Supportive Care in Cancer (2020) 28:4645–4665
https://doi.org/10.1007/s00520-020-05620-9

REVIEW ARTICLE

Financial toxicity associated with a cancer diagnosis in publicly funded healthcare countries: a systematic review

Christopher J. Longo[1] · Margaret I. Fitch[2] · Laura Banfield[3] · Paul Hanly[4] · K. Robin Yabroff[5] · Linda Sharp[6]

Received: 2 April 2020 / Accepted: 7 July 2020 / Published online: 11 July 2020

Abstract

Purpose Financial toxicity related to cancer diagnosis and treatment is a common issue in developed countries. We seek to systematically summarize the extent of the issue in very high development index countries with publicly funded healthcare.
Methods We identified articles published Jan 1, 2005, to March 7, 2019, describing financial burden/toxicity experienced by cancer patients and/or informal caregivers using OVID Medline Embase and PsychInfo, CINAHL, Business Source Complete, and EconLit databases. Only English language peer-reviewed full papers describing studies conducted in very high development index countries with predominantly publicly funded healthcare were eligible (excluded the USA). All stages of the review were evaluated in teams of two researchers excepting the final data extraction (CJL only).
Results The searches identified 7117 unique articles, 32 of which were eligible. Studies were undertaken in Canada, Australia, Ireland, UK, Germany, Denmark, Malaysia, Finland, France, South Korea, and the Netherlands. Eighteen studies reported patient/caregiver out-of-pocket costs (range US$17–US$506/month), 18 studies reported patient/caregiver lost income (range 17.6–67.3%), 14 studies reported patient/caregiver travel and accommodation costs (range US$8–US$393/month), and 6 studies reported financial stress (range 41–48%), strain (range 7–39%), or financial burden/distress/toxicity among patients/caregivers (range 22–27%). The majority of studies focused on patients, with some including caregivers. Financial toxicity was greater in those with early disease and/or more severe cancers.
Conclusions Despite government-funded universal public healthcare, financial toxicity is an issue for cancer patients and their families. Although levels of toxicity vary between countries, the findings suggest financial protection appears to be inadequate in many countries.

Keywords Cancer · Financial burden · Lost income · Financial stress · Financial strain · Financial toxicity · Out-of-pocket costs

---

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00520-020-05620-9) contains supplementary material, which is available to authorized users.

✉ Christopher J. Longo
cjlongo@mcmaster.ca

Margaret I. Fitch
marg.i.fitch@gmail.com

Laura Banfield
banfie@mcmaster.ca

Paul Hanly
Paul.Hanly@ncirl.ie

K. Robin Yabroff
Robin.yabroff@cancer.org

Linda Sharp
Linda.Sharp@newcastle.ac.uk

[1] Health Policy and Management, DeGroote School of Business, McMaster University, Hamilton, Ontario, Canada

[2] Bloomberg Faculty of Nursing, University of Toronto, Toronto, Ontario, Canada

[3] Health Sciences Library, McMaster University, Hamilton, Ontario, Canada

[4] National College of Ireland, Dublin, Ireland

[5] Health Services Research, American Cancer Society, Atlanta, GA, USA

[6] Population Health Sciences Institute, Newcastle University Centre for Cancer, Newcastle University, Newcastle upon Tyne, UK

Introduction

The costs of cancer treatments have been steadily increasing and even in environments of publicly funded healthcare some of that burden is falling on patients and their families. Additionally, patients are often not able to maintain their full employment, resulting in decisions to reduce or stop working as a consequence of the cancer, its treatment, or associated side effects which limit the ability to work. Caregivers may also experience limited capability to work, further adding to the financial burden on the family.

In recent years, the term financial toxicity has been used to describe the "distress and hardship arising from the financial burden of cancer treatment" [1].

The issue of financial toxicity has become increasingly relevant for many developed countries. This is due in part to a number of changes in healthcare system factors including the increased costs of newer cancer therapies [2], the higher rate of healthcare-related debt for patients and their families in certain countries [3], and the impact on ability to work for both patients [4] and their caregivers [5]. As a consequence, patients and their families are experiencing high rates of financial burden from cancer diagnosis and its treatment across both public and private funding settings.

There has been a significant body of literature surrounding this topic, including systematic reviews in the USA [6–8] and Australia [9]. However, none of these reviews focused on publicly funded healthcare systems in very high development index countries. It might seem reasonable to assume that financial burdens in these publicly funded environments are much less than those that are experienced in countries with a strong private sector component, as these public schemes are typically designed to reduce the patients' financial burden associated with accessing healthcare. However, to date, this has not been investigated. In an effort to address this gap in knowledge, we examined the top 10 cancers globally (Globocan 2018: Global Cancer Observatory (http://gco.iarc.fr)) in very high development index countries to better understand these burdens; previous reviews have focused on all countries or predominately privately funded systems. The intent was to investigate the magnitude and extent of financial toxicity between these countries, and if some countries are managing patients' financial toxicity better than others.

Methods

The review was conducted and reported following the PRISMA systematic review in healthcare guidance [10].

Categories of financial burden

There are a number of terms related to this financial toxicity that have appeared in the literature that should be defined in order to be clear about what we are trying to measure, and what we are not trying to measure. Generally speaking, there are several categories of financial toxicity/burden. We considered *out-of-pocket costs (OOPC)*, income loss for patients and caregivers, travel and accommodation costs, and patient perceived stress/strain. For the purposes of this review, we are not focused on psychological adaption, insurance-based issues (except how it pertains to sub-populations of the other categories), or qualitative examinations. We sought to systematically identify studies which reported on the four categories of financial toxicity/burden, as stated above, from the perspective of patients and/or informal caregivers.

Generally, *OOPC* refers to patient expenditures related to their cancer treatment that are not reimbursed by government or insurers. This would typically include direct costs such as those for drugs, devices, homecare, complementary and alternative medicine, health professionals, hospital fees, and other related costs, and studies were eligible if they reported on any of these costs individually or OOPC overall. We note that one of the earliest references to this type of cost characterization was in relation to breast cancer patients' burden [11].

Income loss can result from reductions in hours or days of work, leave of absence, or early retirement, and can occur for the patient or for caregivers in order to provide care and support for the patient. Studies were eligible if they reported income loss in monetary terms, in time, or as a percentage of the sample with lost work.

Travel and accommodation costs can be included in OOPC or can be broken out or reported separately and include fares by taxi, train, plane, fuel costs when travelling by car, parking costs, or government reimbursement calculations based on specific reimbursement per kilometer per mile (imputed). We treated this separately from OOPC because some of these costs are imputed values rather than directly incurred OOP expenses. Studies were eligible if they reported travel costs separately or within OOPC.

Patient perceived financial stress, strain, and distress have a variety of definitions in the literature. Financial stress has been described as "… the impact of the cancer diagnosis on the ability of the household to make ends meet" and is an "objective" measure related to the costs incurred [12]. Financial strain in the cancer context has been defined as "…the impact on the individual" (or the household) and "… how (they) felt about the financial situation they were in" and is considered a more "subjective" measure of financial impact [12]. Financial distress is closely linked to financial toxicity as it represents the psychological response that patients have to the financial toxicity [8]. Studies reporting the frequency of any of these concepts were eligible for inclusion in the review.

Any of these categories of burden could be reported as weekly monthly, yearly, or multi-year.

Inclusion/exclusion criteria and outcomes

The overall review protocol was developed using the PROSPERO template (see Appendix B for details). In the screening process, studies were eligible if they included one or more than one of the 10 most common tumour types (namely lung, colorectal, breast, prostate, bladder, cervix uteri, stomach, esophagus, thyroid, and liver), and were conducted in a very high development index countries (Sources: World Health Organization: International Agency for Research on Cancer, cancer incidence list by tumour type for the world (http://gco.iarc.fr/today/explore) (Multibar option); (HDI country list 2018 http://hdr.undp.org/en/content/human-development-index-hdi)) with publicly funded universal healthcare. (Studies in the USA were therefore ineligible). We recognize that the term publicly funded healthcare can take a variety of forms including a National Health Service model, part of a social security system, or a mix of public and private systems; these different models have been examined in some detail by others [13]. We have not examined each of these types separately, but rather included countries where the dominant system is a public one regardless of model type.

We focused on full papers reporting quantitative studies which included those where the subjects were older than 18 years of age at the time of cancer diagnosis (no pediatric studies) because we wanted to focus on perspectives of working adult patients and/or their informal carers. Eligible studies could have a cross-sectional or prospective observational design. Those which assessed toxicity beyond 5 years post-diagnosis were excluded because the primary focus was on the impact of active treatment and its initial follow-up. Clinical trials were excluded to place the focus on the financial burden experienced by patients being managed in routine clinical care. Additionally, studies with less than 100 subjects were excluded because they are less likely to be generalizable. Only studies that reported on at least one of the following: out-of-pocket costs (OOPC); income loss for patients and carers; costs associated with travel to healthcare facilities; and patient perceived financial stress, strain, or distress were included. We excluded studies focused on qualitative examinations of financial hardship.

