When Cancer Grows Old: Assessing the Socio-economic Burden of Cancer and Ageing and the Policies Required

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Contents

Foreword

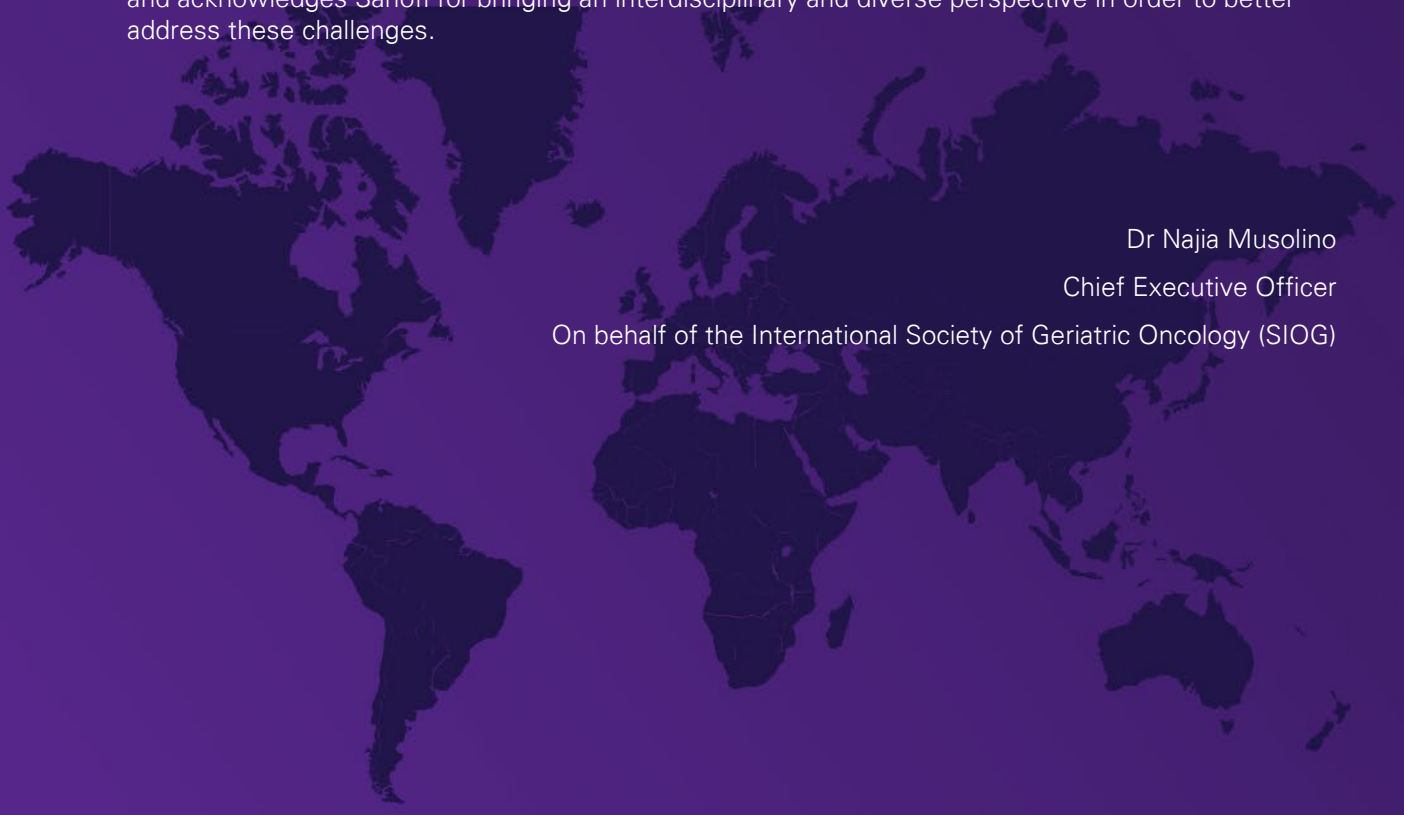
With improvements in health care, life expectancy around the world is substantially longer now than it was 50 years ago. From 2010 to 2030, it is predicted that life expectancy will further increase by 3.7 years on average. Countries must be prepared for their ageing societies.

Age is a well-recognized risk factor for cancer, resulting in a potential rise in the number of people diagnosed with cancer. People over the age of 65 represent the majority of cancer diagnosis and cancer deaths. There is a significant need to prepare for this growing public health challenge. More must be achieved in this area, in order ensure a comprehensive approach to the needs of older cancer patients and survivors.

Advances in technology and treatment modalities bring new hope. However, older cancer patients often have significant comorbidities leading clinicians to choose less intensive therapies. These challenges are daunting, but countries are stepping up to the challenges. The provision of equitable, affordable healthcare, enhanced availability of age-friendly services, access to essential medicines and palliative care have become an urgent matter for the health systems worldwide. In addition, there are important aspects of ageing that must be addressed through public health policies such as cancer prevention, and health promotion.

The United Nations' Universal Health Coverage and the Decade of Healthy Ageing (2021-2030) document provides the foundation to address the issues related to cancer in the ageing population. However, more still needs to be done to address other problems such as adequate treatment, equity and financial protection. The World Health Organization assures that it is committed to the fight against the rising tide of cancer as it continues to work with countries to shift policies and practices to better reflect older people's needs.

The International Society of Geriatric Oncology commends all the stakeholders involved in this study and acknowledges Sanofi for bringing an interdisciplinary and diverse perspective in order to better address these challenges.



Dr Najia Musolino

Chief Executive Officer

On behalf of the International Society of Geriatric Oncology (SIOG)

1 Executive Summary

Cancer is the second most common non-communicable disease plaguing the world, and the elderly contribute significantly to the incidence of this disease. As people generally live longer than before, many countries are facing ageing populations. The trend is likely to continue - statistics show that the global proportion of people above 60 years old is likely to almost double from 12% today to 22% by 2050.[1] As populations age, their risk of developing cancer increases.[2] Research has found that the elderly (defined as people aged 65 years and above) are 11 times more likely to develop cancer, compared to younger people.[3] These trends are also largely consistent in the US, China and EU4 and UK (specific country snapshots can be found in Appendix 1).

While there is a greater awareness of ageing and cancer, one little explored aspect is the quantitative socio-economic burden of cancer among the elderly.

Key measures of cancer's economic toll are Disability-Adjusted Life Years (DALYs) and the burden it places on caregivers. DALY for a disease or health condition is the sum of the years of life lost to due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population. The total economic impact from the DALYs in China, EU4 (France, Germany, Spain, Italy) and UK and US were 1%-2% of their respective gross domestic products (GDPs) in 2020, and this is expected to rise to ~3% by 2040, resulting in significant economic losses.

In addition, informal caregivers usually play an important role in providing the necessary emotional, financial, and personal care support for individuals with cancer. Such support keeps them away from work, resulting in economic losses: From US$20 billion in China to US$83 billion in EU4 and UK over a 2-year period.

These figures do not include the direct medical costs of cancer, which are significant and will further strain healthcare systems around the world. But while some world leaders have recognized the importance of addressing the intersection of cancer and ageing – resulting in many global initiatives, such as the UN Decade of Healthy Ageing (2021-2030) - more needs to be done, especially since the COVID-19 pandemic has disproportionately impacted older individuals and those with cancer. COVID-19 is affecting the whole world, but elderly individuals with cancer are among the highest risk groups. Older patients may develop more severe complications from COVID-19 and in some cases, it may impact their ability to receive treatment for cancer.

National Cancer Control Plans (NCCPs) are a case in point. They are comprehensive cancer prevention and control initiatives to address the national cancer burden. While they certainly help to alleviate the problem, many are insufficient. We have identified three key gaps that remain in NCCPs - insufficient use of geriatric assessments in clinical practice, the lack of geriatric training among oncologists, and under-representation of older patients in cancer trials.

Accordingly, this paper also provides detailed recommendations in attempt to alleviate the burden of cancer among the elderly. Firstly, it is critical to provide relevant education and training in geriatric practice to oncology practitioners given the complexities of geriatric care and management of care in older adults with cancer. The evidence base for treatments for older individuals with cancer through

[1] World Health Organization. Ageing and health. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health. Published February 8, 2018. Accessed August 31, 2021

[2] Cancer Research UK. Age: the biggest cancer risk factor. https://scienceblog.cancerresearchuk.org/2018/06/20/age-the-biggest-cancer-risk-factor/. Accessed August 31, 2021.

[3] Ilene Browner, "Applications in Geriatric Oncology", *John Hopkins Medicine: Geriatric Workforce Enhancement Programme*, [accessed August 31st, 2021]. https://www.hopkinsmedicine.org/gec/series/cancer_aging.html

clinical trials also needs to be enhanced, as there is currently a huge gap in terms of the understanding of cancer in elderly patients due to lack of participation in clinical trials.

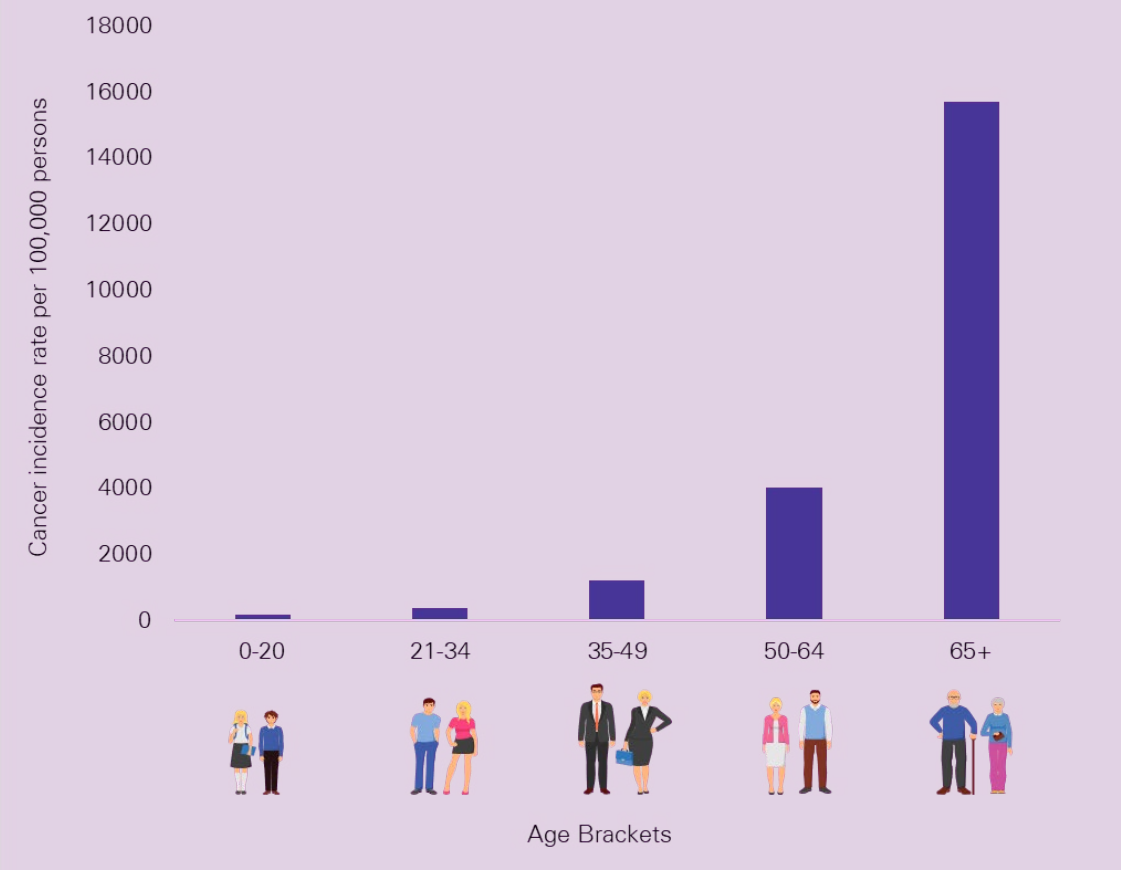
Cancer among the elderly is a health burden that will continue to grow over the next two decades, and policies aimed at addressing this are urgently needed to minimise the socio-economic burden.

2 Introduction

As life expectancy increases globally, many countries around the world are grappling with ageing populations. The trend is likely to continue - statistics show that the global proportion of people more than 60 years old is likely to almost double from 12% in 2015 to 22% by 2050.[4] As populations age, their risk of developing cancer increases.[5] Research has found that the elderly (people aged 65 years old and above) are 11 times more likely to develop cancer, compared to younger people.[6]

As demonstrated in Figure 1, the elderly already account for a disproportionately higher share of total cancer incidence in the world.

Figure 1. Cancer Incidence in the World by Age Groups, 2013-2017



Source: National Cancer Institute [7]

[4] World Health Organization. Ageing and health. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health. Published February 8, 2018. Accessed August 31, 2021

[5] Cancer Research UK. Age: the biggest cancer risk factor. https://scienceblog.cancerresearchuk.org/2018/06/20/age-the-biggest-cancer-risk-factor/. Accessed August 31, 2021.

[6] Ilene Browner, "Applications in Geriatric Oncology", *John Hopkins Medicine: Geriatric Workforce Enhancement Programme*, [accessed August 31st, 2021]. https://www.hopkinsmedicine.org/gec/series/cancer_aging.html

[7] SEER 21 2013–2017. https://www.cancer.gov/about-cancer/causes-prevention/risk/age

Cancer in older people is a health burden that will grow significantly by 2040, driven by both increasing incidence and a rapidly ageing population. According to World Bank estimates for China, EU4 and UK and the US, the number of people aged 65 years and above is expected to almost double in the next two decades (Figure 2). The number of new cancer cases in people aged 65 years and above will also see a substantial increase over the same period (Figure 3).

> "The cancer burden continues to grow globally, exerting tremendous physical, emotional and financial strain on individuals, families, communities and health systems."
>
> **– World Health Organisation** [8]

Figure 2

Estimates for Population Aged 65 and Above

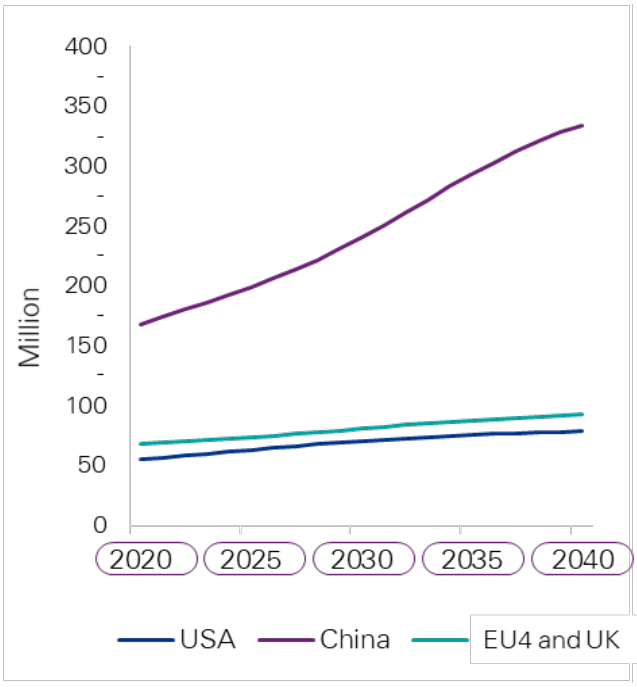
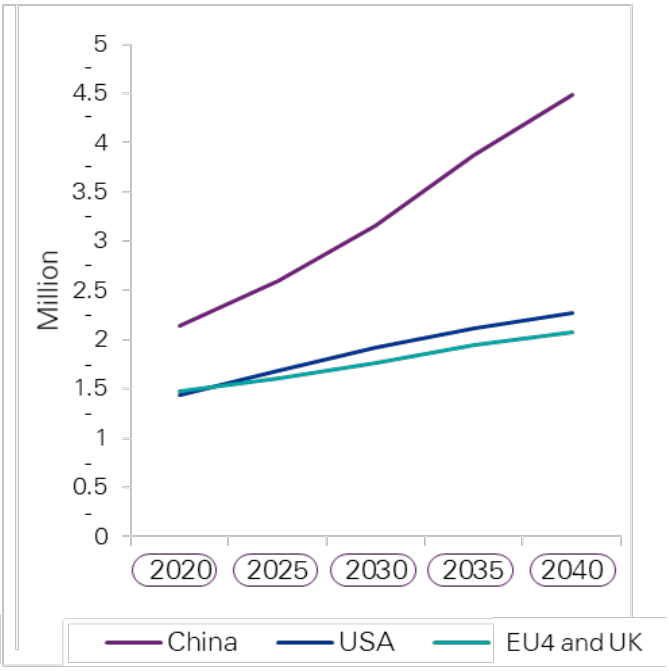


Figure 3

New Cancer Cases for Population Aged 65 Years and Above



Source: World Bank estimates [9]; WHO Global Cancer Observatory: Cancer Tomorrow [10] (as of January 2022)

On a positive note, world leaders have recognized the importance of addressing the intersection of cancer and ageing, resulting in the establishment of many global initiatives, such as the UN Decade of Healthy Ageing (2021-2030) Program. More needs to be done, especially since efforts to deal with the COVID-19 pandemic has taken the spotlight while focus on the treatment of other health conditions has reduced.

