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The global cancer burden

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Abstract

In 2018 cancer remained the second leading cause of death, responsible for an estimated 9.6 million deaths, an increase in the last decade of approximately 25.4%. Premature cancer deaths increased by 19.6% and cancer morbidity by 40.6%. While these trends vary between and within countries and by cancer type, some challenges are shared globally, which include population ageing, the need for increased preventative action and affording cancer care.

Between 2007 and 2017 population ageing accounted for over half the global increase in cancer mortality; demographic shift in low-middle income countries will intensify this burden. Prevention is regarded as the most cost-effective long-term cancer control strategy; advances have been seen for some cancers most associated with behavioural and infectious origins. Meanwhile, economic development and pressures on modern lifestyle increase the threat posed by cancer risks such as obesity in all economic contexts; there is also a need to improve techniques for early cancer diagnosis. While some countries struggle to afford basic preventative action and adequate screening programmes, high income countries are exploring more specialised cancer treatments; many have been found to have a limited impact on survival and quality of life. There may be further potential of low-cost impactful strategies using affordable pharmaceutical agents such as aspirin.

Given the time-lag for prevention efforts to be realised in cancer incidence and the hazard posed by population ageing to the global burden of cancer, improved intelligence is required to effectively distribute resources across cancer programmes that stem the flow of need.

Introduction

In 2018 there were an estimated 18.1 million new cancer cases globally and cancer remained the second leading cause of death, responsible for an estimated 9.6 million deaths [1,2]. In the last decade there have been increases in the number of cancer deaths (25.4% range: 23.9 to 27.0) and premature cancer deaths, measured as years of life lost (YLL) (19.6% range: 17.8 to 21.4) [3]. Cancer morbidity increased, in part due to improved survival; 43.8 million people were living five years post cancer diagnosis [2]. The associated health burden, measured as years lived with a disability (YLD), increased by 40.6% (38.3 to 43.2) since 2007 [4]. While there is some variation in these trends between and within countries and by cancer type [3,4], a few major challenges are shared globally.

Major challenges

Population ageing

Between 2007 and 2017 population ageing accounted for over half the global increase in cancer mortality, with a smaller contribution due to population growth, while cause-specific mortality reduced in this period [3]. Age standardised death rates for cancer mortality have decreased by 4.4% (-5.6 to -3.3) and age standardised premature mortality by 5.6% (-7.0 to -4.1) since 2007. It is positive that after adjusting for changes in global population age patterns there has been a reduction in cancer mortality; although increased survival has increased prevalence and ill health. Table 1 shows these changes for the leading causes of cancer death globally.

Socioeconomic development impacts on population ageing and partly through this, changes in the composition of cancer incidence by country [3]. The cancer burden in lower socio-demographic index (SDI) countries is rapidly increasing and although the odds of developing cancer are still highest in countries with higher SDI for most cancers, survival is lower in most low-medium SDI countries [2,3]. As the demographic of lower SDI countries shifts to the ageing population profile seen in higher SDI countries, there is likely to be an additional burden of disease on healthcare systems and an increase in premature mortality should those systems be ill equipped to catch up with need. Adding to this burden is the cancer incidence associated with preventable risk factors such as obesity, more typically seen in high SDI countries, now growing in low-medium SDI countries with rapidly growing economies [2].

Preventable causes

The WHO estimate that 30-50% of cancer cases could be prevented and highlight that this is the most cost-effective long-term cancer control strategy [5]. Prevention efforts are mainly concerned with reducing exposures to carcinogenic infections and 'industrial lifestyle' factors (Industrial lifestyle risks are behavioural risk factors associated with lifestyles (e.g. diet, physical activity patterns) in high income, developed economies such as those seen in Western Europe and North America). In 2012, 36.6% of cancer cases in high /very high

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Table 1. Global age standardised cancer death rates by cause, percentage change 2007 to 2017.