The main outcomes of interest were OOPC associated with co-payments or cash payments for medically related costs, and non-medically related support (e.g. family care), costs related to accommodations and travel, lost time from work for both patients and their carers, and financial stress/strain including decisions to forego care, loss of savings, and impact on future earning potential post-treatment. These could be weekly, monthly, yearly, or multi-year evaluations.

Searches

The search strategy was conceived and developed collaboratively between two authors (CJL and LB). Using a combination of keywords and database-specific controlled vocabulary, the search strategy incorporated the following concepts: cancer as defined by the top 10 reported adult cancers; financial toxicity including terminology related to financial burden; and patient' stress or burden on the individual and/or the caregiver. Eligible studies were peer-reviewed, published in English. They were first screened by title and then by abstract, and finally by full article, with the last two steps undertaken by two researchers. Individual searches were carried out in the following databases: Ovid Medline, Ovid Embase, Ovid PsycINFO, CINAHL, Business Source Complete, and EconLit. All searches encompass the publication period of January 1, 2005, through March 7, 2019. For an extract of the OVID Medline search, please see Appendix A. Our decision to use this timeframe was because other reviews have covered the period prior to 2005, and it becomes increasingly difficult to compare monetary costs over longer periods of time.

Screening

One reviewer (split across a team of 5) independently screened the titles, followed by two teams of two independent reviewers (CJL and MF; LS and PH) screening the abstracts and then full texts of papers identified as being potentially eligible for inclusion. Disagreements at each stage of screening were resolved through mechanisms within the Rayyan software, which allows blinded review and highlights where discrepancies in decisions occur (inclusion or exclusion). This facilitated discussions [14] among reviewers; if necessary, a third reviewer (LB or CJL) was consulted in the event that any remaining conflicts were unresolved.

Data abstraction

One reviewer (CJL) extracted data from eligible articles into a standardized data abstraction form that best fit our intended examination of included studies [15]. The team resolved any conflicts through discussion and, if necessary, a second reviewer (LB) resolved any discrepancies that persisted. Data abstracted included study characteristics, cancer patient characteristics, measures of OOPC, travel/accommodation costs, lost income, and stress/strain and toxicity. Details on country, year of study, study design, and comparison group (where applicable) were also abstracted. We finally categorized the outcomes into one (or more) of the four categories based on "quantitative" evidence in the paper.

All study outcomes for OOPC and travel/accommodation costs were presented in local currency and were inflated to

2018 values using the OECD Inflation chart (CPI) (https://data.oecd.org/price/inflation-cpi.htm#indicator-chart) based on enrollment dates for study patients. As a second step, in order to convert expenditures into a common currency and time frame to facilitate comparisons, we used the OECD purchasing power parity calculator (https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm) to adjust all currency values to $US/month for comparison purposes. Those studies that reported different outcomes (% change, odds ratios, etc.) were reported separately but not as a comparison between countries. Where studies reported factors associated with variation in financial burden, this information was also abstracted.

Quality appraisal

To assess the quality of eligible studies, we applied the QualStat checklist [16]. The authors' defined quality "in terms of the internal validity of the studies, or the extent to which the design, conduct and analyses minimized errors and biases" [16, pg. 2]. The checklist included 14 items with a range of elements deigned central to internal study validity. Scoring ranged from "yes" = 2, "partial" = 1 to "no" = 0 (with non-applicable items denoted "n/a"). A summary score for each paper was calculated by summing each criterion score across the 14 items and dividing by the total possible score. We selected a minimum threshold for inclusion of 60% given the broad range of financial topics under review and the consequent range in methodological quality.

Results

We identified 7303 citations between Jan 1, 2005, and March 7, 2019 (Embase 3620, Medline 2676, CIHAHL 536, Business Source Premier 269, PsychInfo 119, EconLit 83). After removing duplicates, we identified 7117 unique articles to include in our title review. Following title review, we eliminated all but 751 articles. Abstract review then identified 41 qualifying articles (39 studies). Full paper review eliminated an additional 9 articles. Hence, our final evaluation includes 32 articles [17–48], representing 30 studies, as shown in the PRISMA flow diagram (Fig. 1).

These studies came from Canada (7), Australia (6), Ireland (6), UK (2), Denmark (2), Germany (2), Finland (1), South Korea (1), France (1), Malaysia (1), and the Netherlands (1). Eighteen studies included breast cancer, 16 studies included colorectal cancer, 13 studies included prostate cancer, 7 studies included lung cancer, 4 studies included gastro-intestinal cancers, 2 studies included cervical cancer, and 1 included thyroid; the other cancer types were presented in two papers that included all cancers but did not break them out by tumour.

The most frequent categories of burden reported were as follows: Out of pocket costs (OOPC) (Table 1) 18 studies; income loss (Table 2) 18 studies; travel costs (Table 3) 14 studies; and toxicity/stress and strain (Table 4) 6 studies. Twenty-five studies reported financial burden from the perspective of patients, one from the perspective of caregivers, and four from both perspectives. In Tables 1 and 3 below, we have presented the "key findings" in their native currencies as reported in the paper but converted to $US 2018 when possible and appropriate for OOPC and travel costs to facilitate comparisons. In Tables 2 and 4, where possible, we reported the percentage of lost wages and percentage of those experiencing stress, strain, or distress as appropriate, again to facilitate comparisons.

Out of pocket costs

Most OOPC studies reported actual costs and the duration of observation varied from weekly to 2 years ($n = 18$). Some studies included travel ($n = 5$) in their OOPC, while others provided these as two categories and reported both separately. Some studies examined a single cancer type, while others examined multiple cancers; not all of these latter studies reported OOPC for each tumour type.

In addressing those OOPC studies that could be converted to 2018$US/month, and where travel costs were included ($n = 5$), the highest was in Ireland ($503; [32]) and the lowest, including travel costs, was in Australia ($271; [23]), where both studies included a variety of cancers (Table 1). In studies where travel costs were not included, the highest costs were $418/month in breast cancer in Canada [17] and lowest was $17/month in prostate cancer in Canada [27]. One study [29] also reported OOPC by stage of disease with values of US$183/month (stage 1), $219/month (stage 2), $247/month (stage 3), and $243/month (stage 4).

The remaining two studies reported data differently. Paul et al. [31] included the percentage of patients (in a variety of cancers) who found particular cost types that influenced decisions (11% for treatment costs) and Azzani [29] presented OOPC currency results but by stage of disease in colorectal cancer ($183 stage I, $219 stage II, $247 stage III $243 stage IV), although this was still converted to 2018$US.

Income loss

Income loss was most commonly presented as percentage change in the number of patients with reduced income due to reduced hours and/or days, time away, left work force, or retired ($n = 11$ studies). A few studies ($n = 7$) reported actual days lost or dollars of income lost.

In terms of those studies reporting percentage change, the highest income loss was for Australians predominantly with breast and colorectal cancers, with 67.3% of those employed