[8] https://www.who.int/health-topics/cancer#tab=tab_1

[9] https://databank.worldbank.org/source/population-estimates-and-projections

[10] https://gco.iarc.fr/tomorrow/en/dataviz/isotype?populations=840&single_unit=500000&age_start=13

This paper looks at the estimated burden of cancer among the elderly over the next two decades and examines socio-economic impact, including existing gaps in policies and investments relating to age-inclusive cancer plans. The paper concludes by identifying some recommendations to local healthcare systems that can eventually provide significant economic benefits.

The data confirms that the incidence of cancer among elderly patients prevents economic productivity, including among informal caregivers who provide the necessary emotional, financial, and personal support to elderly patients. It is important to also assess the caregiver burden in addition to the direct burden attributable to the individuals with cancer themselves.

Any assessment of the cancer burden is incomplete without analysing what is being done to address the challenge of the growing incidence of cancer among the elderly population. In 2017, the World Health Assembly resolution recommended that countries develop National Cancer Control Plans (NCCPs), to guide cancer prevention and control activities undertaken in a country to address the national cancer burden. Well-structured and clearly articulated NCCPs are crucial to helping health systems address the cancer burden. Hence, identifying the gaps in NCCPs and what actions can be taken to address them is a crucial part of the analysis.

3 Cancer among the elderly is a growing health burden

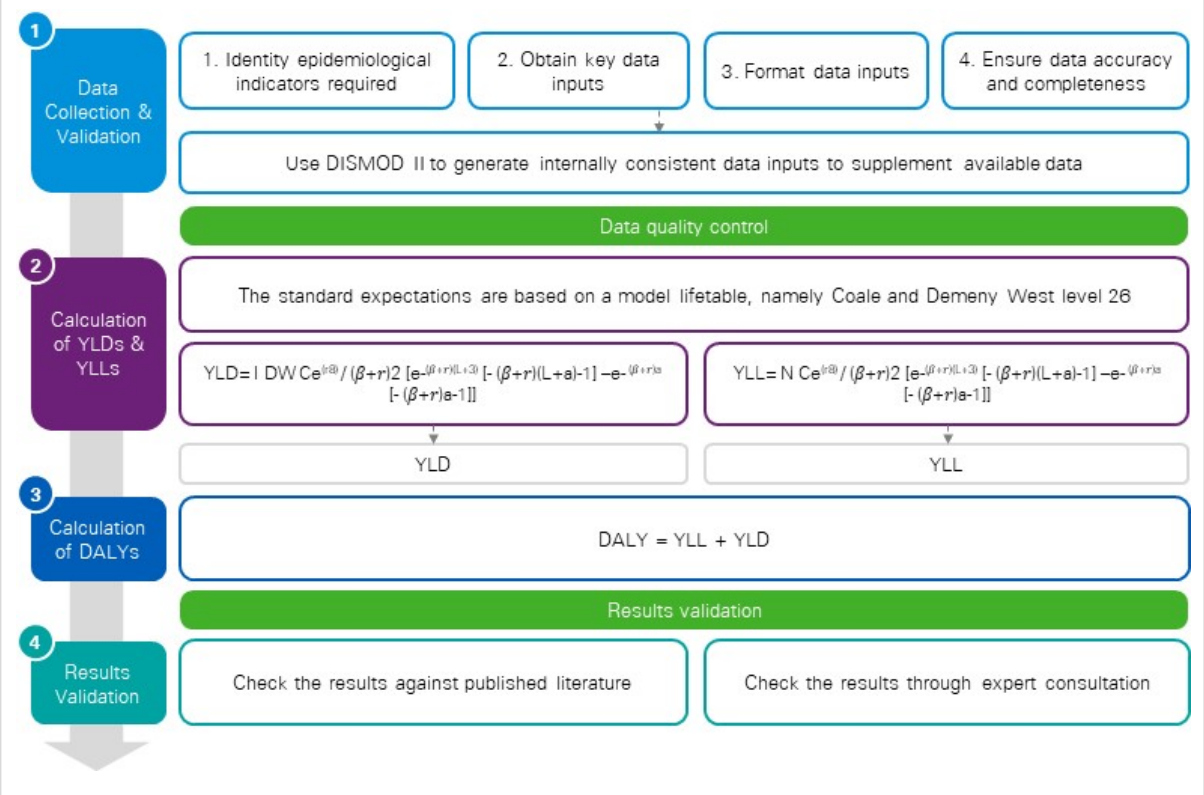
3.1 Methodology to estimate the socio-economic cost of cancer among the elderly

An important measure of health burden is Disability-Adjusted Life Years (DALYs) with "One DALY" equalling the loss of a year of "healthy life". The DALY is used to measure the burden of a disease, considering both time lost due to premature mortality and non-fatal disability conditions. This measure has been used in The Global Burden of Disease and Injury (GBD) study [11], a joint study between the World Bank, the World Health Organization (WHO), and Harvard School of Public Health.

The economic burden can be derived from the health burden by attributing a monetary value to each computed DALY. It is important to note that this does not include direct medical costs, which would further increase the cancer burden.

The methodology to derive the health burden is illustrated below.

Figure 4*: Methodology for estimating the health burden of cancer in older people



Source: WHO 2003 [12], KPMG analysis.

[11] *Murray and Lopez (1996); Mathers CD, Vos T, Lopez AD, Salomon J, Ezzati M (ed.) 2001. National Burden of Disease Studies: A Practical Guide. Edition 2.0. Global Program on Evidence for Health Policy. Geneva: World Health Organization.*

[12] https://www.who.int/quantifying_ehimpacts/publications/en/9241546204chap3.pdf

*Further details of the methodology can be found in Appendix 2 of this paper

The basic formula for DALY is: **DALY = YLL + YLD**

Assuming zero discounting and uniform age weights, the basic formula for YLL is:

YLL = N x L

Similarly, the basic formula for calculating YLD is:

YLD = I x DW x L

(Detailed explanation on DALY calculations can be found in Appendix 2)

Key DALY parameters used in modelling:

0	Discount rate (r)
0.04	Beta (b)
0.1658	Constant (C)
-0.04	-(b+r)
0	K -- K=0 (no age weights) to 1 (full age weights)

We identified the top 10 cancers, which contributed to 80% of total cancer DALYs among the ageing population, from 1990-2019. For modelling purposes, we will focus on the top 10 cancers in our targeted countries among people aged 65 years and above (detailed list of top 10 cancers can be found in Appendix 2).

We collected demographics, incidence, and mortality data for the targeted geographies and for each of 10 cancer types in 2020, 2030, and 2040.

All data collected are stratified by age and sex. The age categories chosen for calculation of DALYs in the current study are:

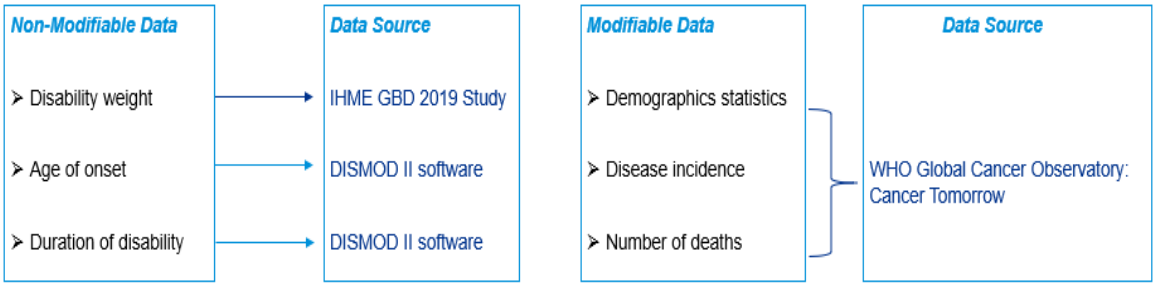
0–4, 5–9, 10–14, 15-19, 20-24 ……, 80–84, 85+

Data collected is often limited by time and geographical area. Some of the data inputs are often unavailable in disease registries and routine databases.

A disease modelling software, DISMOD II, allows us to relate available data to unknown variables (onset age and duration of disability), and generate internally consistent estimates.

We assume that statistics such as disability weight, age of onset of a disease, and duration of disability are relatively constant across countries, and across the years. US data on prevalence, incidence and mortality is complete and is used to project age of onset and duration of disability for each of the 10 cancer types.

Non-modifiable data and modifiable data used in the modelling:



3.2 Health burden of cancer among the elderly

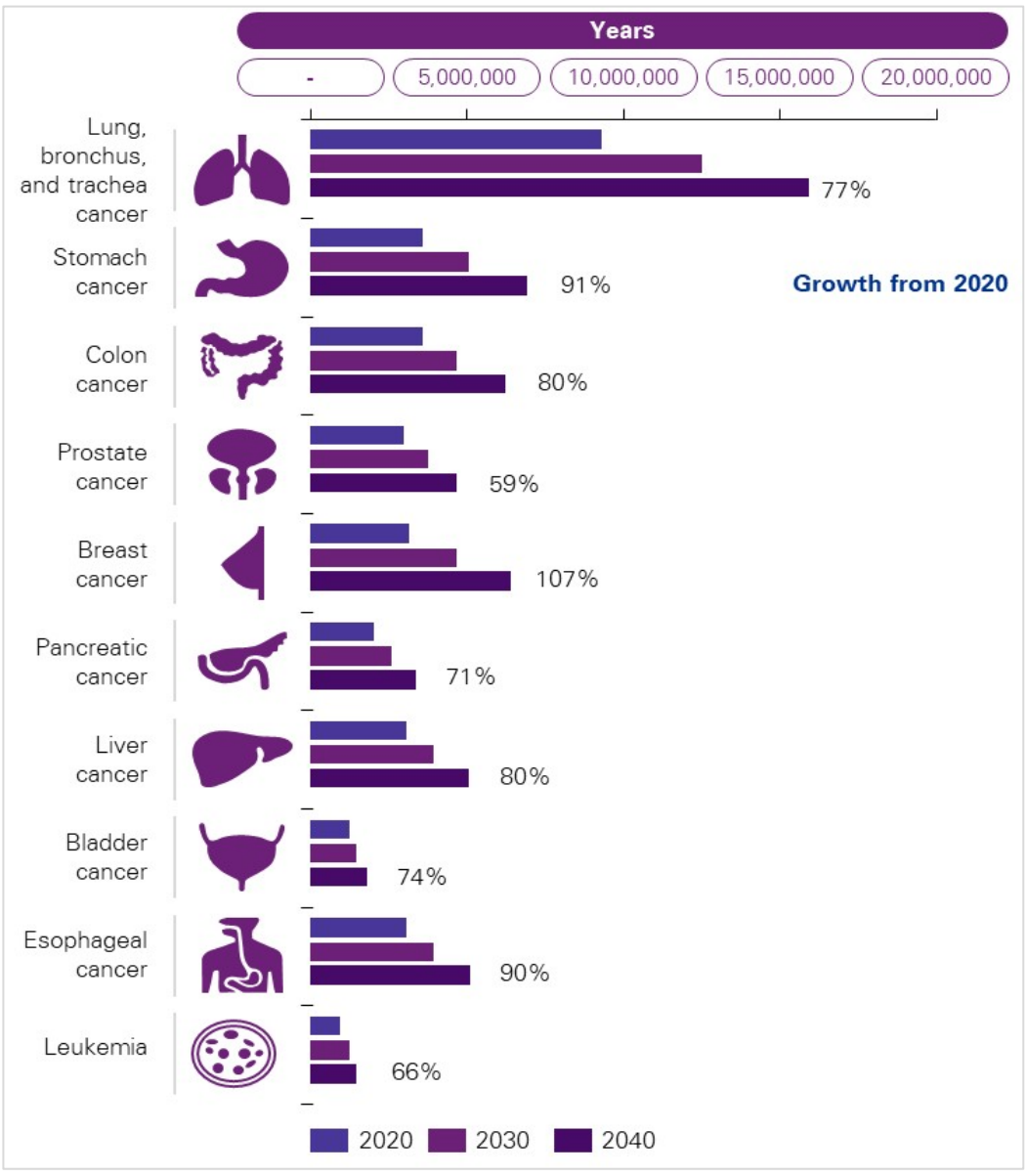
KEY FINDINGS

Cancer burden will see a notable increase over the next two decades among the ageing population…

Overall DALY forecasts reveal that the cancer burden will increase by about 80% over the next two decades among the ageing population. Although the biggest increases are seen in breast, stomach, and oesophageal cancer, the heaviest burden will be imposed by tracheal, bronchus, and lung cancer.

FIGURE 5

Figure 5. Aggregate DALYs (China, EU4 and UK, and the US)



Source: KPMG analysis using data from IHME 2019 GBD study and WHO Global Cancer Observatory Cancer Tomorrow.