Cancer	Age standardised death rate (per 100,000)	% change in age standardised death rate	Direction of change	% change in YLD age standardised rates	Direction of change
Tracheal, bronchus, lung (TBL)	23.7 (23.3 to 24.2)	-2 (-4.3 to 0.1)	↔	7.2 (3.9 to 10.4)	↑
Colorectal	11.5 (11.3 to 11.8)	-4.3 (-7.1 to -1.8)	↓	6.0 (3.1 to 9.0)	↑
Stomach	11 (10.8 to 11.2)	-17.1 (-18.8 to -15.1)	↓	1.2 (−2.3 to 5.0)	↔
Liver	10.2 (9.8 to 10.7)	-2.5 (-5.6 to 2)	↔	8.1 (3.8 to 13.7)	↑
Breast	7.6 (7.4 to 7.8)	-2.6 (-6.9 to 0.4)	↔	4.5 (0.7 to 7.5)	↑
Pancreatic	5.6 (5.5 to 5.7)	4.8 (2.5 to 6.8)	↑	4.7 (1.8 to 7.6)	↑
Prostate	5.5 (4.7 to 6.5)	-2.5 (-4.9 to 1.9)	↔	5.6 (2.1 to 13.2)	↑
Oesophageal	5.5 (5.3 to 5.6)	-14.5 (-16.9 to -12)	↓	-9.1 (-12.6 to -5.4)	↓
Leukaemia	4.5 (4.1 to 4.7)	-9.6 (-12.2 to -7.4)	↓	2.3 (−2.3 to 6.5)	↔
Cervical	3.2 (3 to 3.3)	-7.2 (-11.7 to -4)	↓	−1.7 (−6.8 to 1.8)	↔
Non-Hodgkin lymphoma	3.2 (3.1 to 3.2)	0.1% (-2.7 to 2.4)	↔	11.3 (8.2 to 14.2)	↑

(Adapted from the Global Burden of Disease study; addition includes 'direction of change' column and combining data from the following articles) [27,28].

HDI (Measured using the Human Development Index (HDI), which was developed by the UN and is formed from data on life expectancy, average duration of education by age 25 and gross national income per capita) countries were associated with industrialised lifestyle factors and 9.6% to infections; while for low-medium HDI countries, 20.3% of cases were associated with lifestyle and 25% with infection related causes [6]. Prioritisation of resource towards all prevention themes is required, even if the focus varies by a country's socio-economic development and associated health need. Lung, female breast, and colorectal cancers account for most cancer incidence globally [2]; while they are not the most prevalent cancers among low-resource and some transition economies, incidence is increasing rapidly in these settings [6]. There is a time lag between prevention and impacts on incidence; for example, a lag of 20 to 30 years has been observed between smoking prevalence and lung cancer [7]. The benefits of tobacco control efforts over several decades are only now being seen in reduced lung cancer incidence among men in Northern Europe and North America [8].

Around one third of deaths from cancer are due to five leading behavioural / behaviour related risks; high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use, and alcohol use [9]. A key benefit of intervention to address behavioural risk factors is that doing so reduces the risk for many cancers and has advantages for other non-communicable disease outcomes. For instance, alcohol was attributed to 4.2% of cancer deaths in 2010 and although its main impact was on mouth cancer among men, where it was attributed to 37% of deaths, it was attributed to cancer deaths and morbidity for over eight types of cancer [6]. Projections for obesity and overweight prevalence are a concern; in 2013 13% of the world's population aged 18 and over was obese and 39% were overweight [9]. Between 1975 and 2016 obesity prevalence tripled, with increases observed in all global regions; in Africa there has been almost a 50 percent increase in the number of overweight children under 5 since 2000 [9]. Cancer mortality (all sites combined) increases in a linear fashion with increasing body mass index and is about 70% higher in people who are extremely obese than in people of normal weight [6]. The attributable risk of obesity for cancer incidence varies by cancer type and country but already the increased obesity prevalence in low-middle SDI countries is impacting on the cancer burden and it is a major risk factor for many cancers in high SDI countries [10]. New aetiological links between obesity and cancer are still being identified; for instance, the most recent Global Burden of Disease report identified a 42.3% increase in deaths due to non-alcoholic fatty liver disease (NASH) related liver cancer. Chronic insulin resistance secondary to obesity is mostly commonly the cause of NASH, which is estimated to be present among 10–35% of the global adult population and may pose an increasing future disease burden [3].

Reducing the impact of infections remains a priority in cancer prevention globally; infectious agents account for 100% of the population attributable fraction for cervical cancer and 77% for liver cancer [6]. In some countries, vaccine preventable cancers are the leading cause of cancer incidence and mortality. For instance, cervical cancer is the most common cancer in parts of Africa, South America and Asia and for mortality in parts of Africa and South and Central America [10]. Significant progress has been made for other cancers of mainly infectious origin; table one shows the large reduction in stomach cancer mortality (-17.1%) in the last decade; this is mostly due to improved food hygiene and water sanitation that has reduced infection with Helicobacter pylori, which almost 90% of cases of non-cardia gastric cancer are attributed to (6).