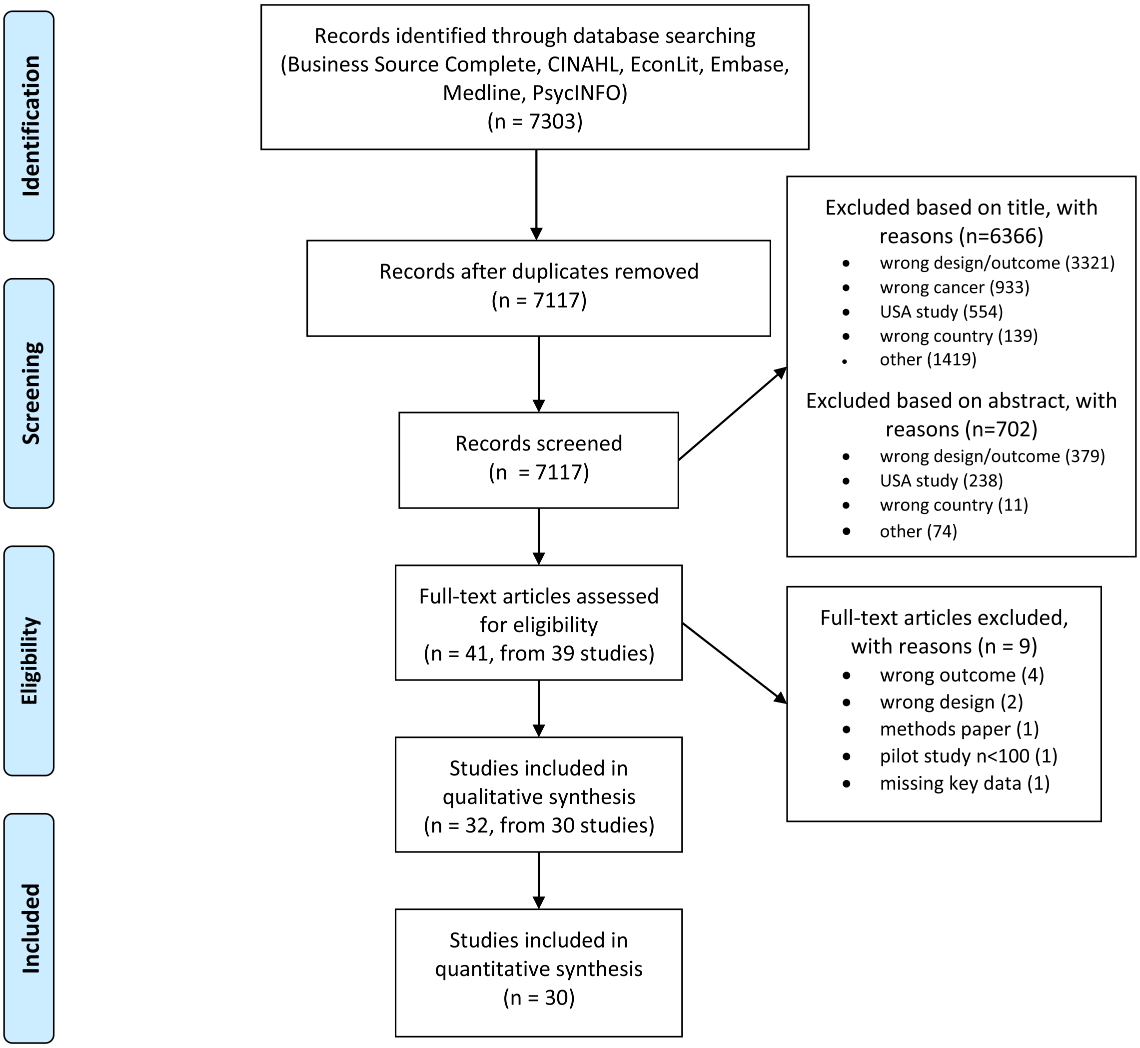

Fig. 1 PRISMA diagram

experiencing a change in employment status [31]. The lowest was in the UK (England, Wales, North Ireland, and Scotland) where only 18% of prostate cancer patients became unemployed or retired [44].

Of the studies which reported absolute losses, most ($n = 4$) focused on lost income of patients, and 2 studies included carers. An Australian study of 272 breast cancer patients reported a median loss of income AUS$5078 in the first 6 months and an additional AUS$1553 between 13 and 18 months [22], a Finnish study of 508 colorectal cancer patients and carers reported income loss ranging from €405 to €5078 depending on stage of treatment [41], a UK study reported breast/colorectal/prostate cancer caregiver's mean income loss of £70 [28], and a Malaysian study reported income loss for colorectal cancer patients in local currency between RM296 and RM1151 [29]. One Canadian study reported lost days of work as 12.6 days for patients and 7.0 days for caregivers per month across breast, colorectal, lung, and prostate cancers [18–20].

Travel and accommodation costs

Some studies only included fares and/or cost of fuel ($n = 3$) while at the other extreme, they included imputed costs related to wear and tear on personal vehicles using government reimbursement rates for travel per kilometer per mile ($n = 3$).

Across studies, the average travel (and accommodation) costs were US$139. The highest travel costs were from a Canadian study reporting US$393 per month for breast cancer; this included imputed costs for private car wear and tear [24]. The lowest was in the UK in a mix of breast, colorectal, and prostate cancers with a cost of US$8/month but does not include personal vehicle wear and tear costs [28].

Toxicity, stress, distress, and strain findings

We found that for financial strain (subjective financial burden), the lowest prevalence was 7% at 12 months after diagnosis for Australian colorectal cancer patients [42] and the

Table 1 Studies reporting OOPC (papers) $n = 18$ ($n = 20$)

Ref #	Author	Year publish	Sample characteristics	Country	Key findings	Mean cost per month (US$2018)
[17]	Butler	2006	77 breast, 30 lung, and 53 prostate patients (data 2003); CS	Canada	Annual per person expenditure by level of adjustment (good fair poor psychosocial adjustment) was: In breast ($n = 77$), $5511 (good), $4736 (fair), and $5594 (poor); in lung ($n = 30$), $5000 (good), $4353 (fair), and $4710 (poor); in prostate ($n = 53$), it was $1660 (good), $6170 (fair), and $1547 (poor). In the overall sample, $4230 (good), $5166 (fair), and $4498 (poor).	$485 breast $144 prostate $435 lung
[18–20]	Longo	2006 (2007, 2011)	Breast, colorectal, lung, and prostate patients and carers $n = 282$ (data 2003); RCO	Canada	Mean monthly OOPC was $213. It was observed that higher total expenditures (excluding travel) in those under 65 years of age (*t* test $287 vs. $115; $P = 0.0064$) and without insurance (*t* test $422 vs. $194: $P = 0.0432$). In the full sample, 4.5% found the financial burden “unmanageable”, and 15.2% found the burden “significant”.	$213 ALL $120 ≥ 65 years $300 < 65 years
[21]	Balnaeaves	2006	Breast patients ($n = 334$) (data 1998); RCS	Canada	Mean monthly cost per complimentary therapy (CT) was $20.61 (SD = 47.48). The mean monthly cost for patients using CT was $70.05 (SD 139.40). The majority of women spent less than $50 per month (~ 65% from graph).	$82
[22]	Gordon	2007	Breast patients $n = 272$ (data 2004); PL	Australia	Total weighted mean for costs over 18 months was $1781 (range $0–$43,727), with the greatest burden during the first 6 months ($1453, range $20–$31,440).	$236 (1–6 months) $97 (1–-18 months)
[23]	Gordon	2009	All cancer patients $n = 410$ (data 2007); CS	Australia	Average mean cost over 16-month period: GP visits $243 SD324, medical tests $869 SD875, support services $1275 SD1474, other services $1199 SD1645. Total (including travel) 4826 SD5852.	$271*
[24]	Lauzier	2011	Breast patients $n = 693$ (data 2003); PCS	Canada	Treatments over 4–5 weeks. For all women who received radiotherapy, the mean and median total net costs were $445 (SD, $407) and $311, respectively. On average, these costs represented 2% of the before-tax family income reported by women. The total net cost for women who lived away from home during treatments was twice as high as that for women who lived at home during treatments (mean SD, $804_$528 (median: $685) and $404_$369 (median: $294), respectively; 0.001).	$463* home $838* away
[25]	Housser	2013	Breast and prostate patients $n = 301$ (data 2009); CS	Canada	In the 3-month period before the survey, 18.8% of prostate and 25.2% of breast cancer patients had OOPC greater than $500. OOPCs consumed more than 7.5% of quarterly household income for 15.9% of prostate and 19.1% of breast cancer patients. Few patients (8.8% prostate, 15.3% breast) ever adopted any drug- or appointment-related cost-saving strategy. Few patients (< 10%) said OOPCs influenced treatment decisions. More patients told their physicians about their OOPCs (27.0% prostate, 21.1% breast) or were aware of available financial assistance programs (27.3% prostate, 36.9% breast). A larger proportion of prostate (56.0%) and breast (58.3%) cancer patients with high OOPCs said that those costs created stress.	$52 (prostate) $97 (breast)
[26]	Hanley	2013	Colorectal carers $n = 154$ (data 2010); CCS	Ireland	Mean weekly cost €393 (time cost 69%; 42% waiting/visiting and 26% travelling); spent €79/week on OOPC (18% of total costs) and €59 on travel (14% of total costs). The total economic burden of caring for colorectal cancer survivors in the first year of informal care cost was estimated as €29,842 per carer.	$472
[27]	Oliveira	2014	Prostate patients $n = 585$ (data 2006); RCS	Canada	Mean time costs $838/year and mean OOPC were $200/year representing 10% of income for those in lower income categories. Radical prostatectomy, younger age, poor urinary function, current androgen deprivation therapy,	$17

Table 1 (continued)