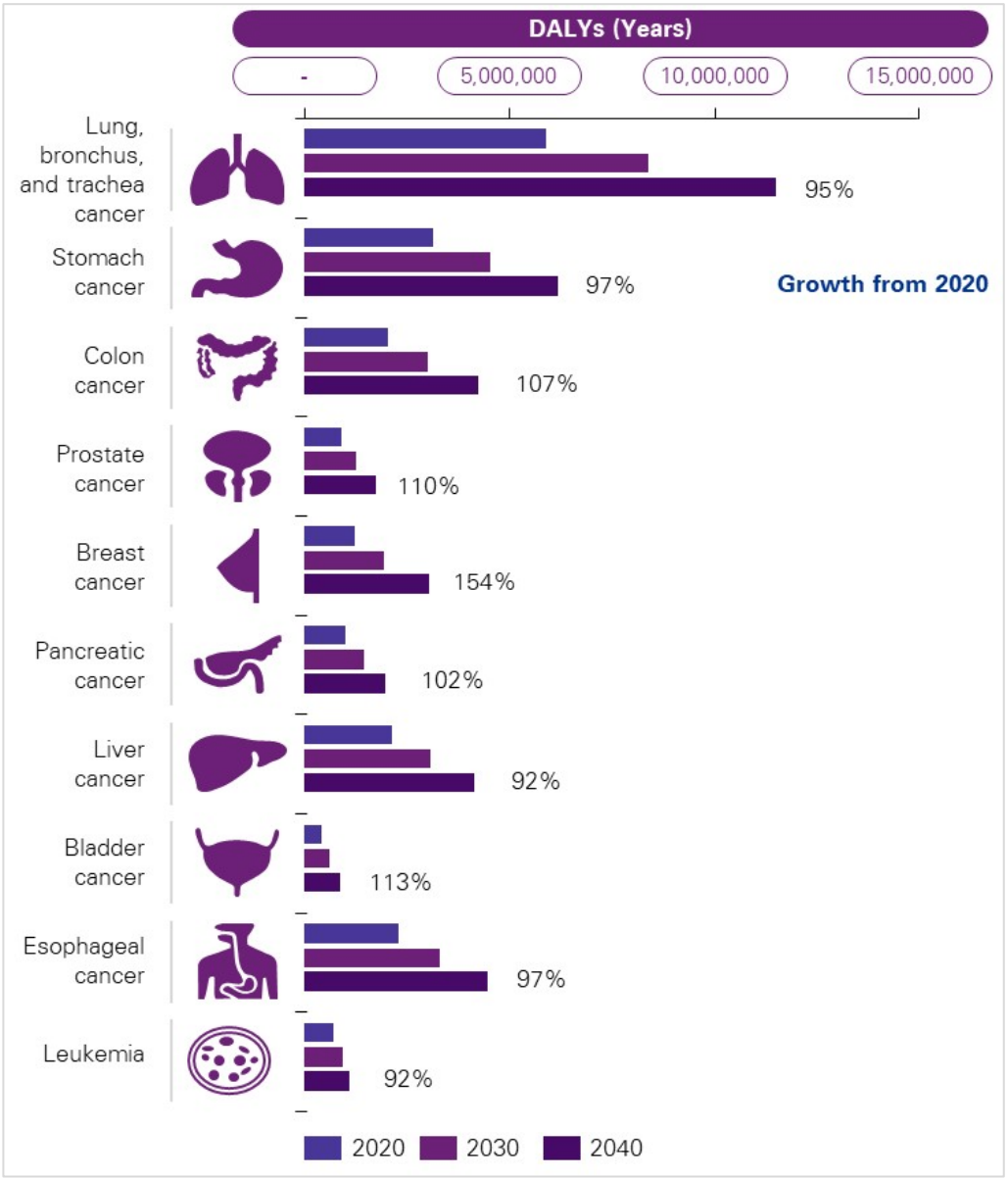
KEY FINDINGS – CHINA

China will likely see the cancer burden among the elderly almost double over the next two decades…

The cancer burden will almost double over the next two decades among the ageing population in China, with the biggest increases seen in breast cancer, bladder cancer, and prostate cancer. Tracheal, bronchus, and lung cancer will impose the heaviest burden.

FIGURE 6

Figure 6. Projections of cancer burden in China



Source: KPMG analysis using data from IHME 2019 GBD study and WHO Global Cancer Observatory Cancer Tomorrow.

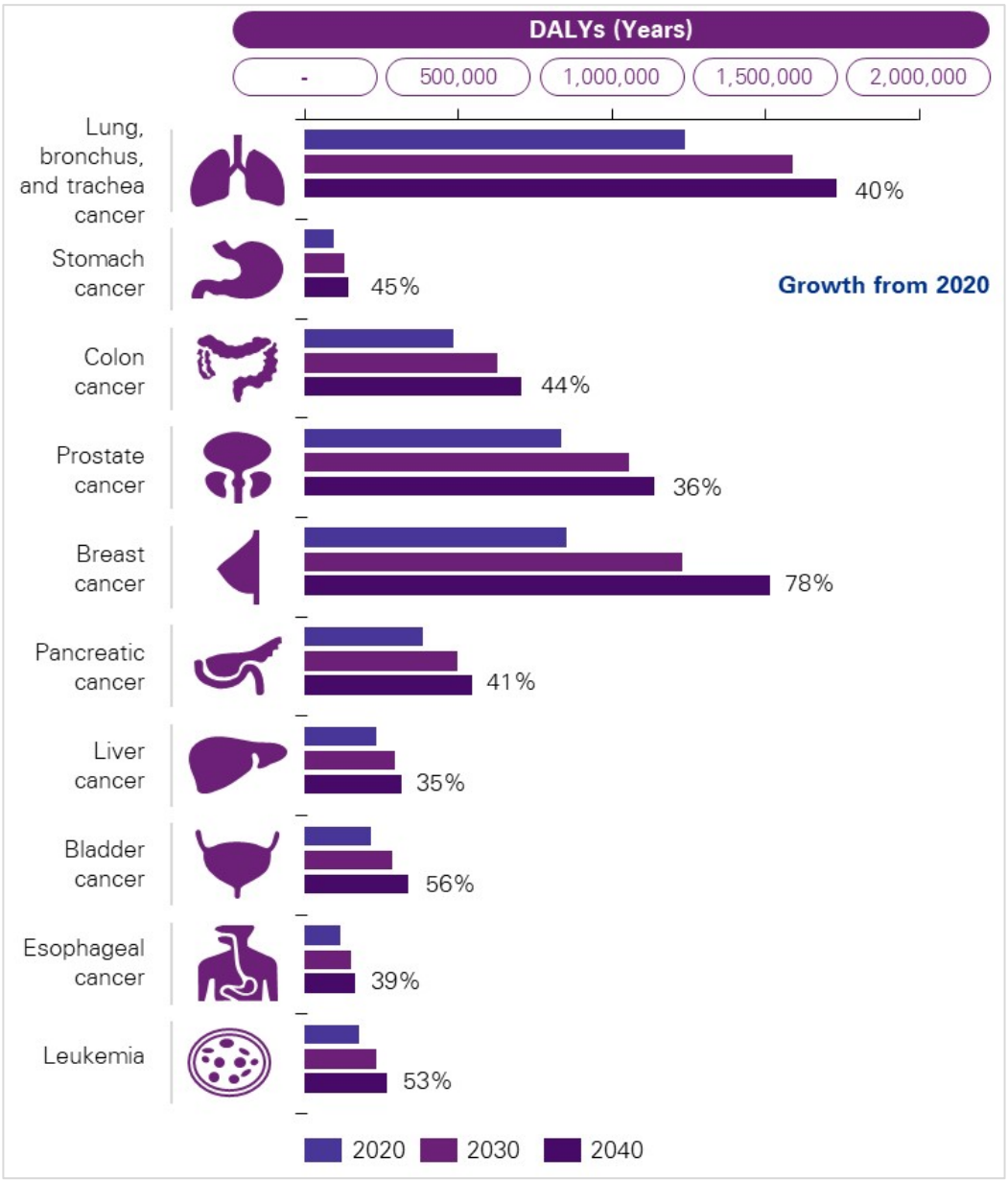
KEY FINDINGS – U.S.

The US will see a notable increase in the burden of cancer among the elderly over the next two decades…

The biggest increase are seen in breast cancer, bladder cancer, and leukemia. Tracheal, bronchus, and lung cancer will impose the heaviest burden, followed by breast cancer

FIGURE 7

Figure 7. Projections of cancer burden in the U.S.



Source: KPMG analysis using data from IHME 2019 GBD study and WHO Global Cancer Observatory Cancer Tomorrow.

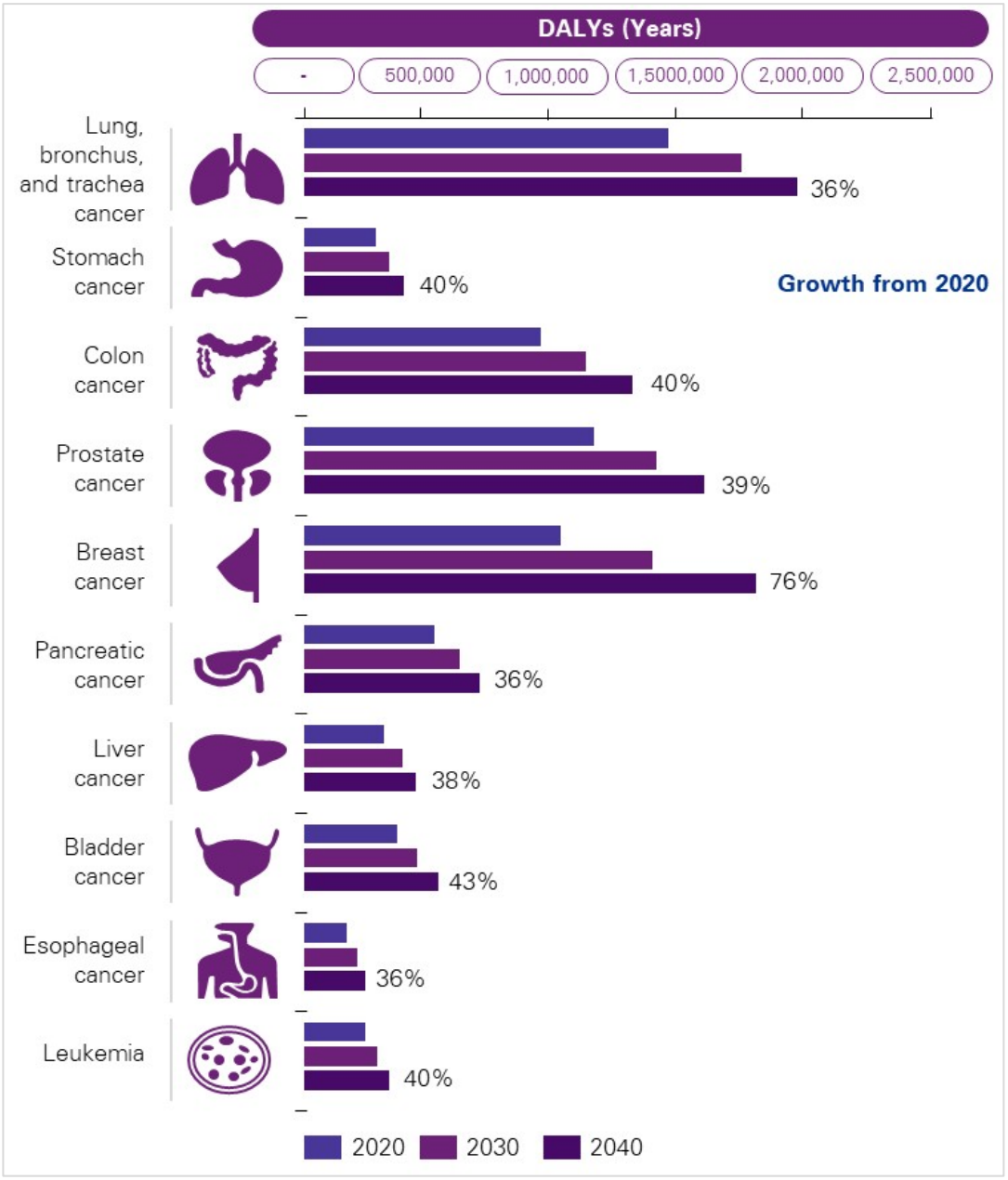
KEY FINDINGS – EU4 and UK

…and similar trends are observed in the EU4 and UK

The biggest increases are seen in breast cancer, bladder cancer, and leukemia. Tracheal, bronchus, and lung cancer will impose the heaviest burden, followed by breast cancer

FIGURE 8

Figure 8. Projections of cancer burden in the EU4 and UK

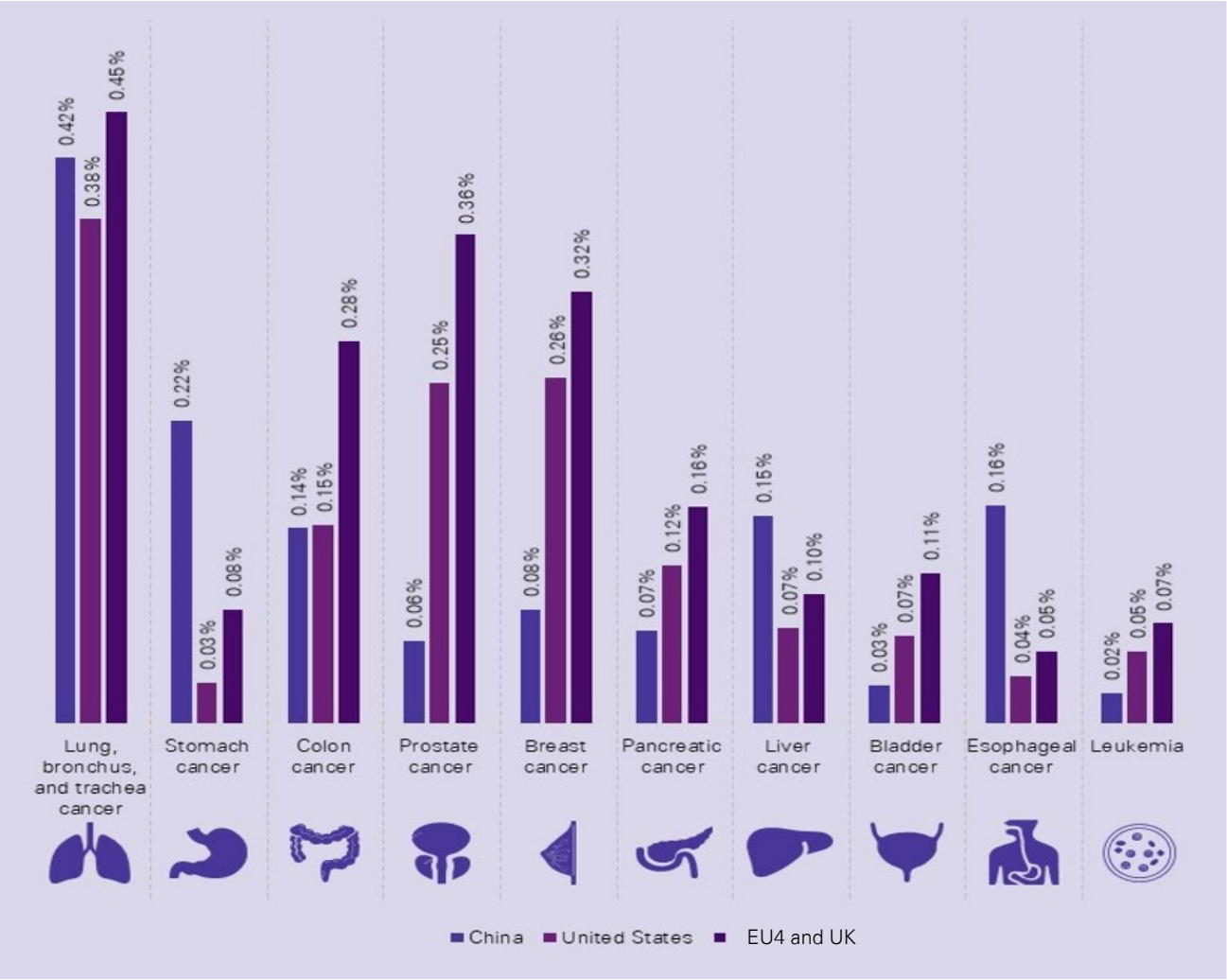


Source: KPMG analysis using data from IHME 2019 GBD study and WHO Global Cancer Observatory Cancer Tomorrow.

3.3 Economic burden of cancer among the elderly

Years of life lost or lived with disability because of cancer result in opportunity costs such as income that the individual could have generated if not for the disability or life lost due to cancer among others. A conservative estimate of the economic impact assumes that each DALY leads to a loss of a year of income. The economic impact has been estimated by multiplying the calculated DALYs with the GDP per capita of each country. The economic costs have also been expressed as a percentage of GDP (Figure 6).

