancer deaths in the United States. *J Natl Cancer Inst* 2008;100:1755-62.
 41. Li C, Ekwueme DU, Rim SH, et al. Years of potential life lost and productivity losses from male urogenital cancer deaths--United States, 2004. *Urology* 2010;76:528-35.
 42. Mariotto AB, Yabroff KR, Shao Y, et al. Projections of the cost of cancer care in the United States: 2010-2020. *J Natl Cancer Inst* 2011;103:117-28.
 43. Tangka FK, Trogdon JG, Richardson LC, et al. Cancer treatment cost in the United States: has the burden shifted over time? *Cancer* 2010;116:3477-84.
 44. Elkin EB, Bach PB. Cancer's next frontier: addressing high and increasing costs. *JAMA* 2010;303:1086-7.
 45. Warren JL, Yabroff KR, Meekins A, et al. Evaluation of trends in the cost of initial cancer treatment. *J Natl Cancer Inst* 2008;100:888-97.
 46. Dinan MA, Curtis LH, Hammill BG, et al. Changes in the use and costs of diagnostic imaging among Medicare beneficiaries with cancer, 1999-2006. *JAMA* 2010;303:1625-31.
 47. Wong YN, Meropol NJ, Speier W, et al. Cost implications of new treatments for advanced colorectal cancer. *Cancer* 2009;115:2081-91.
 48. Howard DH, Kauh J, Lipscomb J. The value of new chemotherapeutic agents for metastatic colorectal cancer. *Arch Intern Med* 2010;170:537-42.
 49. Yabroff KR, Lawrence WF, Clauser S, et al. Burden of illness in cancer survivors: findings from a population-based national sample. *J Natl Cancer Inst* 2004;96:1322-30.
 50. Yabroff KR, Lund J, Kepka D, et al. Economic burden of cancer in the United States: estimates, projections, and future research. *Cancer Epidemiol Biomarkers Prev* 2011;20:2006-14.

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