Ref #	Author	Year publish	Sample characteristics	Country	Key findings	Mean cost per month (US$2018)
					and recent diagnosis were significantly associated with increased likelihood of incurring any costs	
[28]	Marti	2016	Breast, colorectal, and prostate patients $n = 298$ (data 2012); PCS	UK	(Mean OOP expenses: $US40, 95% CI: $US15–$US65) (mean: £25, 95% CI: £9–£42). The distribution of costs was skewed with a small number of patients incurring very high costs. Measured over a 3-month period 12–15 months post-diagnosis.	$44
[29]	Azzani	2016	Colorectal patients $n = 138$ (data 2013); PL	Malaysia	The total 1-year patient OOPC (both direct and indirect) higher among later stage: RM 6544.5 (USD 2045.1) for stage I, RM 7790.1 (USD 2434.4) for stage II, RM 8799.1 (USD 2749.7) for stage III, and RM 8638.2 (USD 2699.4) for stage IV. The majority of patients (69% in last 6 months of treatment) perceived paying for their healthcare as somewhat difficult.	$183 stage I $219 stage II $247 stage III $243 stage IV
[30]	Sharp	2016	Breast and prostate patients $n = 698$ (data 2008); CS	Ireland	Three-quarters of the sample incurred some direct medical OOPC (mean = €1491, standard deviation = €4053); 87% experienced other cancer-related costs (mean = €1180, standard deviation = €7559) and 57% reported that their household bills had increased as a result of having cancer. (17 month average breast/prostate, personal communication L Sharp)	$123
[31]	Paul	2016	Breast, colorectal, and other patients and carers $n = 105$ (data NR); CS	Australia	Patient-stated factors that influenced treatment? Decisions: travel (14.5%), loss of income (13.7%), cost of treatment (10.9%), cost related to other carer responsibility (4.8%), and accommodation (2.0%).	% change, no $cost available
[32]	Collins	2016	Breast, gastro-intestinal, lung, and other patients $n = 151$ (data NR); RCS	Ireland	The median additional cost for each individual patient was €354 per month (range €4–€5149). The median total cost for the estimated complete duration of cancer therapy was €1138 per patient (range €21.60–€7089.84). The median total cost during treatment was €1617 for women, compared with €974 for men (Table 3), $p = xxx$. Monthly costs by category in Euros: Complementary and alternative medicine (55), fuel (31), other transport (25), parking (24), medications (19), and food (10).	$506*
[33]	O'Cella-echair	2017	Colorectal patients $n = 497$ (data 2009); RCS	Ireland	The average OOPC was €1589 (SD = €3827, median €638, inter-quartile range €100– €1450). Mean OOPCs for stage III disease were significantly higher than for those with other disease stages ($F = 5.34$, $p = 0.0212$). Those aged 70+ had a significantly lower mean OOPC than those < 70 (€1160 versus €1948) ($F = 5.27$, $p = 0.0221$). Those employed at diagnosis had a slightly higher OOPC than those who were not (€1963 versus €1367; $F = 2.81$, $p = 0.0943$). €133 per month	$196
[34]	Gordon	2018	Breast, colorectal, prostate, and other patients $n = 419$ (data 2011); RADE	Australia	Participants from the QSkin Sun and Health Study ($n = 43,794$) had a confirmed diagnosis of either melanoma, prostate, breast, colorectal, or lung cancer. These were matched to a general population group ($n = 421$) and a group of high users of GP services ($n = 419$). Medical fees charged and out-of-pocket medical expenses for Medicare services were analysed. Over 2 years, three-quarters of individuals with cancer paid up-front provider fees of up to A$20551 compared with A$10995 for the high GP user group and A$6394 for the general population group. OOPC were significantly higher for those with cancer (mean A$3514) compared with the high GP-user group (mean A$1837) and general population group (A$1245). Highest expenses were for therapeutic procedures (mean A$2062). Older individuals,	$117 Control 1 $61 Control 2 $45

Table 1 (continued)

Ref #	Author	Year publish	Sample characteristics	Country	Key findings	Mean cost per month (US$2018)
					those with poor perceived health or private health insurance had the highest costs.	
[35]	Newton	2018	Breast, colorectal, lung, and prostate patients $n = 400$ (data 2016); PCS	W. Australia	After a median 21 weeks post-diagnosis, participants experienced an average OOPE of AU$2179 (95% CI $1873–$2518), and 45 (11%) spent more than 10% of their household income on these expenses. Participants likely to experience higher total OOPE were younger than 65 years ($p = 0.008$), resided outside the South West region ($p = 0.007$) and had private health insurance (PHI) ($p < 0.001$).	$315*
[36]	Buttner	2019	Breast, cervical, gastro-intestinal, and lung patients $n = 502$ (data 2009); RCS	Germany	At baseline (t0), 502 cancer patients. The mean 3-month OOPPs were as follows: €205.8 at baseline, €179.2 at t1 (3 months after t0), and €148.1 at t2 (15 months after t0). Compared with the lowest income group (< €500 monthly), all other income groups (€500–999, €1000–1499, and ≥ €1500) had higher 3-month OOPPs of €52.3 ($p = 0.241$), €90.2 ($p = 0.059$), or €62.2 ($p = 0.176$). Financial burden at t0 was 6.4% (SD 9.2%) on average, 5.4% (SD 9.9%) at t1, and to 3.9% (SD 7.0%) of monthly income at t2.	$106

Sample characteristics: tumours for patients/carers, *n*, date data collected, study design: *CS*, cross-sectional; *PCS*, prospective cross-sectional; *RCS*, retrospective cross-sectional; *CSP*, cross-sectional postal; *CSC*, cross-sectional cohort; *PCO*, prospective cohort; *LC*, longitudinal cohort; *PL*, prospective longitudinal; *RCO*, retrospective convenience sample; *RADE*, Retrospective Administrative Data Extraction

*Include travel

highest was 39% in Ireland for colorectal cancer patients [30]; in that study, the levels of financial stress (objective burden) were even higher. One Denmark study reported on financial toxicity (based on the financial question in the EORTC QLQ-C30), which was reported by 22% of working patients and 27% of non-working patients, but did not specifically address financial stress and strain [46]. Finally, in the Irish colorectal cancer study, 49% of patients reported depletion of savings; with low savings, borrowing money, and loans from family/friends all increasing the risk of both financial stress and strain [47]. We note that the time since diagnosis varies across these studies as outlined in Table 4.

Quality appraisal

The quality review revealed studies to be of mid to high quality with a relatively high average score across the included literature of 87.1%. The scores ranged between 63.6% (36.4% prior to inclusion criteria threshold) and 100%. In terms of time period, the 2006–2010 sample scored lower (85.8%) than more recent papers published between 2011 and 2019 (87.5%). Older papers revealed a minimum score of 77.3% compared with 63.6% for newer papers suggesting that while the average methodological quality of papers was improving over time, the variability in that quality also grew. Details on the quality scores by study can be seen in Table 5.

While the sampled papers generally scored high across the literature, with 10 of the 11 criteria scored, on average, between 80.6 and 100%, a distinct weakness arose in relation to controlling for confounding in the sample. This criterion scored 48.4% with, on average, 32.2% of the literature in the sample either failing to control for confounding, or not reporting the attempt, generally in relation to their statistical models. The reporting of results criterion scored 2nd lowest at 80.6% indicating that deficiencies also arose in relation to cost presentation where full results were only reported for some outcomes making it difficult to assess the overall financial burden of the cancer under study. In some cases, this was likely due to a lack of comprehensive data collection. The remainder of the criteria was above 83.9% indicating a high level of quality across the majority of the papers.

Discussion

We identified a range of financial impacts related to OOPC, income loss, travel costs, and financial stress/strain/toxicity across eleven countries and ten cancer types in publicly funded healthcare systems. Although there is some evidence of financial toxicity across all jurisdictions, and evidence of significant amounts across some jurisdictions despite the public healthcare focus of the review, it is less clear that we have

Table 2 Lost income studies (papers), $n = 18$ ($n = 20$)

Ref #	Author	Year	Sample characteristics	Country	Key findings	% persons lost/change income
[18–20]	Longo	2006, 2007, 2011.	Breast, colorectal, lung, and prostate patients and caregivers $n = 282$ (data 2003); RCO	Canada	In terms of lost income among patients who were working, mean 12.6 days per month lost from work, additionally 35% of caregivers took time from work (averaging mean 7.0 days per month). As a percentage of family income, this represented 20.8% of income in the "unmanageable" group, and 15.0% in the "significant" group compared with just 3.9% in the "none" group and 6.3% in the "slight" group.	No percentage reported
[37]	Park	2007	Breast, bladder, colorectal, gastro-intestinal, liver, cervical, and other patients $n = 5396$ (data 2006); OPDC	S. Korea	Among the patients who were employed patients at the baseline, 47.0% lost their job over 72 months of follow-up and 25.9% lost their job within the first year12 months. This accounted for 55.1% of the total patients who lost their job. Among patients who lost their job within the first year (study patients at second baseline) 12 months, 30.5% were reemployed during within 69 months of follow-up. A number of factors influenced these results including age, type of job, income level, and cancer site.	55.1% over 72-month follow-up
[22]	Gordon	2007	Breast patients $n = 272$ (data 2004); PL	Australia	Lost income steadily declined with a median loss of $5078 (0–6 months) to a median of $1553 (13–18 months).	No percentage reported
[38]	Lauzier	2008	Breast patients $n = 459$ (data 2004); PCS	Canada	Across the sample, 0.4% stopped retired, 0.8% stopped other reasons (4 pts), of the remaining, 7.5% had no absence for more than 1 week, 1.8% reduced hours but not days, and 90.7% were absent from work more than 1 week. Most women had a single absence averaging 32.3 weeks (7.5 months). At 12 months, 21.6% were still not back at work	21% not back at work at 1 year
[39]	Ross	2011	Breast, gastro-intestinal, lung, prostate, and other patients $N = 598$ (data 2006); CS	Denmark	Of patients < 65, 63% had returned to work, but only 39% if diagnosed < 6 months earlier. Those between 6 and 12 months, 62–68% had returned to work in total sample, and 62–71% for breast cancer subgroup.	61% at 6 months 32% at 12 months 29% br at 12
[26]	Hanley	2013	Colorectal carers $n = 154$ (data 2010); CSC	Ireland	Mean weekly cost €393 (time cost 69%, 42% waiting/visiting, and 26% travelling). The total economic burden of caring for colorectal cancer survivors in the first year of informal care cost was estimated as €29,842 per carer. Note: Focus on caregivers rather than patients.	No percentage reported.
[40]	Muijen	2013	Cancer survivors $n = 131$ (data 2007); LC	Netherlands	Of the cancer survivors, 33 persons had less than 35%, 25 persons had between 35 and 80%, and 28 persons had over 80% loss of former wages earned, as assessed by the SSA at 24 months. Fourteen variables were found to be associated with the level of work disability at 24 months. These factors were related to sociodemographics, health characteristics, work-related characteristics, and return to work (RTW) expectations.	66% of sample lost a portion of their wages (86 of 131).
[41]	Farkikila	2015	Colorectal patients and carers $n = 508$ (data 2011); CSC	Finland	Lost productivity primary (€5098), rehab (€405), remission (€1130), metastatic (€4175), palliative (€4271). These productivity costs represent a combination of sick leave and early retirement effects.	Shows loss of income but not percentage