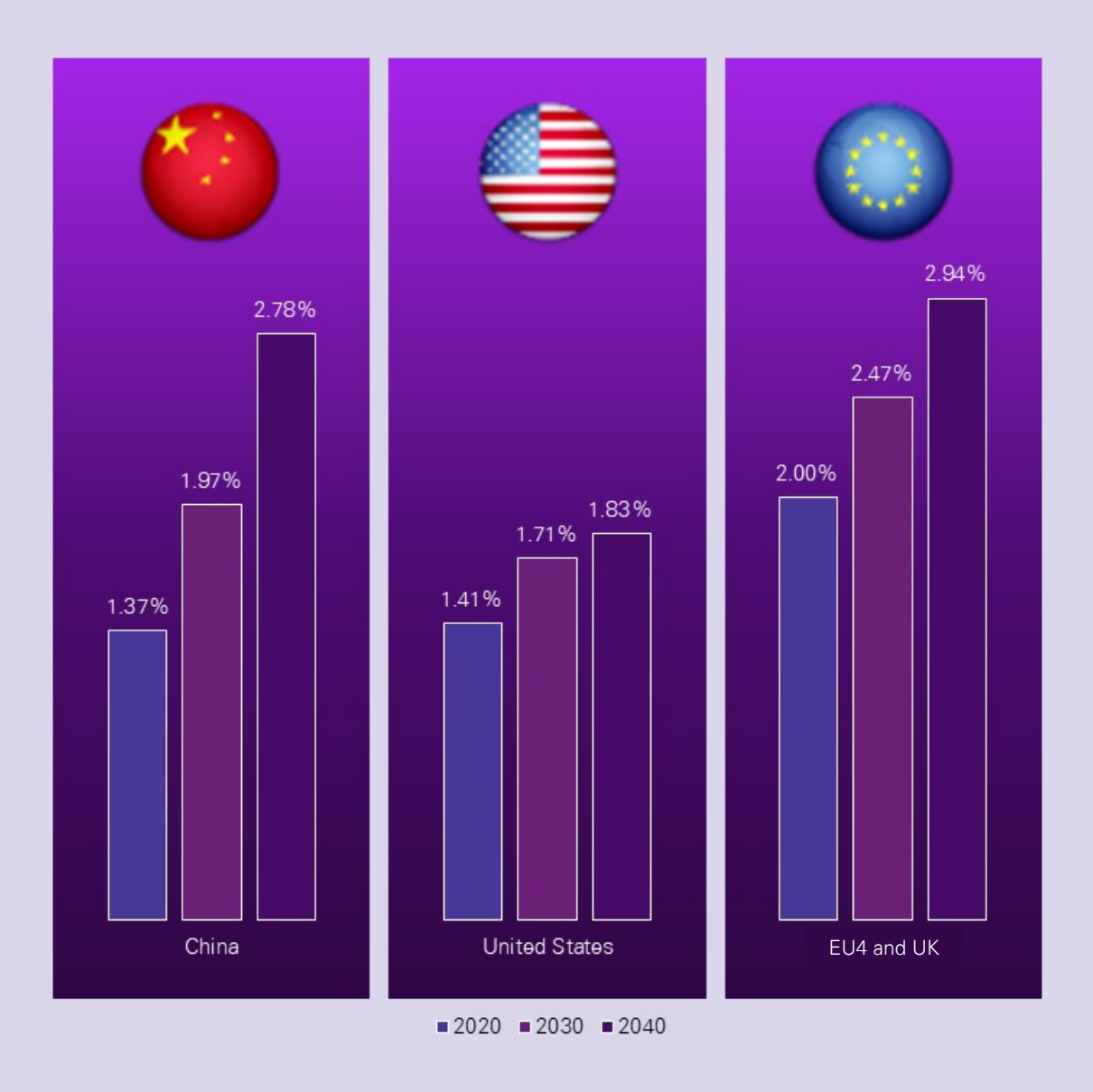
Figure 6. Estimates of economic costs of cancer DALYs in 2020 (% of respective countries GDP)



Note: EU4 and UK figures are calculated as the weighted average of the five countries (United Kingdom, France, Germany, Italy, and Spain).

Source: KPMG analysis using data from GDP per capita from World Bank.

Figure 7. Forecast of economic cost of DALY in terms of GDP, 2020-2040



Source: KPMG analysis using data from World Bank [13], IHME 2019 GBD study, WHO Global Cancer Observatory Cancer Tomorrow [14], and PwC World in 2050 [15]

By 2040, if current spending and policies remain unchanged, the EU4 and UK is projected to see the biggest impact among the target countries studied, at 2.94% of GDP. China is not significantly behind – its burden is projected to grow from 1.37% to 2.78% by 2040.

[13] https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=CN-US-ES-IT-FR-DE-GB

[14] https://gco.iarc.fr/tomorrow/en/dataviz/trends?types=0&sexes=1_2&mode=cancer&group_populations=0&multiple_populations=0&multiple_cancers=1&cancers=39&populations=160&apc=cat_ca20v1.5_ca23v-1.5

[15] https://www.pwc.com/gx/en/research-insights/economy/the-world-in-2050.html

3.3.1 Assumptions in the analysis

As with any analysis of this nature, certain assumptions have been made in the derivation of the results, primarily due to the paucity of available data. Assumptions include that the elderly would continue to be economically productive for the rest of their lives if they were not diagnosed with cancer. This assumption does not consider the fact that a subset of such people may be in retirement or may just not choose to work in their later years. The second assumption is that a working elderly person would earn the average wage in the corresponding country. Once again, among the elderly who do work, a range of remuneration types is likely to exist in each country of study.

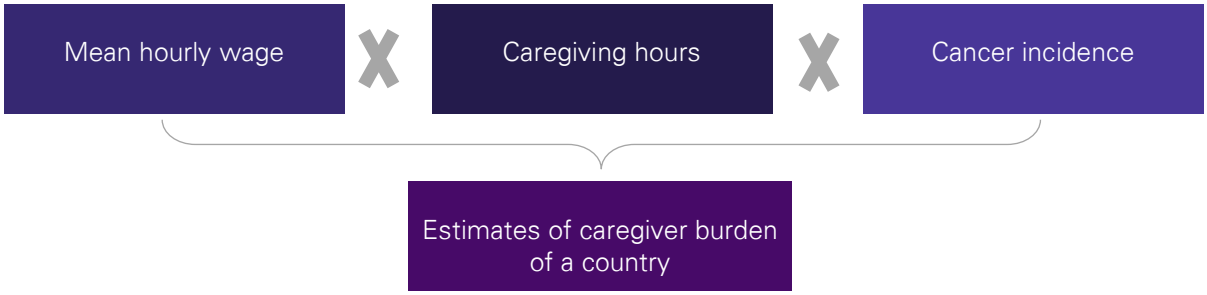
3.4 Caregiver burden

Time spent by informal caregivers is also an important component of the burden of cancer care. The burden is typically the opportunity lost due to the time costs associated with informal caregiving for individuals with cancer.

> "Research indicates that caregiving can be both demanding and burdensome – physically, emotionally, and financially – for many cancer caregivers."
>
> **-National Alliance for Caregiving, in partnership with the National Cancer Institute and the Cancer Support Community** [16]

Literature review on estimated time spent by caregivers in caring for individuals with cancer was conducted. In order to estimate the time costs, the median wage rate is then used to value caregiver time (Figure 12). The caregiver burden can be economically calculated in this manner as the mean hourly wage represents the generic opportunity cost faced by a caregiver when they provide their time to take care of an individual with cancer as opposed to work. By understanding the caregiver burden of cancer in a country, it could give a meaningful insight on the indirect economic impact resulting from informal caregiving for individuals with cancer.

Figure 8*: Methodology for Estimating Caregiver Burden

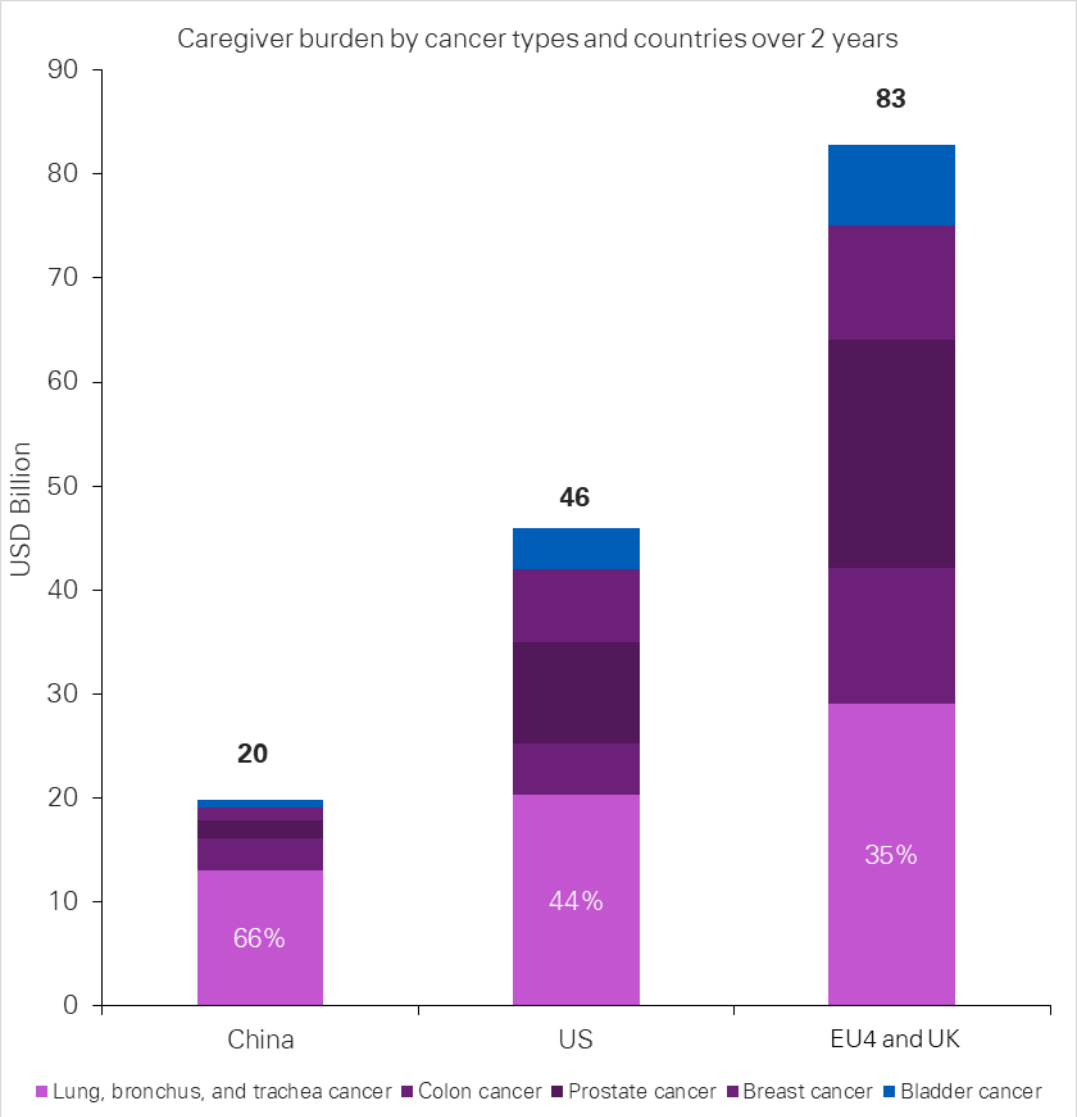


[16] https://www.caregiving.org/wp-content/uploads/2020/05/CancerCaregivingReport_FINAL_June-17-2016.pdf

* Further details on the methodology for estimating caregiver burden can be found in Appendix 3 of this paper

Figure 9 shows that, among the target countries, EU4 and UK has the highest caregiver burden of US$83 billion, followed by the US of US$46 billion, and China of US$20 billion. The differences in caregiver burden are mainly driven by different wage levels. Figure 9 also shows that lung, bronchus, and trachea cancer have the highest burden in all target countries, because of higher caregiving hours and prevalence. Detailed estimates by country and cancer type can be found in Appendix 3.

Figure 9. Caregiver Burden by Cancer Types and Countries



Source: ACS Journals [17], WHO [18].

Note(s): Figures labelled at the top indicate the total economic value of caregiver burden in the specified countries. The percentages refer to the share of lung, bronchus, and trachea cancer of total in the specified countries.

[17] https://acsjournals.onlinelibrary.wiley.com/doi/10.1002/cncr.24588

[18] https://gco.iarc.fr/today/online-analysis-table?v=2020&mode=cancer&mode_population=continents&population=900&populations=160&key=asr&sex=0&cancer=39&type=0&statistic=5&prevalence=0&population_group=0&ages_group%5B%5D=13&ages_group%5B%5D=17&group_cancer=1&include_nmsc=1&include_nmsc_other=1#collapse-group-0-4

3.4.1 Assumptions in the analysis

As with any analysis of this nature, certain assumptions have been made in the derivation of the results, primarily due to the paucity of available data. It is difficult to place a value on caregiving hours spent, and simply multiplying the caregiving hours by a median wage does not account for the value of lost leisure, non-wage benefits, implications for future employability, and wages. Our study also focuses on informal care, or unpaid care provided by family and friends who would otherwise be working. In contrast, since professional caregivers are paid, they could potentially contribute to economic output, offsetting losses.

4 Challenges in current handling of cancer in the elderly

4.1 Insufficient focus in National Cancer Control Plans (NCCPs)

A National Cancer Control Programme is defined by the World Health Organization (WHO) as "a public health programme designed to reduce cancer incidence and mortality and improve quality of life of individuals with cancer, through the systematic and equitable implementation of evidence-based strategies for prevention, early detection, diagnosis, treatment and palliation, making the best use of available resources [19].

Comprehensive NCCPs should be able to guide countries in making the right investments towards improving cancer outcomes. This includes taking the entire continuum of care into consideration: prevention, early detection, diagnosis, treatment, rehabilitation, palliation and research [20]. Complete NCCPs also involve setting realistic priorities, robust costing of cancer plans and sustained budgeting for cancer programmes. In 2017, the World Health Assembly resolution recommended that countries develop NCCPs, to guide cancer prevention and control activities undertaken in a country to address the national cancer burden. This paper comes at an important time in the context of the initiatives the International Cancer Control Partnership (ICCP) is working on to outline clearer guidance on cancer and ageing for NCCPs.

Despite the increase in the number of cancer plans globally, from 66% in 2013 to 81% of countries in 2017, [21] many country NCCPs have significant gaps, such as having only a generic non-communicable disease (NCD) plan rather than one focused on cancer; having a non-operational or outdated plan, or one that is not tailored towards the elderly. A WHO review of NCCPs in 152 countries in 2018 explored a number of key metrics indicating the comprehensiveness of the planning, including the needs of vulnerable groups, but did not include indicators relating to elderly with cancer. [22] Additionally, many countries' national statistics do not cover older age groups, and the data that much of global reporting depends on either does not disaggregate by age or set age caps. [23]

Appendix 4 provides further details on the gaps in NCCP's, as well as some description of NCCPs in the targeted countries.