Cancer prevention programmes that seek to reduce exposure to these risk factors, whether behavioural, infectious or environmental in origin are an important platform from which to address cancer burden. It is not possible to eliminate exposure though and a proportion of cancer is not attributable to such preventable hazards. Early detection of cancer therefore continues to be a vital preventative intervention. The WHO highlight that early diagnosis is particularly relevant for cancers of the breast, cervix, mouth, larynx, colon and rectum, and skin. For instance, data in England suggests up to 99% of women may survive breast cancer for five years or more if diagnosed at stage I, compared to 15% if diagnosed at the most advanced stage [11]. Even where factors such as rapid progression and asymptomatic presentation in early stages limit the efficacy of current diagnostic methods, early identification can improve survival. Staying with our example in England, survival rates of 35% at five years for lung cancer have been observed where detected at stage I, compared to 6% for stage III (survival data to five years for later stages is not available since prognosis is so poor) [12]. Although the

impact is much lower than for other cancers, new methods of diagnosis are being explored and may reduce the burden of disease created by such cancers [13].

Methods for supporting early identification include improving public awareness, case finding and screening. Not all cancers are suitable for population screening programmes and not all cancer screening programmes are suitable for all countries. Cancer screening programme success is dependent on three common principles; there needs to be an available test procedure that is acceptable, safe, and relatively inexpensive; the cancer should be one that is associated with high morbidity and mortality in that area; and funding for effective screening, diagnosis and treatment needs to be available [14]. The WHO advocate breast and cervical screening but highlight the need for further evidence of effectiveness in other cancers. Cochrane have published a series of reviews of cancer screening, which highlight concerns regarding appropriate follow up periods of studies to measure cause specific and all cause impacts on survival and quality of life outcomes, the risk of overdiagnosis, overtreatment and the harms associated with this [15-18]. Also, as public awareness of cancer symptoms increases, the additional benefit screening programmes confer may reduce. Relevant decision-making bodies in each country are best placed to consider the current evidence in their local context and make decisions on the value of the impact cancer screening programmes may have. Whether through screening or case finding, early detection should remain a priority in programmes seeking to reduce the burden of cancer.

Affording cancer care

In 2017, less than a third of low-income countries had cancer treatment services in place (30%) and just over one quarter reported having pathology services available in the public sector (26%) [1]. Few low- or middle-income countries had data systems in place to inform cancer policy and yet it is estimated that 70% of cancer deaths occur in these countries [1,5].

In high income countries, 90% of which have treatment services in place, the range of treatment options available is expanding and becoming more 'personalised' or 'targeted' [19]. While traditional cancer treatments such as surgery, radiotherapy and chemotherapy have been effective, many high-income countries are now observing slowing in declines of cancer deaths [3]. There are several strategies available to address this; reduce incidence through preventative interventions; enhance quality of care and early diagnosis; specialise treatments to target specific cancers in specific patients. This latter strategy is being pursued by many high-income countries, where resources and mechanisms are being directed to improve access to these novel therapies, for example the Cancer Drugs Fund in the UK and The Cancer Genome Atlas Program in the US. There is evidence to suggest that most of these new drugs have limited efficacy on quality of life or survival [20]; although this may not be true for all and it will take time for adequate follow up periods to fully assess outcomes such as survival, this raises questions about human and economic costs. While scarce resources are directed to fund an increasing array of new treatments, which may raise patient expectations of improved outcomes, there is still much room for improvement in the quality and equity of well-established methods. There are some new developments that suggest low cost impactful strategies that could be tested in populations. In this regard chemoprevention strategies using affordable pharmaceutical agents such as aspirin and acid suppression, are making potential progress in patients with Barrett's esophagus (predisposes to esophageal adenocarcinoma) [21-25].

Conclusions

There continue to be advances in knowledge regarding the aetiology, identification, treatment and management of cancer. The benefits from this have not been felt globally and are mainly seen in changes to mortality rather than incidence; there is still greater scope to reduce cancer incidence and mortality through prevention. This is a particularly pertinent point given that population ageing is driving a large proportion of the cancer burden and as such, efforts to delay onset and identify cancers early may help to stem the flow of cancer healthcare needs. The IARC are leading work on international cancer survival benchmarking, which will explore the role of lifetime exposure to modifiable risk factors such as obesity and the role of health care system intervention and structures on cancer survival [26]. An informed approach to prioritisation of resources is much needed at this time of rapid technological advancement in understanding cancer and sustainable methods to treat it. Such an approach must also effectively assess the value of prevention and current care options compared to these novel treatments to ensure the greatest human benefit.

Authorship

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