Table 2 (continued)

Ref #	Author	Year	Sample characteristics	Country	Key findings	% persons lost/change income
					Informal care costs over the 6 months were as follows: primary (€857), rehab (€99), remission (€232), metastatic (€2098), and palliative (€7184)	
[28]	Marti	2016	Breast, colorectal, and prostate carers *n* = 298 (data 2012); PCS	UK	The cost of informal care (mean: $US110, 95% CI: $US57–$US162) (mean: £70, 95% CI: £38–£102). The distribution of costs was skewed with a small number of patients incurring very high costs	Informal care costs but not percentage
[29]	Azzani	2016	Colorectal patients *n* = 138 (data 2013); PL	Malaysia	Average income loss as outpatient was RM 296 and as inpatient was RM 1151 and was highest in stages III and IV.	Lost income but not percentage
[31]	Paul	2016	Breast, colorectal, and other patients *n* = 105 (data NR); CS	Australia	Participants were employed prior to diagnosis; of these, only 32.7% reported no permanent change in employment status post-diagnosis**.** The most frequently reported permanent employment changes were reduced hours (23.1%), retirement (20.2%), and resigning or being unemployed (16.4%). The mean income reduction was 48.5% highest in lowest income quartile at 55.4% and lowest in 2nd and 3rd quartile at 2.8%.	67.3% had change in employment
[32]	Collins	2017	Breast, gastro-intestinal, lung, and other patients *n* = 151 (data NR); RCS	Ireland	At the time of the completion of the questionnaire, the majority (74%) of patients were not working. Fourteen (9%) patients were self-employed, of whom 7 (50%) were working during treatment. In contrast, only 19% of patients who were not self-employed (*n* = 137) reported to be working. Over half of all patients (53%, *n* = 80) did not consider anti-cancer therapy the reason for not working, however, of this group of respondents, 38% were retired and a further 35% were still working in some capacity.	50% of self-employed persons were no longer working
[42]	Gordon	2017	Colorectal patients *n* = 187 (data 2011); PCS	Australia	Middle-aged working cancer survivors who ceased or reduced work were more likely to report not being financially comfortable, compared with those who had continued work (adjusted prevalence ratio 1.66, 95% CI: 1.12, 2.44) at 12 months.	No percentage reported
[43]	Barbaret	2017	Advanced breast, colorectal, lung, and prostate patients *n* = 143 (data 2014); CS	France	Patients earning less than 15,000 euros a year had more FD (34 (64%)) than those earning more (36 (42%), $p = 0.013$). Before diagnosis, 76 (53%) patients were employed whereas only 37 (26%) were still employed after diagnosis.	49% of those working remained working (37/76)
[44]	Bennett	2018	Prostate patients *n* = 3913 (data 2016); CS	England, Wales, N Ireland, Scotland	Eighty-one percent of men in the EtoE, with 6.2% in EtoU and 11.4% in the EtoR groups. Men with stage IV disease (OR = 4.7 95% CI 3.1–7.0, relative to stage I/II) and reporting moderate/big bowel (OR = 2.5, 95% CI 1.6–3.9) or urinary problems (OR = 2.0, 95% CI 1.4–3.0) had greater odds of becoming unemployed. Other clinical (≥ 1 comorbidities, symptomatic at diagnosis) and sociodemographic (higher deprivation, divorced/separated) (living in Scotland or Northern Ireland (NI)) factors were predictors of becoming unemployed. Men who were older, from NI, with stage IV disease and with caring responsibilities had greater	17.6% either became unemployed or retired. Percentages were higher in more severe disease.

Table 2 (continued)

Ref #	Author	Year	Sample characteristics	Country	Key findings	% persons lost/change income
					odds of retiring early. Self-employed and non-white men had lesser odds of retiring early.	
[35]	Newton	2018	Breast, colorectal, lung, and prostate patients $n = 400$ (data 2016); PCS	W. Australia	Thirty-three percent of participants were working in a full- or part-time role, and 14% were self-employed. Nineteen percent of participants experienced a change in employment circumstances post-diagnosis.	41% of those working had a change in employment.
[45]	Arndt	2019	Breast, colorectal, and prostate patients $n = 1558$ (data 2011); CSP	Germany	Within a mean period since diagnosis of 8.3 years, 63% of all working-age cancer survivors initially returned to their old job and another 7% took up a new job. Seventeen percent were granted a disability pension, 6% were early retired (not cancer-related), 4% became unemployed, and 1% left the job market for other reasons. Resumption of work occurred within the first 2 years after diagnosis in 90% of all returnees. Cancer-related reduction of working hours was reported by 17% among all returnees and 6% quit their job due to cancer within 5 years past return to work. The probability of return to work was strongly related with age at diagnosis, tumour stage, education, and occupational class but did not differ with respect to the tumour site, gender, nor marital status	28% saw a decrease in their income
[46]	Pearce	2019	Colorectal, cervical, prostate, and thyroid patients $n = 2931$ (data 2016); LC	Denmark	Participants with diverse cancer types were included in the analysis with a mean age of 55 years (range 18 to 65). Nearly half (49%) of participants were employed at the time of the survey, and 22% reported financial toxicity. Those who were not employed were at greater risk of financial toxicity (27% vs 16%, $p < 0.001$), and this did not vary according to time since diagnosis. The odds of reporting financial toxicity were greater for participants who were male, younger, unmarried, with low education, low socioeconomic status, or without paid employment. Note that one-third (35%) reported changes in their work environment (such as retiring early, being retrained, or working fewer hours)	35% changed work environment

Sample Characteristics**:** tumours for patients/carers, *n*, date data collected, study design: *CS*, cross-sectional; *PCS*, prospective cross sectional; *RCS*, retrospective cross-sectional; *CSP*, cross-sectional postal; *CSC*, cross-sectional cohort; *PCO*, prospective cohort; *LC*, longitudinal cohort; *PL*, prospective longitudinal; *RCO*, retrospective convenience sample; *RADE*, Retrospective Administrative Data Extraction; *OPDC*, Observational Prospective Data Collection

comparable patient populations. However, it is clear that all of these countries have some evidence and varying frequency of financial toxicity with certain patient and disease characteristics increasing risk. Although there is some evidence that recent increases in costs of care [5], and changes in level of public coverage are exacerbating this issue [5], more details on these phenomena are still needed. Additionally, we might expect that differences observed are strongly influenced by the healthcare system structure (e.g. the co-pay or deductibles required, and the degree of privatization) and by social welfare provisions (e.g. extent of income replacement during sickness absence), which vary significantly across countries. In fact, we anticipated differences across countries specifically because of these types of factors. The relevant point here, from our

Table 3 Travel and accommodation studies (papers) $n = 16$ ($n = 14$)