4.2 Insufficient use of geriatric assessments (GAs) in clinical practice

Geriatric assessments are multidimensional, multidisciplinary assessments designed to evaluate an older person's functional ability, physical health, cognition and mental health, and socioenvironmental circumstances [24]. These assessments could lead to the reduction of health care cost, early recognition and treatment of geriatric syndromes and improved survival and quality of life for patients. [25]

GAs are able to evaluate health problems and impairments that would otherwise likely not be detected as part of routine cancer care. Through these assessments, it is possible to determine the

[19] https://www.iccp-portal.org/developing-nccp

[20] https://www.iccp-portal.org/developing-nccp

[21] https://www.uicc.org/news/%E2%80%9Cnational-cancer-control-plans-global-analysis%E2%80%9D-published-lancet-oncology

[22] http://www.cancercontrol.info/wp-content/uploads/2020/11/cc2020-nov20.pdf

[23] http://globalagewatch.org/reports/global-agewatch-insights-2018-report-summary-and-country-profiles/

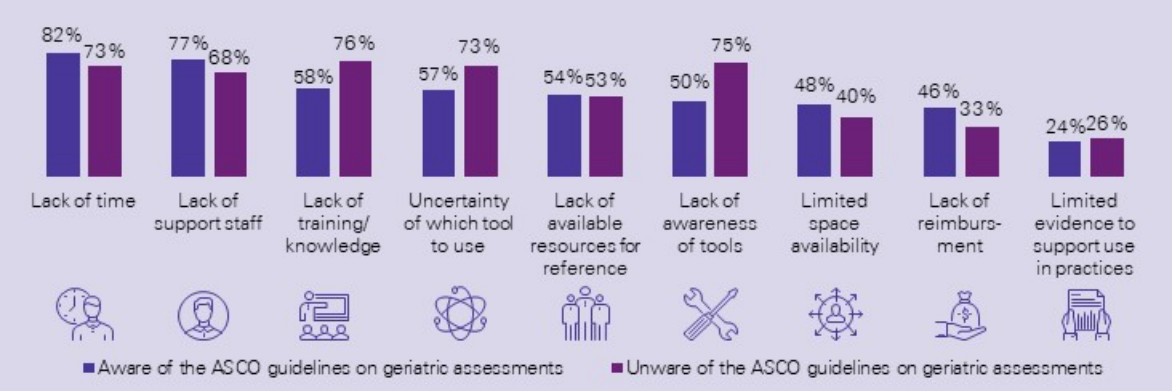
[24] https://www.aafp.org/afp/2011/0101/p48.html

[25] https://pubmed.ncbi.nlm.nih.gov/16447851/

older adults at highest risk of serious side effects from cancer treatment. Results from a study showed that the use of geriatric assessment reduced cancer treatment side effects for older adults. The patients in the trial who received geriatric assessments not only encountered fewer side effects but were also less likely to experience falls during treatment. The results showed that only 12% of these patients experienced a fall compared to the 21% of patients who did not receive geriatric assessments. [26]

Primary research conducted as part of this assessment brought to light that geriatric assessments are under-utilised. Despite the importance of geriatric assessments to guide oncologists to evaluate their patients holistically, only 17% out of 332 cancer practitioners surveyed in the United States carried out geriatric assessments on their patients in 2019. The top three barriers identified were insufficient time, lack of personnel, and limited familiarity with available, validated tools. [27] This finding is echoed by another study in 2020 which surveyed 1,277 cancer practitioners. [28]

Figure 10. Awareness of American Society of Clinical Oncology (ACSO) Guidelines on Geriatric Assessment



Source: American Society of Clinical Oncology Journal [29]

[26] https://www.cancer.gov/news-events/cancer-currents-blog/2021/cancer-geriatric-assessment-fewer-side-effects
[27] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6845793/
[28] https://ascopubs.org/doi/full/10.1200/OP.20.00442
[29] https://ascopubs.org/doi/pdf/10.1200/OP.20.00442

4.3 Lack of geriatric training among oncologists

Oncologists care for the majority of older patients with cancer. Despite this, not only is there a lack of oncologists globally (especially in the US with a shortage of around 2,300 projected in 2025 [30]), many existing oncologists receive little training in geriatric medicine. A study of oncology trainees in the UK found that 66.1% reported never receiving training on the particular needs of older people with cancer, while 19.4% reported to have received this training only once. Only 27.1% of the trainees were confident in assessing risk to make treatment recommendations for older patients, compared with 81.4% being confident in treating younger patients. [31] The situation in the US is similar. A study of oncology fellows in the US found that none had required geriatric rotations or an elective experience in geriatrics during medical school. [32] Another study found that only 32% of oncology training programmes had a formal curriculum that covered topics in geriatric oncology. [33]

4.4 Under-representation of older patients in cancer trials

Older patients are hugely under-represented in cancer trials despite shouldering a disproportionate burden of disease and consumption of prescription drugs and therapies. [34] The proportion of those aged 70 and above who enrolled in FDA clinical trials (2005-2015) is disproportionate to cancer incidence in that age group (Figure 11). Consequently, evidence and knowledge about responses of elderly patients to medications is inadequate, hindering understanding of the benefit-risk profile of drugs in this population. [35]

Figure 11. FDA Clinical Trial Participants and Cancer Incidence

Source: Journal of Geriatric Oncology; Kanapuru, B. (n.d.), FDA

[30] https://ascopubs.org/doi/10.1200/JOP.2013.001319
[31] https://www.nature.com/articles/bjc2013204
[32] https://pubmed.ncbi.nlm.nih.gov/24484724/
[33] https://www.sciencedirect.com/science/article/abs/pii/S1879406810000317
[34] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2837461/
[35] https://www.cambridgecognition.com/blog/entry/why-are-elderly-patients-under-represented-in-clinical-trials

5 Call to Action/ Key priorities and opportunities

The analysis conducted highlights significant gaps, challenges and opportunities as societies around the world grapple with the rising tide of cancer and ageing. Based on the insights uncovered in this assessment, there is need for urgent policy action to alleviate the socio-economic burden projected to increase in coming decades. This section outlines a series of recommendations for policymakers, public health officials and medical professionals.

5.1 Education and training in geriatric practice to oncology practitioners should be better provided

"China has been forming institutions to specifically tackle the problem of cancer among the elderly. In terms of education, geriatrics as an independent standalone specialization was only carved out recently. Among major hospitals, we are seeing more geriatrics departments."

– Dr Li Zhiming, Sun Yat-Sen University Cancer Centre, China.

"There is a need for more oncologists in general, and as part of their basic training, they should understand how to deal with the elderly. There is a need to remind the current oncologists that most of the patients are older and to adapt treatment to fit these patients better."

– Dr Stuart Lichtman, Memorial Sloan Kettering, United States.

Category 5.1.1: Educate and train healthcare providers on geriatric assessment tools

Update the knowledge and skills of healthcare providers so that they can confidently use geriatric assessment to evaluate the health of elderly individuals with cancer, promote early detection and support holistic treatment.

Category 5.1.1.1: By formulating national oncogeriatric training as part of an on-going professional development

Category 5.1.2: Integrate more geriatric training in oncology education

Provide more exposure and training on geriatrics in the healthcare curriculum to increase the skillsets in managing elderly individuals with cancer.

Category 5.1.2.1: By appointing a National Clinical Lead in Geriatric Oncology to coordinate education and training in geriatric oncology in collaboration with national training bodies.

Category 5.1.2.2: By including geriatric oncology in core undergraduate nursing and medicine curriculum, as well as teaching modules for both geriatric and oncology specialist trainees.

Category 5.1.2.3: By establishing national workshops jointly for oncology and geriatric trainees and promoting opportunities for participation in international fora.

5.2 Encourage the use of geriatric assessment

"More research can be done into elderly and cancer specifically and geriatric assessment should be utilitized more in Chinese hospitals."

– Dr Li Zhiming, Sun Yat-Sen University Cancer Centre, China.

"Geriatric assessment will help determine the appropriate treatment for the elderly."

– Dr Stuart Lichtman, Memorial Sloan Kettering, United States

Category 5.2.1: Encourage the use of geriatric assessment

Provide more personalized cancer management treatment for elderly individuals with cancer

Category 5.2.1.1: By developing recommendations for treatment strategies tailored to the elderly through understanding their physical abilities, cognition, diet, co-morbidities, psychological status, and social support to better meet the patient's individual needs.

Category 5.2.1.2: By incorporating geriatric evaluation into oncology decision-making, in line with the core recommendation of the International Society of Geriatric Oncology.

Better support for elderly individuals with cancer with comorbidities

Category 5.2.1.3: By obtaining a more complete understanding on the complex health considerations of elderly individuals living with cancers.

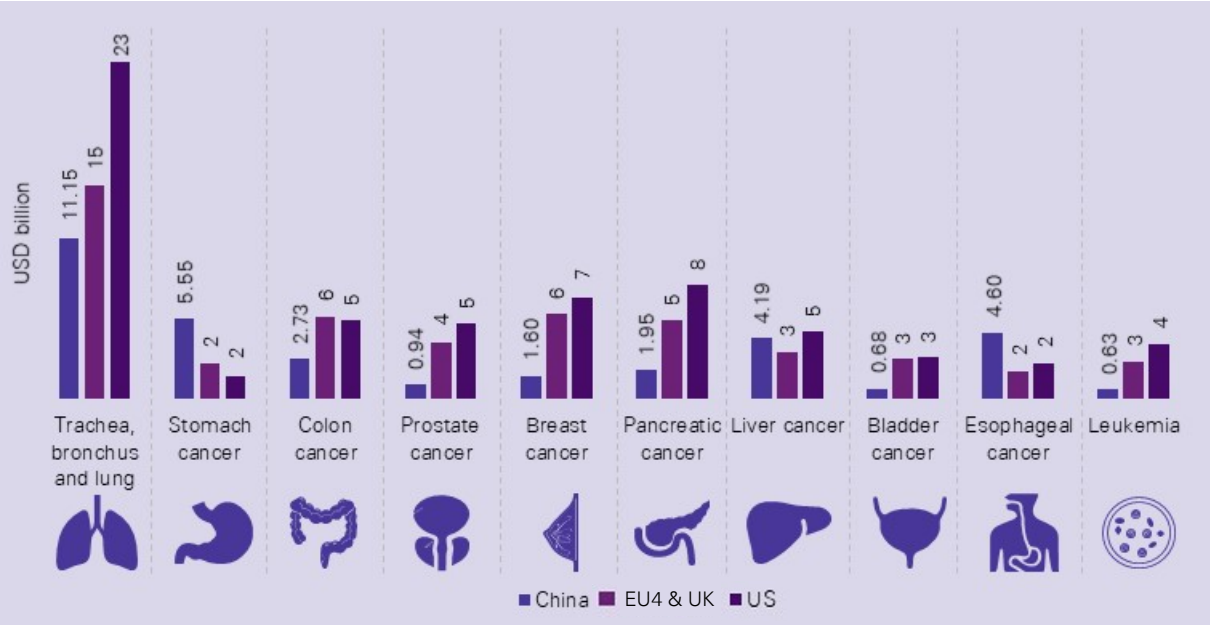
Category 5.2.1.4: By recognizing Geriatric Oncology as a specialization in the National Health System.

Identify the risk level of elderly undergoing clinical cancer treatment

Category 5.2.1.5: By appointing a National Clinical Lead in Geriatric Oncology to work with cancer centres to improve care of older patients and utilize research studies and programmes to develop care pathways for older patients.

Geriatric assessment is an important requirement to improve the treatment of older patients with cancer. The proper use of geriatric assessments is expected to lead to a reduction in the DALY's for all types of cancer leading to a direct reduction in the economic burden. The economic impact of not adopting GA is estimated to be – US$64.2 billion in the US followed by the EU4 and UK at US$48.6 billion and China at US$34.0 billion. Breakdown of the economic burden avoided due to use of GA by cancer types is shown in figure 15 below.

Figure 12. 2030 Economic burden avoided due to the use of GA, in billions



5.2.1 Assumptions in the analysis

There is significant paucity of data on the benefit of GA and research efforts are required to assess the impact across all countries. Our analysis references a study[36] by the Aarhus University Hospital on the impact of GA on 90-day mortality in older patients with cancer in Denmark. Results of the study indicate that - in the non-GA group, 74 patients died (24%), versus 68 patients (17%) in the GA group. This study was undertaken across a range of cancer types.

Among the DALY constituents, the years of life lost due to premature mortality (YLL) has been assumed to change as a result of GA while the years lived with a disability (YLD) is assumed to remain unchanged. The impact of an unchanged YLD is expected to be relatively insignificant given that the disability weight value is <1.

The care cost for cancer in the continuum phase for the US has been assumed to be US$6,400.[37] Care cost in the European countries has been assumed to be the same as that in the US.[38] While data in China for care cost in just the continuum phase was unavailable, the total care cost was derived from data on care costs of specific cancers and the cancer distribution in China, assuming that individuals with cancer incur both inpatient and outpatient costs.[39] The care costs for China may be an overestimate which in turn underestimates the reduction in economic impact of DALY. As a result, total treatment costs for China was calculated to be US$5,559. The GDP per capita values in 2030 and 2040 are reflected in terms of USD in 2020 terms, and thus, higher avoidance by using GA is due to higher incidence.

[36] https://www.sciencedirect.com/science/article/abs/pii/S0959804919302928
[37] https://cebp.aacrjournals.org/content/cebp/early/2020/06/08/1055-9965.EPI-19-1534.full.pdf
[38] https://pubmed.ncbi.nlm.nih.gov/25802950/
[39] https://pubmed.ncbi.nlm.nih.gov/31062522/

5.3 Enhance the evidence base for treatments for elderly patients with cancer through clinical trials

"There is an increase in interest by the government in obtaining information of efficacy and tolerance to treatments from dedicated clinical trials and real-life experiences of the ageing population."

– Carlos Gomez-Roca, Institut Claudius Regaud, France

"There is definitely a gap as there is not enough representation of older cancer patients due to lack of education and understanding, and a low number of geriatric medicine physicians since geriatric medicine is not recognized as a distinct specialty."

– Pawanbir Singh, Cancer Research, United Kingdom

"There are only a few studies which specifically focus on the elderly in clinical trials. Geriatric assessment could be a solution where elderly patients can be admitted into clinical trials if certain criteria are met."

– Josep Maria Borras Andres, Oncology Strategy, Spain

Based on the interviews conducted and the research presented in the earlier sections, this paper provides some recommendations to alleviate the burden of cancer among the elderly as follows:

Category 5.3.1: Increase participation of elderly individuals with cancer in clinical trials

To confidently treat elderly individuals with cancer better

Category 5.3.1.1: By suggesting that cancer trial organisations place more focus on improving research in the field of geriatric oncology.

Category 5.3.1.2: By carrying out specific research projects in oncogeriatrics, particularly on treatment strategies and the use of new drugs with a target participation rate of 5% in elderly subjects within five years.

Category 5.3.1.3: By conducting clinical trials on treatment strategies specifically for elderly patients.

Category 5.3.1.4: By obtaining real-world evidence on the efficacy of cancer treatments on the elderly in clinical trials.

Conclusions

Cancer in the elderly is a pressing global issue that is projected to have significant global impact if not addressed adequately. Based on the interviews conducted and the research presented in the earlier sections, this paper aims to ignite solutions-oriented dialogues and provide some strategic recommendations to serve as a stepping-stone to alleviate the growing socio-economic cancer burden of cancer and ageing. While there have been promising achievements over the years, additional research and greater focus on cancer among the elderly still has to be made in an attempt to address the gaps in care for elderly individuals with cancer.