Ref #	Author	Year	Sample characteristics	Country	Key findings	Mean cost per month (US$2018)
[18–20]	Longo	2006	Breast, colorectal, lung, and prostate patients and carers $n = 282$ (data 2003); RCO	Canada	Data from 2007b and 2011c is from same dataset. Mean monthly travel cost was $372.	$388
[23]	Gordon	2009	All cancer patients $n = 410$ (data 2007); PL	Australia	Average mean cost over 16-month period: Travel $3430 SD4889, accommodation $255 SD704 based on 410 complete surveys.	$209
[24]	Lauzier	2011	Breast patients $n = 693$ (data 2003); PCS	Canada	Travel costs over 4–5 weeks were transportation $377 (SD277), Parking $58 (SD40), meals $145 (SD278), and accommodations $387 (SD244) if living away. If living at home, transport $323 (SD333), park $53 (SD41), and meals $199 (SD135)	$393
[25]	Housser	2013	Breast and prostate patients $n = 301$ (data 2009); CS	Canada	Prostate cancer mean monthly patient travel costs over a 3-month period had mean $89.30, median $42.00, and SD$114.47; for prostate and breast cancer patients, had mean $102.73; for breast cancer patients, median $60.00, SD $102.15	$79 prostate $101 breast
[26]	Hanly	2013	Colorectal patients $n = 154$ (data 2010); CS	Ireland	Mean weekly cost €393 (time cost 69%; 42% waiting/visiting and 26% travelling); €59 on travel (14% of total). The total economic burden of caring for colorectal cancer survivors in the first year of informal care cost was estimated as €29,842 per carer. Note: Focus on caregivers rather than patients.	$352
[41]	Farkikila	2015	Colorectal patients $n = 508$ (data 2011); CSC	Finland	Travel costs over the 6 months varied: primary (€206), rehab (€59), remission (€37), metastatic (€335), palliative (€403).	$20 rehab $102 palliative
[28]	Marti	2016	Breast, colorectal, and prostate carers $n = 298$ (data 2012); PCS	UK	68.1% incurred travel cost with a mean $7.10 monthly cost (95% CI $4.90 to $9.20)	$8
[29]	Azzani	2016	Colorectal patients $n = 138$ (data 2013); PL	Malaysia	Travel costs averaged RM480 (USD150) for the year and were highest in stages III and IV.	$162
[30]	Sharp	2016	Breast and prostate patients $n = 698$ (data 2008); CSP	Ireland	Other costs (travel, parking, accommodation, over the counter meds) had 13% with no costs, 29.5% less than €230, 28.9% €231–€700, and 28.5% > €700	$19–58 in the middle spend category
[31]	Paul	2016	Breast, colorectal, and other patients $n = 105$ (data NR); CS	Australia	Patient-stated factors that influenced decisions: travel (14.5%)	Frequency only, cost in $AUD not provided
[32]	Collins	2016	Breast, gastro-intestinal, lung, and other patients $n = 151$ (data NR); RCS	Ireland	Recurring costs totaled a median of €160 (range €4–€864) each month, including transportation, childcare, complementary therapies, prescription medicines, and consumables. Total costs were greater for those who lived greater than 25 km away (€2015 vs €1078; $p = 0.00008$). €31 fuel, €25 alternate transport, €24 parking, €10 meals	$129 (fuel, transport, parking, meals)
[33]	O'Celleachair	2017	Colorectal patients $n = 497$ (data 2009); RCS	Ireland	The mean chemotherapy-related OOPC was €239 ($n = 172$; 35%) and for radiotherapy was €489 ($n = 56$; 11%). For the majority, these costs were comprised of payments for the parking and purchase of meals.	Travel accommodation large portion but value not reported
[35]	Newton	2018	Breast, colorectal, lung, and prostate patients $n = 400$ (data 2016); PCS	W. Australia	Total costs for all items relating to their diagnosis and accessing or receiving treatment (mean $AU2179, SD = $3077). The most commonly reported OOPEs were for surgery (61%), doctors' appointments (63%), and fuel (56%). Surgery and tests expenses accounted for the greatest proportion of total OOPE (22% and 20%, respectively). These were followed by accommodation (12%) and fuel (8%).	$79 (accommodation and fuel)

Table 3 (continued)

Ref #	Author	Year	Sample characteristics	Country	Key findings	Mean cost per month (US$2018)
[36]	Buttner	2019	Breast, cervical, gastro-intestinal, and lung patients $n = 502$ (data 2009); RCS	Germany	3-month travel costs categorized by monthly income were as follows: income < €500, mean €44.7(SD63.6); income €500–999, mean €78.7 (SD108); income €1000–1499, mean €78 (SD88); income > €1500, mean €88.6 (SD118.6)	$44 low Inc. $89 high Inc.

Sample Characteristics: tumours for patients/carers, *n*, date data collected, study design: *CS*, cross-sectional; *PCS*, prospective cross-sectional; *RCS*, retrospective cross-sectional; *CSP*, cross-sectional postal; *CSC*, cross-sectional cohort; *PCO*, prospective cohort; *LC*, longitudinal cohort; *PL*, prospective longitudinal; *RCO*, retrospective convenience sample; *RADE*, Retrospective Administrative Data Extraction

perspective, is that these health policy decisions have varying impacts on patients' and their families' financial burdens, but that all systems result in some degree of financial toxicity.

There are many ways to examine these findings, and in actuality, one of the biggest challenges is to decide how best to portray these financial burdens across the 30 studies identified. In one sense, the most efficient way to examine this is to look to the patient and determine their level of stress and strain or distress caused by the financial challenges (toxicity). Our identified studies present a range with a low strain of 7% 12 months after diagnosis for Australian colorectal cancer patients [42] and a high of 39% in Ireland for colorectal cancer patients [30] with levels of financial stress even higher. Although this is a broad range, even the 7% rate is of concern and certainly when numbers greater than a third of cancer patients experience financial strain, it suggests that the healthcare system is not able to fully support patients financially. It could be argued that this is not the role of governments, and with budget constraints, this is a fair argument. However, there should be a threshold for considering alternate strategies when a significant portion of the population is experiencing financial stress and strain related to their cancer treatment and follow-up. Some researchers have gone beyond these concepts to consider the psychological impact, the effect on overall well-being, and the need for better assessments of patients' overall ability to cope with these financial impacts to support vulnerable patients more effectively [49–51].

Any comparisons across countries are limited by differences across studies by patient cancer types, stage at diagnosis, and whether patients are in active treatment [18, 19] or follow-up care [27]. As we were unable to control for this heterogeneity, it is less clear whether one country fares better than another, but suffice it to say that the majority of studies (14/16), when examining patients in active treatment, have OOPC that exceed US$100/month with many having costs that exceed US$300 (5 of 16).

We observed variation in lost income by country. Differences could be a consequence of better income replacement programs funded through social welfare systems by government using, for example, partial compensation for income loss as in the Netherlands [40] or partial wage continuance as in Germany [45]. These social system factors likely account for much of the differences observed as disease treatments are not likely to vary significantly, so impact on ability to work should be similar. In any case, it is clear that income effects are common for patients and, as has recently been reported in another systematic review (de Boer et al., in press), these negative impacts on income may be evident years after the cancer diagnosis [48]. Much less appears to be documented around caregiver lost income with only a few of the studies examining this in a more focused way [28, 41].

Few studies examined travel costs separately, although several embedded travel costs into the OOPC totals. Larger geographies of some countries appear to show greater travel expenses (Canada and Australia). This is to be expected, especially considering the number or rural settings that exist in both countries where healthcare services for cancer may be unavailable locally [23, 24, 35]. As might be expected in each of these studies, those travelling greater distances to centres experienced higher travel costs. In this regard, comparing across countries is a challenge when examining travel costs when geographies vary both within a country and between countries, again making straightforward comparisons almost impossible.

We attempted to look at the top 10 cancers based on worldwide incidence; however, in fact, we found that specific studies within the top 10 that included analyses of the actual tumour type were limited for many with breast (18), colorectal (16), prostate (13), lung (7), GI (4) (which included stomach and esophagus), and cervix (2) identifying multiple studies. However, just one study each for bladder and thyroid cancers was identified, and a few additional studies listing other cancers (3) or all cancers (2) with no details on individual tumours, likely due to smaller sample sizes. Detail across tumour type was mostly limited to the top 8 cancers.

The three most commonly studied cancers were breast, colorectal, and prostate and, in many of these cases, a number of observations were made that mostly aligned between

Table 4 Financial stress, strain studies, $n = 6$

Ref #	Author	Year	Sample characteristics	Country	Key findings	% affected
[30]	Sharp	2016	Breast and prostate patients $n = 698$ (data 2008); CSP	Ireland	Of the respondents, 48% reported cancer-related financial stress and 32% cancer-related financial strain. Respondents were at least 3–24 months post-diagnosis. Compared with those employed at diagnosis, risk of cancer-related financial stress was significantly lower in those not working (RR = 0.71, 95% CI 0.58–0.86) or retired (RR = 0.48, 95% CI 0.34–0.68). It was significantly higher in those who had dependents, experienced financial stress pre-diagnosis, had a mortgage/personal loans, had higher direct medical out-of-pocket costs, and had increased household bills post-diagnosis.	48% stress 32% strain (3–24 months)
[42]	Gordon	2017	Colorectal patients $n = 187$ (data 2011); PCS	Australia	A higher proportion of workers with colorectal cancer reported financial strain (money shortage for living essentials) at 6 months (15%) but eased and was comparable with the control group at 12 months (7%).	15% strain (6 months) 7% (12 months)
[43]	Barbaret	2017	Advanced breast, colorectal, lung, and prostate patients $n = 143$ (data 2014); CS	France	Fifty one-percent of patients reported having FD and were on average 5.4 years post-diagnosis. Patients reported having FD were most likely to be younger (53.8% (16.7SD) versus 62% (10.5 SD), $p < 0.001$), single ((62%) versus (44%), $p = 0.03$), and had a breast cancer ((36%), $p = 0.024$). Patients with FD had a lower FACT-G score (59 versus 70, $p = 0.005$). FD decreased physical (14 versus 18, $p = 0.008$), emotional (14 versus 16, p = 0.008), and social wellbeing (17 versus 19, $p = 0.04$).	51% distress (5.4 years on average)
[11]	Sharp	2018	Colorectal patients $n = 493$ (data 2009); CSP	Ireland	Main focus financial stress and strain. Overall, 41% reported cancer-related financial stress and 39% cancer-related financial strain; 32% reported both financial stress and financial strain. Respondents were at 6–37 months post-diagnosis. After adjustment for sociodemographic and clinical variables, the odds of low health-related quality of life were significantly higher in those who reported cancer-related financial stress post-diagnosis compared with those who reported no change in financial stress post-cancer (OR = 2.54 (95% CI, 1.62–3.99)). The odds of low health-related quality of life were also significantly higher in those with worse financial strain post-diagnosis (OR = 1.73 (95% CI, 1.09–2.72)).	41% stress 39% strain 32% both (6–37 months)
[47]	Hanly	2018	Colorectal patients $n = 496$ (data 2010); CSP	Ireland	Respondents were at 6–37 months post-diagnosis. Depletion of savings (49.1%) was the most prevalent form of financial coping strategy. Factors significantly associated with increased objective stress were having a stoma (OR = 2.1; 95% CI, 1.1–3.9), using savings (OR = 9.4; 95% CI, 4.9–18.0), formally borrowing money (OR = 3.1; 95% CI, 1.0–9.6), and loans from family members/friends (OR = 3.8; 95% CI, 1.9–7.8). Not working (excluding retirees) (OR = 0.44; 95% CI, 0.20–0.96) was associated with decreased objective stress. Significant predictors of subjective strain included having dependents, a stoma, using savings (OR = 5.3; 95% CI, 2.9–9.5), and loans from family members/friends (OR = 2.0; 95% CI, 1.1–3.9) but excluded borrowing money	Stress and strain not reported as percent
[46]	Pearce	2019	Colorectal, cervical, prostate, and thyroid patients $n = 2931$ (data 2016); LC	Denmark	Nearly half (49%) of participants were employed at the time of the survey, and 22% reported financial toxicity. Participants were on average 3.7 years post-diagnosis (49% < 2 years; 26% 2–5 years; 19% 6–9 yeas; 6% > 9 years). Those who were not employed were at greater risk of financial toxicity (27% vs 16%, $p < 0.001$), and this did not vary according to time since diagnosis. The odds of reporting financial toxicity were greater for participants who were male, younger, unmarried, with low	22% toxicity working, 27% toxicity if not working (3.7 years on average)