Appendix 1 Country snapshot

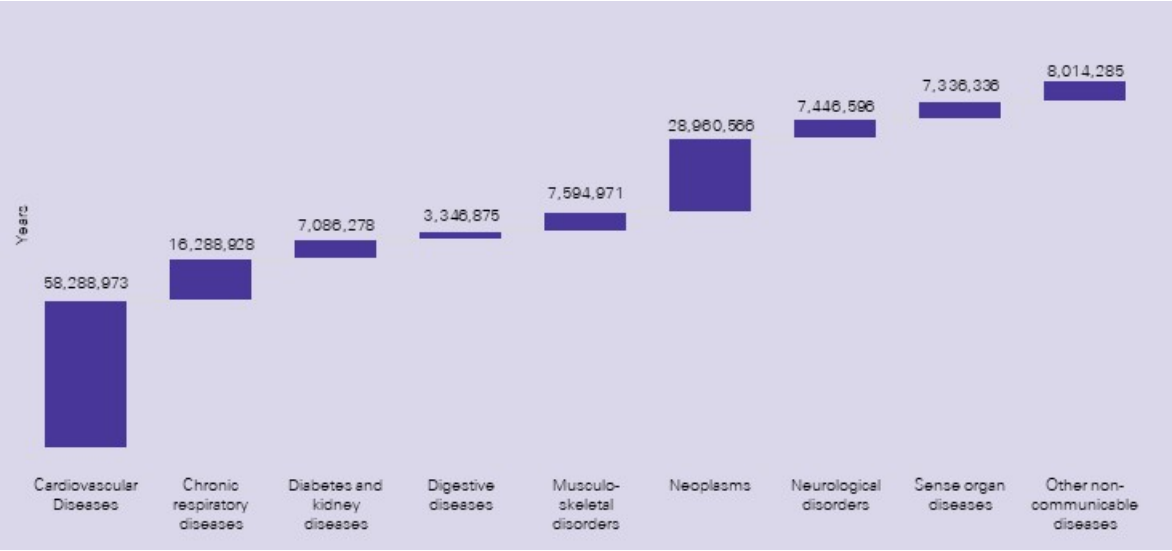
China

— As shown in Figure 15, in China, cardiovascular diseases, neoplasms, and chronic respiratory diseases were the top three worst non-communicable diseases faced by elderly. They accounted for 71.7% of the total DALYs.

— Neoplasm, the second worst non-communicable disease faced by the elderly behind cardiovascular disease, accounted for 20.1% of total DALYs.

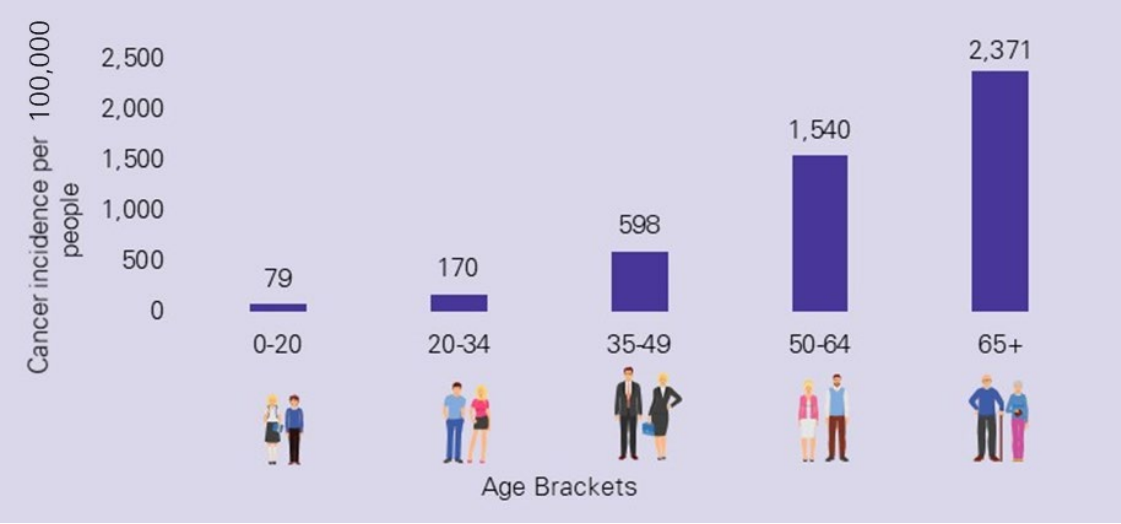
— As shown in Figure 16, in China, cancer incidence showed an exponential rising trend across the age groups. The elderly accounted for 49.8% of total cancer incidence in China.

Figure 13. Causes of DALYs in Elderly, China, 2019



Source: IHME[40]

Figure 14. Cancer Incidence in China by Age Groups, 2019



Source: IHME[40]

[40] GBD Results Tool | GHDx (healthdata.org)

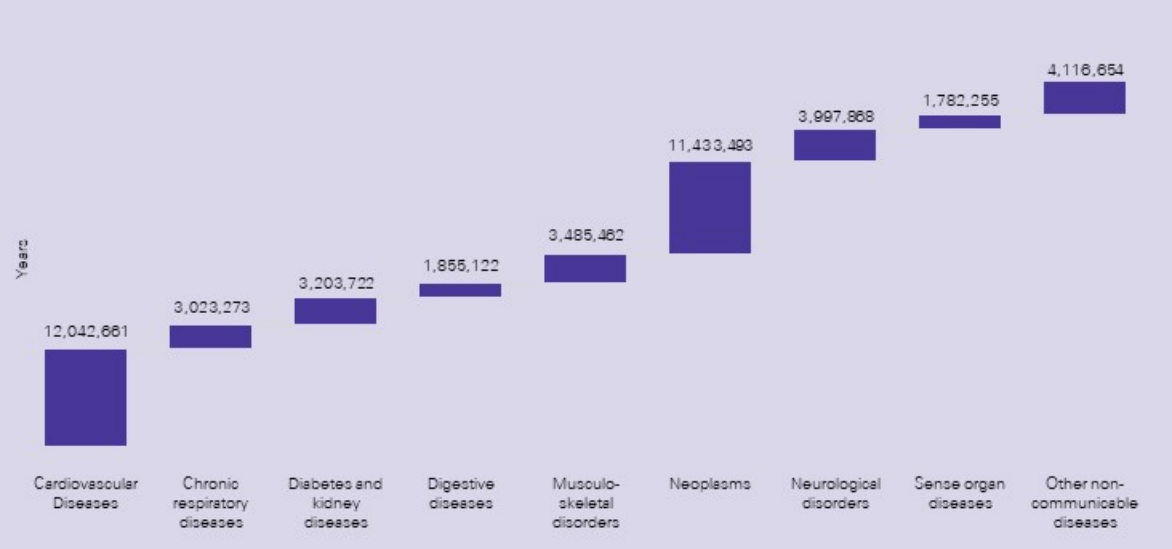
EU4 and UK

— As shown in Figure 17, in EU4 and UK, cardiovascular diseases, neoplasms, and neurological disorders were the top three worst non-communicable diseases faced by elderly. They accounted for 59.0% of the total DALYs.

— Neoplasm, the second worst non-communicable disease faced by the elderly behind cardiovascular disease, accounted for 25.4% of the total DALYs.

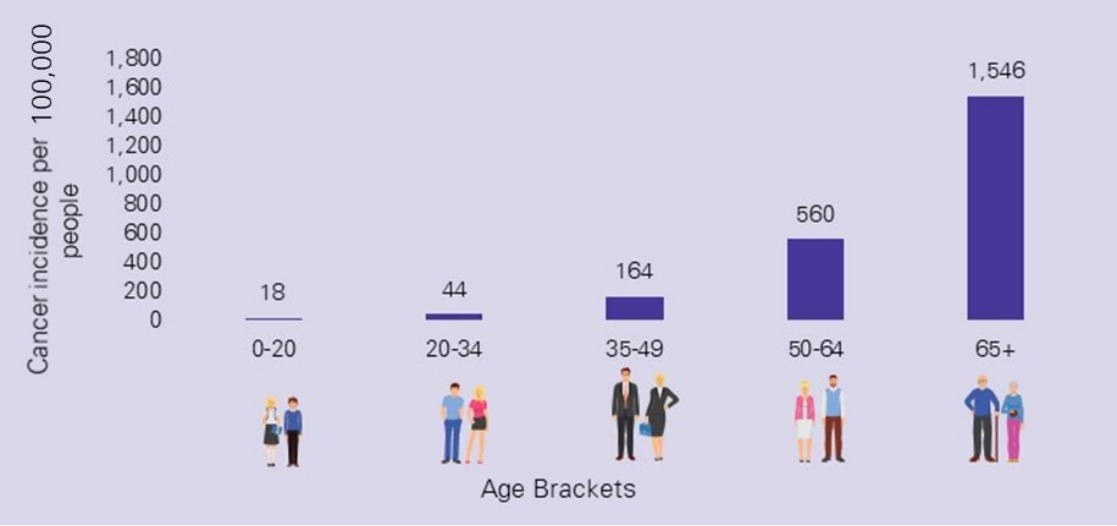
— As shown in Figure 18, in EU4 and UK, cancer incidence showed an exponential rising trend across the age groups. The elderly accounted for 66.3% of total cancer incidence in the region.

Figure 15. Causes of DALYs in Elderly, EU4 and UK, 2019



Source: IHME[40]

Figure 16. Cancer Incidence in EU4 and UK by Age Groups, 2019



Source: IHME[40]

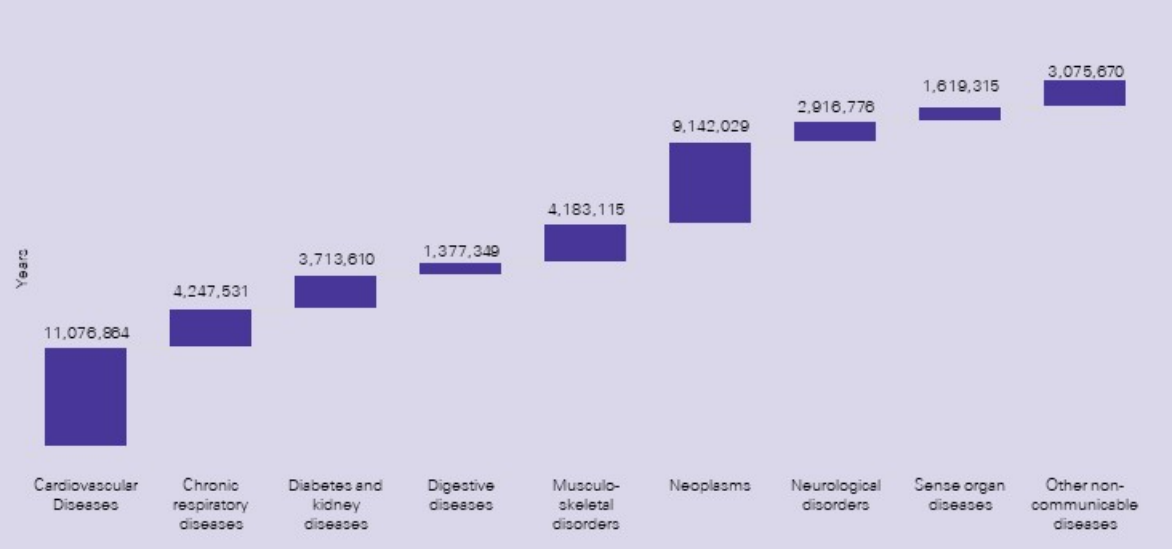
U.S.

— As shown in Figure 19, in the US, cardiovascular diseases, neoplasms, and chronic respiratory diseases were the top three worst non-communicable diseases faced by elderly. They accounted for 59.2% of the total DALYs.

— Neoplasm, the second worst non-communicable disease faced by the elderly behind cardiovascular disease, accounted for 22.1% of the total DALYs.

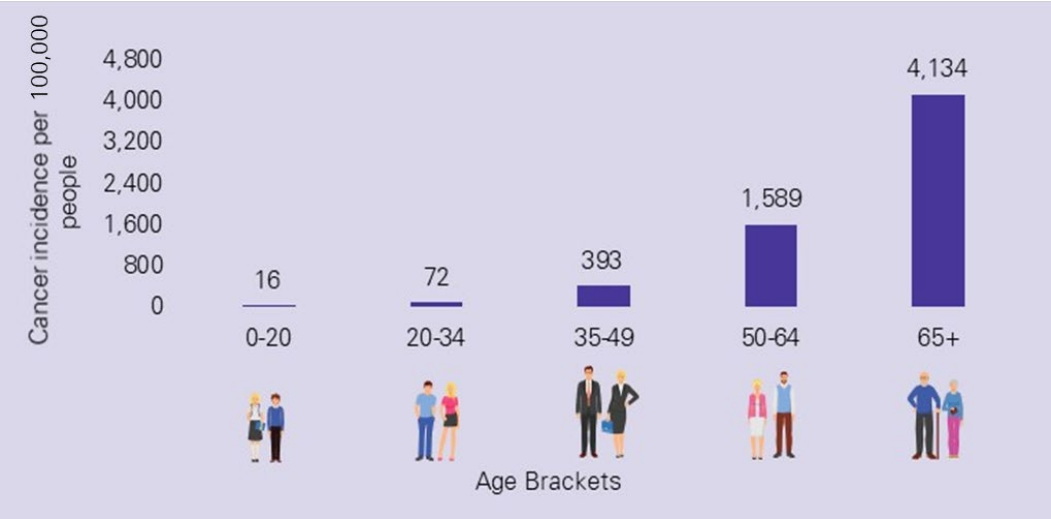
— As shown in Figure 20, in the US, cancer incidence showed an exponential rising trend across the age groups. The elderly accounted for 66.6% of total cancer incidence in the country.

Figure 17. Causes of DALYs in Elderly, the US, 2019



Source: IHME[40]

Figure 18. Cancer Incidence in the US by Age Groups, 2019



Source: IHME[40]

Appendix 2 DALY calculation

One DALY represents the loss of the equivalent of one year of full health. DALYs for a disease or health condition are the sum of the years of life lost to due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population.

The basic formula for DALY is: **DALY = YLL + YLD**

Detailed calculations of YLL:

Calculation of YLLs

Assuming zero discounting and uniform age weights, the basic formula for YLL is:

YLL = N x L

The full formula for non-zero discounting and age weighting is as follows:

$$YLL = N\,Ce^{(ra)} / (\beta+r)2\,[e^{-(\beta+r)(L+a)}\,[-(\beta+r)(L+a)-1] - e^{-(\beta+r)a}\,[-(\beta+r)a-1]]$$

where N is the number of deaths, r is the discount rate, C is the age-weighting correction constant, β is the parameter from the age-weighting function, a is the age of onset, and L is the duration of disability or time lost due to premature mortality.

Detailed calculations of YLD:

Calculation of YLDs

Assuming zero discounting and uniform age weights, the basic formula for calculating YLD is:

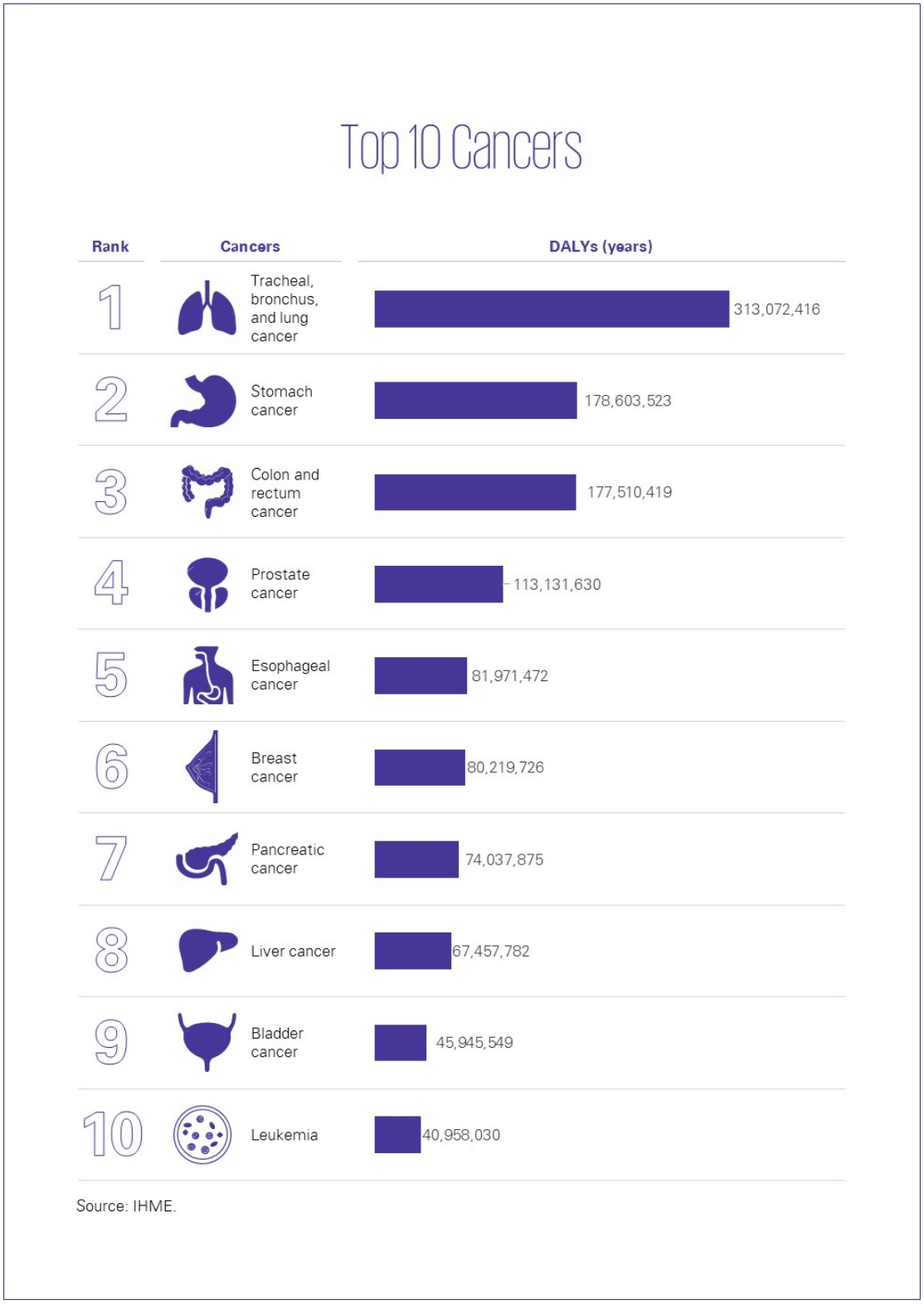
YLD = I x DW x L

The full formulae for YLD with non-uniform age weights are given by:

$$YLD = I\,DW\,Ce^{(ra)} / (\beta+r)2\,[e^{-(\beta+r)(L+a)}\,[-(\beta+r)(L+a)-1] - e^{-(\beta+r)a}\,[-(\beta+r)a-1]]$$

where I is the number of incident cases, DW is the disability weight, r is the discount rate, C is the age-weighting correction constant, β is the parameter from the age-weighting function, a is the age of onset, and L is the duration of disability.

The top 10 cancers identified which contributed to 80% of total cancer DALYs among the ageing population, from 1990-2019 are shown in the table below.



Source: IHME.

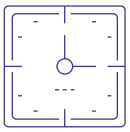
Appendix 3 Calculating caregiver burden

We reviewed the estimated time spent by caregivers on individuals with cancer. To estimate the cost, the median wage rate was used to value caregiver time – in other words, they lost this amount by caring for patients instead of working.

Benchmark research:

- A joint study by the National Cancer Institute and the American Cancer Society estimated the time associated with informal caregiving in the 2 years after patient diagnosis of various cancers in the US.

Estimating time costs of informal caregiving:



- As cancer-specific informal caregiving hours are unavailable for the other target countries (China and EU4 and UK), the average caregiving hours are assumed to be the same across countries.
- The median wage rates in respective countries were used to value caregiver time. This will be multiplied by cancer incidence to estimate the total caregivers' burden in respective countries.

Source: ACS Journals [41]

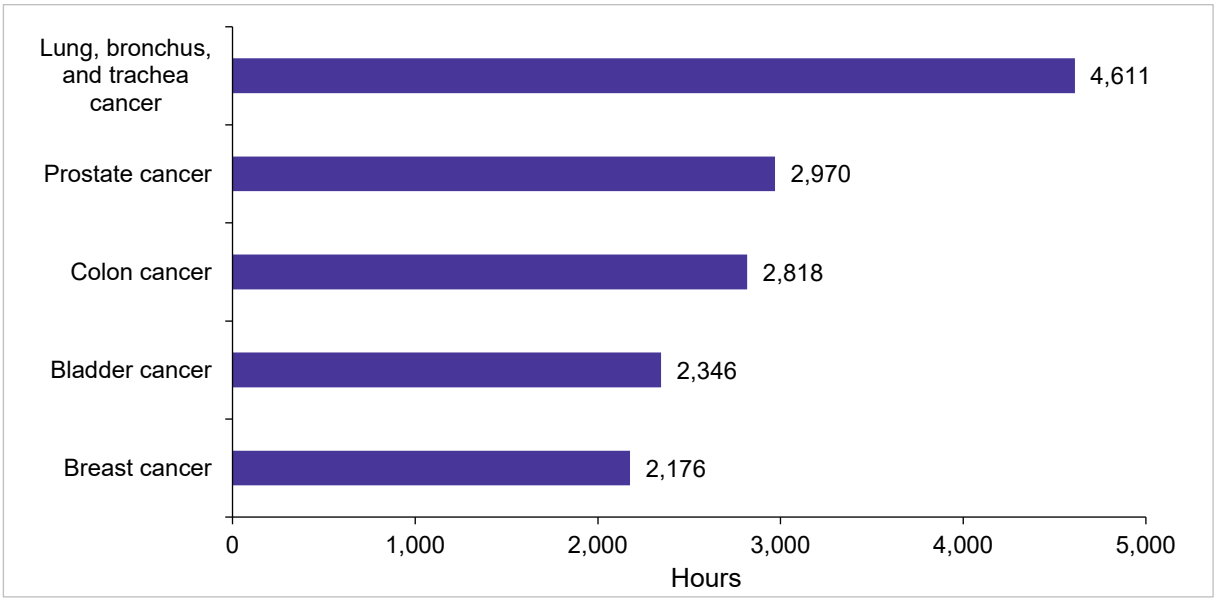
Caregiving hours

A joint study by the National Cancer Institute and the American Cancer Society provided an estimate of the time associated with informal caregiving in the 2 years after diagnosis of various cancers in the US. [42] The amount of emotional, tangible, or medical support usually differs according to the type of cancer, and so does time spent by caregivers. Figure 22 provides estimates for the total number of caregiving hours a patient of each cancer type likely requires. Lung, bronchus, and trachea cancer demands the most, at 4,611 hours. Since cancer-specific data is unavailable for the other countries, the US numbers are used for estimates instead.

[41] https://acsjournals.onlinelibrary.wiley.com/doi/10.1002/cncr.24588

[42] https://acsjournals.onlinelibrary.wiley.com/doi/10.1002/cncr.24588

Figure 22. Caregiving Hours in the US for Different Cancer Types over 2 Years (hours)



Source: ACS Journals[42]

Median wage level

The median wage levels used in the analysis were obtained from official data in the targeted countries. By comparing their wages in USD, the opportunity costs and economic caregiver burden for cancer can be attained.

Table 1. Mean Hourly Wage in Base Currency and USD

Country	Mean hourly wage in base currency	Mean Hourly Wage in USD
China (RMB)	*37.75 (2019)	5.91
France (EUR)	37.50 (2020)	46.02
Germany (EUR)	36.60 (2020)	44.91
Italy (EUR)	29.80 (2020)	36.57
Spain (EUR)	22.80 (2020)	27.98
UK (EUR)	28.50 (2019)	35.32
US (USD)	27.07 (2020)	27.07

**The average annual wage in China was obtained from the average wage of employed person in urban non-private units of RMB 90,501.*

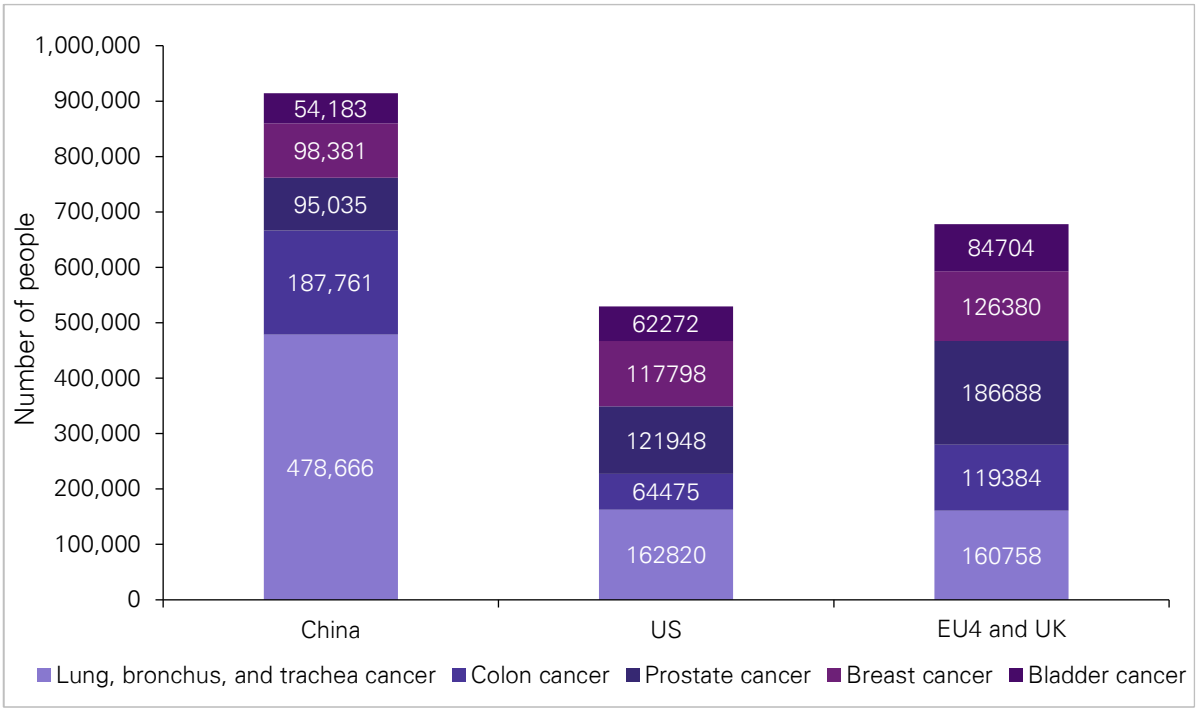
Note(s): for the countries where their 2020 data were not available (China and UK), their 2020 mean hourly wages were estimated by inflating 2019 mean hourly wages (inflation rate is 2.419% for China [43] and 0.989% for UK [44]).

Sources: BIS [45], China Statistical Yearbook [46] & International Labour Organisation [47], Eurostat [48], U.S. Bureau of Labor Statistics [49]

Cancer incidence

We also factored in total cancer incidence in a country to estimate the caregivers' burden. Figure 19 shows the cancer incidence of China, US, and the EU4 and UK, by different disease types. As can be seen, China has the total highest cancer incidence among the target countries, with lung, bronchus, and trachea cancer are the most prevalent.

Figure 19. Cancer incidence by target countries and selected cancer types in 2020



Source: WHO Global Cancer Observatory: Cancer Tomorrow [50]

[43] China Inflation Rate 2020: https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=CN

[44] United Kingdom Inflation Rate 2020: https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=GB

[45] Conversion Rates: https://stats.bis.org/statx/srs/table/i3?m=E, 1.00000 USD = 0.81493 EUR = 6.53777 RMB

[46] Mean hourly wage is derived by dividing the average annual wage by 52 times the average hours worked per week. Average annual wage found here: http://www.stats.gov.cn/tjsj/ndsj/2020/indexeh.htm. Average hours worked per week found here: https://ilostat.ilo.org/topics/working-time/

[47] Mean hourly wage is derived by dividing the average annual wage by 52 times the average hours worked per week. Average annual wage found here: http://www.stats.gov.cn/tjsj/ndsj/2020/indexeh.htm. Average hours worked per week found here: https://ilostat.ilo.org/topics/working-time/

[48] https://ec.europa.eu/eurostat/databrowser/view/lc_lci_lev/default/table?lang=en, for mean hourly wage of EU5 countries

[49] https://www.bls.gov/oes/2020/may/oes_nat.htm for mean hourly wage in US

[50] Cancer Tomorrow (iarc.fr)

The economic value of caregiver burden in each country and by each cancer type can be calculated by multiplying the mean hourly wage with the caregiving hours, and with incidence.

The tables below compute the absolute economic caregiver burden for cancer in the US, China, and EU4 and UK.

US. As seen in Table 2, the highest economic caregiver burden for cancer in US is attributed to lung, bronchus, and trachea cancer, at US$20.322 billion.

Table 2. Economic Value of Caregiving 2020 in the US

Cancer	Total number of caregiving hours over 2 years (hours)	Total cancer incidence in the elderly	Economic value of caregiving (USD)
Bladder	2,346	62,272	3,954,322,191
Breast	2,176	117,798	6,938,492,208
Colorectal	2,818	64,475	4,918,363,189
Lung, bronchus, and trachea cancer	4,611	162,820	20,322,714,198
Prostate	2,970	121,948	9,804,363,109

Source: ACS Journals[51], WHO[18]

China. Using the US estimation for caregiving hours, as seen in Table 3, the highest economic caregiver burden for cancer in China is attributed to lung, bronchus, and trachea cancer at US$13.052 billion.

Table 3. Economic Value of Caregiving 2020 in China

Cancer	Total number of caregiving hours over 2 years (hours)	Total cancer incidence in the elderly	Economic value of caregiving (USD)
Bladder	2,346	54,183	751,660,759
Breast	2,176	98,381	1,265,954,258
Colorectal	2,818	187,761	3,129,062,426
Lung, bronchus, and trachea cancer	4,611	478,666	13,052,272,521
Prostate	2,970	95,035	1,669,198,084

Source: ACS Journals[51], WHO[18]

[51] https://acsjournals.onlinelibrary.wiley.com/doi/10.1002/cncr.24588

EU4 and UK. This trend is consistent in EU4 and UK, where lung, bronchus, and trachea cancer brought the highest economic caregiver burden, at US$29.097 billion as seen in Table 4.