Table 4 (continued)

Ref #	Author	Year	Sample characteristics	Country	Key findings	% affected
					education, low socioeconomic status, or without paid employment	

Sample characteristics: tumours for patients/carers, *n*, date data collected, study design: *CS*, cross-sectional; *PCS*, prospective cross-sectional; *RCS*, retrospective cross-sectional; *CSP*, cross-sectional postal); *CSC*, cross-sectional cohort; *PCO*, prospective cohort; *LC*, longitudinal cohort; *PL*, prospective longitudinal; *RADE*, Retrospective Administrative Data Extraction

countries. These commonalities included an increased financial burden (in most categories) for individuals with low income [18, 31, 37]; under retirement age (60–70 years) [18, 31, 35]; with more severe disease [29, 41, 44]; with shorter time since diagnosis [22, 27, 39]; without supplemental health insurance [18, 34]; and living further from cancer treatment centres [24, 32]. Each of these findings highlights that the disease and the time since diagnosis has a significant influence on the severity of the financial toxicity patients experience.

We should also compare these results with literature in a country; the USA has often been studied, where publicly funded healthcare is not the primary method of delivery. A recent US review of financial toxicity [6] suggests high rates of productivity loss although the difference is not that clear when comparing with publicly funded countries. Travel costs in the USA appear to be within the range observed in our publicly funded studies [6]. Differences in OOPC are evident; these are higher in the USA with monthly values ranging from $250–900/month when measured directly [6]. US data on financial stress (28–73%) and strain (16–32%) suggest that it is higher on average than that seen in publicly funded countries [8], although the effect for those under 65, hence not age-eligible for Medicare, is greater which mirrors that seen in the publicly funded countries. The rate of medical debt and/or bankruptcy was between 5 and 62% in the US studies [6] a number that although not well described in our identified studies are likely lower than that seen in the USA.

A 2015 systematic review has suggested that as the costs of healthcare increase, the burden on patients also increases both in cancer and in other diseases like cardiovascular disease and rheumatoid arthritis [52]. These costs are most likely to increase in the future, highlighting the urgency to address the financial gaps. Additionally, a recent ASCO abstract from late 2019 suggests that in specific cases, such as the use of tyrosine kinase inhibitors (TKIs) therapy for non-small cell lung cancer, the impact on patients' finances in the USA has also had a negative impact on patient outcomes [53].

This review identified a number of the gaps in the existing literature including a shortage of data relating to the 3–5-year period post-diagnosis; literature suggests that lost wages can persist up to 5 years in some patients [48] but little has been published on other aspects of the financial burden. A further limitation relates to the lack of research on the work impact for caregivers; only 5 studies captured any detail on this population. We also noted that there are a variety of ways to capture lost income or OOPC, suggesting that standardization of measures would be valuable to allow easier comparison across jurisdictions.

Lastly, how do we put these outcomes into the current context as cancer care continues to evolve? Will the increased price tags on cancer drugs result in higher OOPC for patients? Will the use of more oral agents result in a reduction in travel costs, but increase the rates of emergency department visits and admissions or other services? When new treatments are less toxic, will it allow patients to work longer hours or more frequently? Will the increase in care costs have an impact on insurance co-payments or strategies to minimize government and private payor burdens? What role might debt and bankruptcy have on perceived financial distress, and what influence might public systems play here compared with private systems? We are hopeful that this investigation therefore encourages others to address these unanswered questions and provide a more fulsome explanation of the current burden faced by patients in publicly funded healthcare systems.

Limitations, of this review

We recognize that "publicly funded healthcare systems" are not all the same, as differences between countries may be influenced by their structure, culture, and political differences, among other factors [13]. We do not attempt to tease out all these differences, but acknowledge their examination and the role they play could be examined in future research.

Although we attempted to standardize outputs, some studies were presented in a way that did not allow them to be compared. In these cases, we summarized the results but not for comparison purposes. Comparisons are a challenge due to a variety of factors, including year of study, time since diagnosis, mix of cancer types, severity of illness, average age, and included costs within categories. Despite these limitations, it is clear that partly due to differences in support systems for patients between countries, the financial burdens appear to differ. This difference is particularly stark when looking at income losses for patients and their informal carers.

Table 5 Quality assessment of sample literature on cancer-related financial toxicity (2006–2019)

Criteria	Butler et al. 2006	Longo et al. 2006	Balneaves et al. 2006	Gordon et al. 2007	Longo et al. 2007	Lauzier et at 2008	Park et al. 2008	Gordon et al. 2009	Lauzier et al. 2011	Longo et al. 2011	Hanly et al. 2013	Housser et al. 2013	Oliveira et al. 2014	Farkkila et al. 2015	Azzani et al. 2016
1. Question/objective sufficiently described?	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2
2. Study design evident and appropriate?	1	1	2	2	2	2	2	1	2	2	1	1	2	2	2
3. Method of subject/ comparison group selection or source of information/input variables described and appropriate?	1	2	2	2	2	2	1	1	2	2	2	1	2	2	2
4. Subject (and comparison group, if applicable) characteristics sufficiently described?	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
5. If interventional and random allocation was possible, was it described?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6 If interventional and blinding of investigators was possible, was it reported?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. If interventional and blinding of subjects was possible, was it reported?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	2	2	1	1	2	2	2	2	2	2	2	2	2		2
9. Sample size appropriate?	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2
	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2

Table 5 (continued)

10. Analytic methods described/justified and appropriate?																
11. Some estimate of variance is reported for the main results?	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2
12. Controlled for confounding?	1	0	0		0	1	1	2	0	2	2	1	0	1	2	0
13. Results reported in sufficient detail?	1	1	1		1	2	2	1	1	2	2	2	2	2	2	2
14. Conclusions supported by the results?	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2
Total score (out of 100)	*81.8*	*81.8*	*81.8*		*81.8*	*95.5*	*95.5*	*90.9*	*77.3*	*100.0*	*95.5*	*86.4*	*77.3*	*90.9*	*90.9*	*90.9*

Criteria	**Marti et al. 2016**	**Paul et al. 2016**	**Sharp et al. 2016**	**Barbaret et al. 2017**	**Collins et al. 2017**	**Gordon et al. 2017**	**O'Ceileachair et al. 2017**	**Bennett et al. 2018**	**Buttner et al. 2018**	**Gordon et al. 2018**	**Hanly et al. 2018**	**Lee et al. 2018**	**Sharp et al. 2018**	**Newton et al. 2018**	**Arndt et al. 2019**	**Pearce et al. 2019**
1. Question/objective sufficiently described?	1	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2
2. Study design evident and appropriate?	1	1	2	1	1	2	2	2	2	2	2	1	2	2	2	2
3. Method of subject/comparison group selection or source of information/input variables described and appropriate?	2	1	2	1	1	2	2	2	2	2	2	1	2	2	2	2
4. Subject (and comparison group, if applicable) characteristics sufficiently described?	2	2	2	1	1	2	2	2	2	1	2	1	2	2	2	2
5. If interventional and random allocation was possible, was it described?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. If interventional and blinding of investigators was possible, was it reported?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. If interventional and blinding of subjects was	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5 (continued)

possible, was it reported?																
8. Outcome and (if applicable) exposure measure(s) well defined and robust to measurement / misclassification bias? Means of assessment reported?	2	2	2	2	2	2	2	1	2	2	2	1	2	2	2	2
9. Sample size appropriate?	2	1	2	2	1	1	2	2	2	1	2	1	2	2	2	2
10. Analytic methods described/justified and appropriate?	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11. Some estimate of variance is reported for the main results?	2	2	2	2	1	1	2	1	2	2	2	1	2	2	2	2
12. Controlled for confounding?	0	1	2	0	0	0	1	1	1	2	2	2	2	1	1	1
13. Results reported in sufficient detail?	1	1	2	1	2	2	2	2	2	1	1	2	1	2	2	2
14. Conclusions supported by the results?	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total score (out of 100)	*77.3*	*77.3*	*100.0*	*72.7*	*63.6*	*81.8*	*90.9*	*86.4*	*95.5*	*86.4*	*95.5*	*72.7*	*95.5*	*95.5*	*95.5*	*95.5*

Key: 2, yes; 1, partial; 0, no; *NA*, not applicable. Italics represent overall agregate scores out of 100

Our attempt to standardize to $US2018/month for OOPC and travel costs is also less than ideal as CPI adjustments are for all goods and services within a country and in many cases, healthcare cost changes are slightly different from other goods. We used purchase price parity from OECD tables but again, this may not be the same for healthcare as the PPP values are for the net effect of all goods and services and may be slightly different for healthcare. However, we believe this gives us a better sense than leaving each result in its native currency and year making it much more difficult to compare.