Table 4. Economic Value of Caregiving 2020 in EU4 and UK

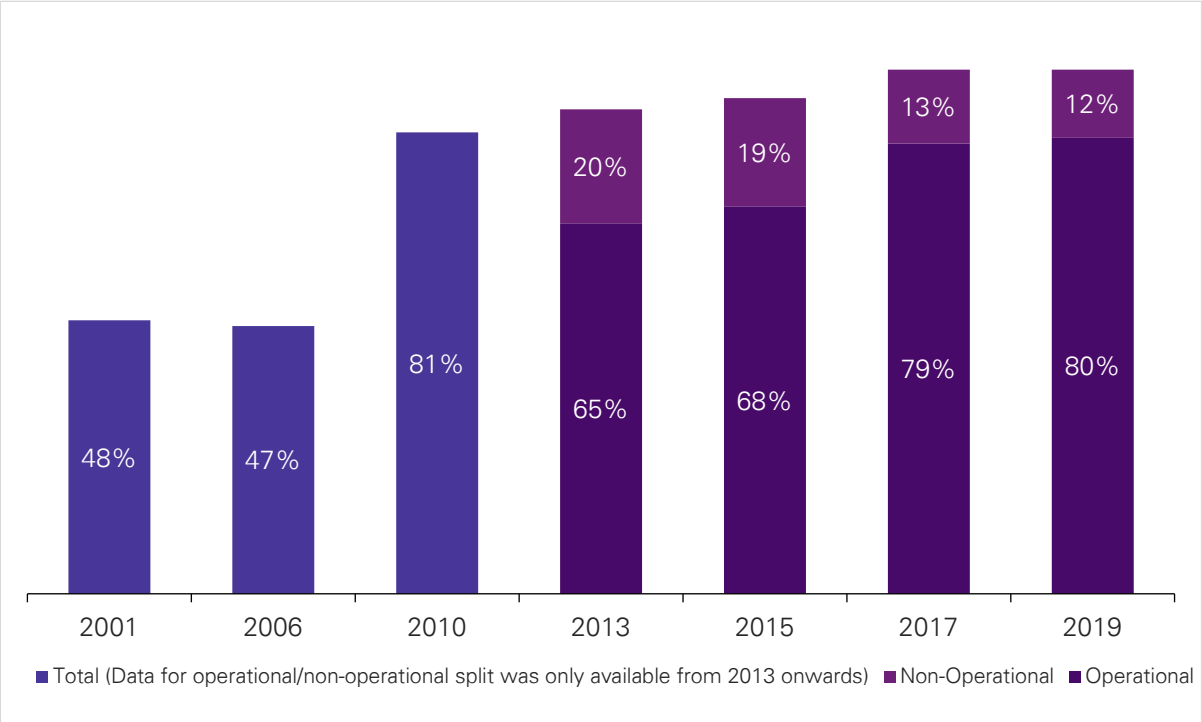
Cancer	Total number of caregiving hours over 2 years (hours)	Total cancer incidence in the elderly	Economic value of caregiving (USD)
Bladder	11,729	84,704	*7,771,778,662
Breast	10,880	126,380	*10,887,865,784
Colorectal	14,090	119,384	*12,981,033,531
Lung, bronchus, and trachea cancer	23,055	160,758	*29,096,813,666
Prostate	14,850	186,688	*22,048,394,392

*The economic value of caregiving in EU4 and UK is calculated by taking the summation of the respective economic value of caregiving in France, Germany, Italy, Spain, and United Kingdom.

Source: ACS Journals[51], WHO[18]

Appendix 4 Gaps in NCCPs

Figure 20. Proportion of Countries with a National Cancer Control Plan



Source: WHO NCD Country Capacity Surveys [52]

Since the 2010s, many countries have begun formulating plans to tackle cancer at the national level. The number of countries with a non-communicable disease (NCD) plan, policy, or strategy which includes cancer, or a standalone NCCP, has increased from 48% in 2001 to 92% in 2019. [53] However, when considering whether these plans are operational, the figure decreases to 80%. The distinction between a NCD plan and a NCCP also matters. Cancer plans subsumed under a general NCD plan usually focus less on that disease, with 41% of countries having only NCD plans. Countries with an NCCP generally performed better across the eight steps for cancer strategizing found in the WHO handbook on strategizing national health in the 21st century than those without. [54]

There are also opportunities to update NCCPs in some of the target countries such as China, Italy, and the United Kingdom– Italy did not have NCCPs since 2013 – while Germany did not specify years of coverage for its plan. Having an up to date NCCP is important in order to outline the most immediate priorities and programmes to effectively address the cancer burden.

[52] https://www.who.int/teams/ncds/surveillance/monitoring-capacity/ncdccs
[53] https://www.who.int/teams/ncds/surveillance/monitoring-capacity/ncdccs
[54] https://pubmed.ncbi.nlm.nih.gov/30268693/

Table 5. NCCPs in Target Countries

Country	Type of plan	Up to date?	Years of coverage
China	NCCP	No	2015-2017
France	NCCP	Yes	2021-2030
Germany	NCCP	Unspecified	Launched in 2017
Italy	NCCP	No	2010-2013
Spain	NCCP	Yes	2018-2023
United Kingdom	NCCP	No	2015-2020
United States of America	State-level CCP	Depends on State	Depends on State

Sources: ICCP (China [55], France [56]), bundesgesundheitsministerium (Germany [57]), ICCP Italy [58], Spain [59], United Kingdom [60], USA [61])

[55] https://www.iccp-portal.org/system/files/plans/China%E2%80%99s_cancer_prevention_and_treatment_three-year_action_plan_%282015-2017%29.pdf

[56] https://www.iccp-portal.org/system/files/plans/Feuille%20de%20route%20-%20strat%C3%A9gie%20d%C3%A9cennale%20de%20lutte%20contre%20les%20cancers.pdf

[57] https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/5_Publikationen/Praevention/Broschueren/Broschuere_Nationaler_Krebsplan.pdf

[58] https://www.iccp-portal.org/system/files/plans/Italy_National_Oncology_Plan_Summary_English.pdf

[59] https://www.iccp-portal.org/system/files/plans/plan-oncologico-euskadi-2018-2023.pdf

[60] https://www.iccp-portal.org/system/files/plans/Strategy%20-Final.pdf

[61] https://www.iccp-portal.org/map, USA selected as location

Appendix 5 NCCPs with a focus on elderly care

Table 6. Some countries with NCCPs that focus on elderly care

Country	Years of coverage	Clinical	Education	Research
Belgium	2008-2010	— Pilot geriatric oncology projects for hospitals aimed at optimising the care of elderly patients suffering from tumours with a view to creating units specialising in clinical geriatric oncology — Validate and adapt tools to evaluate the geriatric care of elderly patients suffering from cancer in order to predict those who will benefit the most from certain treatments and what types of treatment they will be able to tolerate		— Conduct clinical trials on treatment strategies tailored to elderly patients
France	2009-2013	— Improve care management of elderly cancer patients by creating 15 pilot coordination units in oncogeriatrics across 13 regions with the view of setting them up nationwide — Finalise the clinical study on the geriatric assessment tool (ONCODAGE) and expand its use beginning in 2011 — Develop recommendations for treatment strategies tailored to the elderly for cancers with the highest incidence, starting in 2010	— Publish and distribute to cancer organisations a booklet describing the statutory services relating to loss of autonomy among the elderly	— Carry out specific research projects in oncogeriatrics, particularly on treatment strategies and the use of new drugs with a target participation rate of 5% in elderly subjects (over 75 years) within five years
Ireland	2017-2026	— Appoint a National Clinical Lead in Geriatric Oncology to work with cancer centres to improve care of older patients; and utilise research studies and programmes to develop care pathways for older patients — Geriatric evaluation must be incorporated into oncology decision-making, in line with the core recommendation of the International Society of Geriatric Oncology	— Appoint a National Clinical Lead in Geriatric Oncology to coordinate education and training in geriatric oncology (both for medical and nursing oncology specialists) in collaboration with national training bodies — Geriatric oncology should be included in the core undergraduate nursing and medicine curricula as well as the teaching modules for both geriatric and oncology specialist trainees — National workshops jointly for oncology and geriatric trainees should be established and opportunities for participation in international fora should be promoted — National oncogeriatric training, as part of on-going continual	— Suggests that organisations such as Cancer Trials Ireland and the Irish Cancer Society might place more focus on improving research in the field of geriatric oncology

Country	Years of coverage	Clinical	Education	Research
			professional development, should also be formulated	
Italy	2010-2012	— Recognise Geriatric Oncology as a specialisation in the National Health System — Creation of Oncology-Geriatric Coordination Units with direct responsibility for the management of elderly patients and identification of diagnostic-therapeutic pathways that include services, oncology care and geriatric care both inside and outside the hospital	— Start information programs for citizens on healthcare delivery and prevention in elderly oncology patients	

Sources: epaac (Belgium [62], France [63]), National Cancer Strategy (Ireland [64]), epaac (Italy [65])

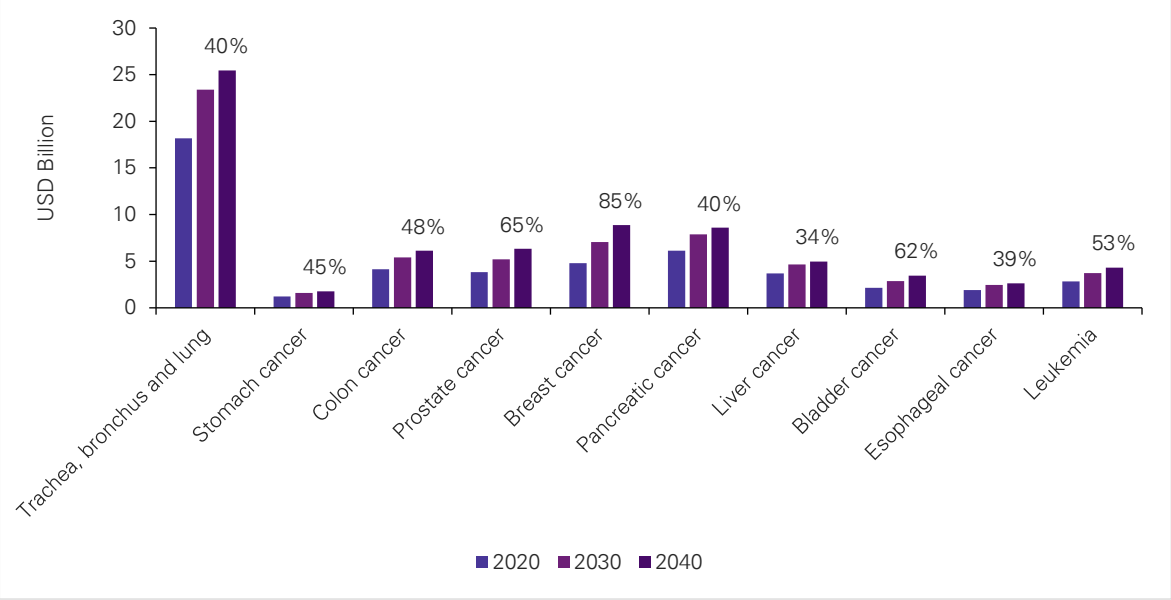
There are some countries which include cancer and ageing in their NCCPs, and these can be broadly categorised into clinical, education, and research policies. There are also several common policies in these countries: using geriatric assessments in clinical practice, training and educating cancer practitioners on geriatrics, and involving elderly patients in clinical trials.

[62] http://www.epaac.eu/from_heidi_wiki/Belgium_National_Cancer_Plan_2008-2010_English.pdf
[63] http://www.epaac.eu/from_heidi_wiki/France_National_Cancer_Plan_English.pdf
[64] https://assets.gov.ie/9315/6f1592a09583421baa87de3a7e9cb619.pdf
[65] http://www.epaac.eu/from_heidi_wiki/Italy_National_Oncology_Plan_Summary_English.pdf

Appendix 6 Economic Burden Avoided due to GA

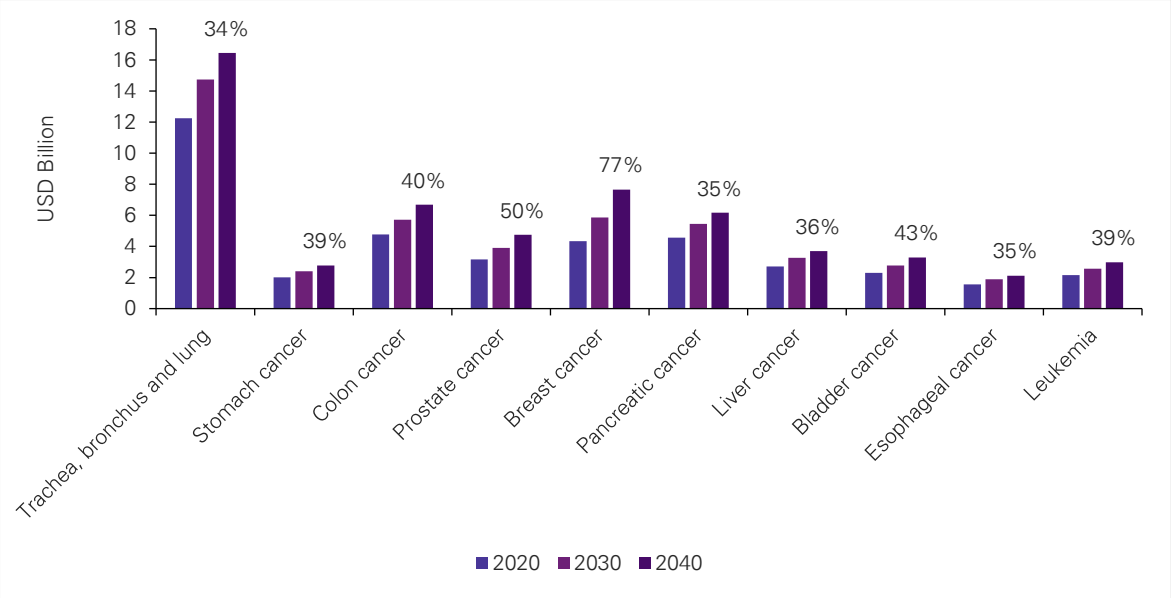
United States

Figure 21. US Economic Burden Avoided due to GA



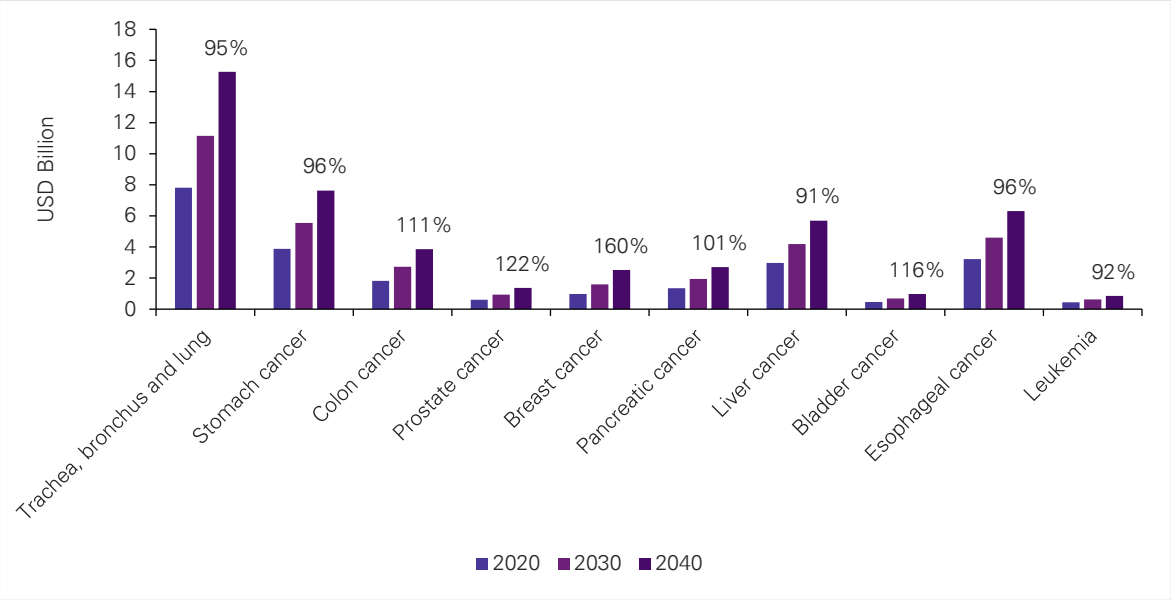
EU4 and UK

Figure 22. EU4 and UK Economic Burden Avoided due to GA



China

Figure 23. China Economic Burden Avoided due to GA



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