Lastly, we used the “whole world” (WW) cancer top ten, rather than the “high development index” (HDI) list which differs with liver and esophageal (WW) replacing melanoma and uterine (HDI). We also note that the use of HDI itself has some limitations as “high development” does not necessarily mean a strong publicly funded healthcare system nor does it ensure a similar level of care when compared with other jurisdictions.

Limitations, in the existing research

It is clear from this review that an agreed upon standard for measuring each of these outcomes has not been determined; hence, part of our challenge is making valid comparisons. Although we did our best to compare findings across studies, we recognize that this comparison is less than optimal, and comparisons made here need to be interpreted cautiously. As an illustration, not all lost income was reported similarly, as those who experienced reduced hours of work or lost productivity were not always captured, and these types of losses may be higher in more severe disease and younger populations. Additionally, some of these studies summarized a variety of cancer types, different stages of disease, and different time duration since diagnosis and it is known that each of these factors has an impact on the treatments and services required and in the ability of patients to return to work. Since virtually none of the studies matches exactly for all of these variables, comparisons are difficult and unreliable and again should be interpreted with caution. Finally, financial stress and strain studies used different time frames from diagnosis which is likely to have an impact on the frequency of these states; it is also unclear whether these studies used consistent definitions for these concepts.

Conclusions

Although government funded public healthcare exists in many very high development index countries, financial toxicity is still common among cancer patients and caregivers. The evidence suggests that those with a shorter time since diagnosis [22, 27, 39], not currently working [46, 47], and with more severe cancers [29, 41, 44] have higher rates of financial toxicity, including stress and strain. The studies also reveal that the rate of financial toxicity varies between these countries and yet still translates into high rates of financial stress and strain in the countries studied in this review. We believe this suggests that the current financial protections in many countries with publicly funded healthcare are still inadequate and room for improvement still exists. In comparison with the USA, OOPC burden in countries with public healthcare is smaller, as are the rates of financial stress and strain, but no evidence for differences related to travel costs or lost income was identified. This review also highlights the need for additional research, including standardization of outcomes and questions around some of the gaps in coverage that occur in too many of these countries, especially as it relates to lost income that persists well beyond the cancer diagnosis and its treatment.

References

1. Zafar SY, Abernethy AP (2013) Financial toxicity, part I: a new name for a growing problem. Oncology (Williston Park) 27:80–149
2. Tran G, Zafar SY (2018) Financial toxicity and implications for cancer care in the era of molecular and immune therapies. Ann Transl Med 6. https://doi.org/10.21037/atm.2018.03.28
3. Reeves A, McKee M, Basu S, Stuckler D (2014) The political economy of austerity and healthcare: cross-national analysis of expenditure changes in 27 European nations 1995–2011. Health Policy 115:1–8. https://doi.org/10.1016/j.healthpol.2013.11.008
4. Torp S, Nielsen RA, Gudbergsson SB, Dahl AA (2012) Worksite adjustments and work ability among employed cancer survivors. Support Care Cancer 20:2149–2156. https://doi.org/10.1007/s00520-011-1325-3
5. Swanberg JE (2006) Making it work. J Psychosoc Oncol 24(3):1–18. https://doi.org/10.1300/J077v24n03_01
6. Altice CK, Banegas MP, Tucker-Seeley RD, Yabroff KR (2017) Financial hardships experienced by cancer survivors: a systematic review. JNCI J Natl Cancer Inst 109:djw205. https://doi.org/10.1093/jnci/djw205
7. Smith GL, Lopez-Olivo MA, Advani PG, Ning MS, Geng Y, Giordano SH, Volk RJ (2019) Financial burdens of cancer treatment: a systematic review of risk factors and outcomes. J Natl Compr Cancer Netw 17:1184–1192. https://doi.org/10.6004/jnccn.2019.7305
8. Carrera PM, Kantarjian HM, Blinder VS (2018) The financial burden and distress of patients with cancer: understanding and stepping-up action on the financial toxicity of cancer treatment. CA Cancer J Clin 68:153–165. https://doi.org/10.3322/caac.21443
9. Gordon LG, Merollini KMD, Lowe A, Chan RJ (2017) A systematic review of financial toxicity among cancer survivors: we can’t pay the co-pay. Patient 10:295–309. https://doi.org/10.1007/s40271-016-0204-x
10. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gotzsche PC, Ioannidis JPA, Clarke M, Devereaux PJ, Kleijnen J, Moher D (2009) The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ 339:b2700. https://doi.org/10.1136/bmj.b2700

11. Moore KA (1999) Breast cancer patients' out-of-pocket expenses. Cancer Nurs 22:389–396. https://doi.org/10.1097/00002820-199910000-00007
12. Sharp L, O'Leary E, O'Ceilleachair A, Skally M, Hanly P (2018) Financial impact of colorectal cancer and its consequences: associations between cancer-related financial stress and strain and health-related quality of life. Dis Colon Rectum 61:27–35. https://doi.org/10.1097/DCR.0000000000000923
13. Burau V, Blank RH (2006) Comparing health policy: an assessment of typologies of health systems. J Comp policy Anal Res Pract 8:63–76. https://doi.org/10.1080/13876980500513558
14. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A (2016) Rayyan—a web and mobile app for systematic reviews. Syst Rev 5:210. https://doi.org/10.1186/s13643-016-0384-4
15. Hayhurst KP, Leitner M, Davies L et al (2015) The effectiveness and cost-effectiveness of diversion and aftercare programmes for offenders using class A drugs: a systematic review and economic evaluation. Health Technol Assess 19:1–168, vii–viii. https://doi.org/10.3310/hta19060
16. Kmet L M, Lee R C, Cook L S (2004) Standard quality assessment criteria for evaluating primary research papers from a variety of fields. Edmonton: Alberta Heritage Foundation for Medical Research (AHFMR). AHFMR - HTA Initiative #13.
17. Butler L, Downe-Wamboldt B, Melanson P, Coulter L, Keefe J, Singleton J, Bell D (2006) Prevalence, correlates, and costs of patients with poor adjustment to mixed cancers. Cancer Nurs 29:9–16
18. Longo CJ, Fitch M, Deber RB, Williams AP (2006) Financial and family burden associated with cancer treatment in Ontario, Canada. Support Care Cancer 14:1077–1085
19. Longo CJ, Deber R, Fitch M et al (2007) An examination of cancer patients' monthly "out-of-pocket" costs in Ontario, Canada. J Cancer Care 16:500–507
20. Longo CJ, Bereza BG (2011) A comparative analysis of monthly out-of-pocket costs for patients with breast cancer as compared with other common cancers in Ontario, Canada. Curr Oncol 18:e1–e8
21. Balneaves LG, Bottorff JL, Hislop TG, Herbert C (2006) Levels of commitment: exploring complementary therapy use by women with breast cancer. J Altern 12:459–466
22. Gordon L, Scuffham P, Hayes S, Newman B (2007) Exploring the economic impact of breast cancers during the 18 months following diagnosis. Psycho-Oncology 16:1130–1139
23. Gordon LG, Ferguson M, Chambers SK, Dunn J (2009) Fuel, beds, meals and meds: out-of-pocket expenses for patients with cancer in rural Queensland. Cancer Forum 33:202–208
24. Lauzier S, Levesque P, Drolet M, Coyle D, Brisson J, Mâsse B, Robidoux A, Robert J, Maunsell E (2011) Out-of-pocket costs for accessing adjuvant radiotherapy among Canadian women with breast cancer. J Clin Oncol 29:4007–4013. https://doi.org/10.1200/JCO.2011.35.1007
25. Housser E, Mathews M, Lemessurier J et al (2013) Responses by breast and prostate cancer patients to out-of-pocket costs in Newfoundland and Labrador. Curr Oncol 20:158–165. https://doi.org/10.3747/co.20.1197
26. Hanly P, Ceilleachair AO, Skally M et al (2013) How much does it cost to care for survivors of colorectal cancer? Caregiver's time, travel and out-of-pocket costs. Support Care Cancer 21:2583–2592. https://doi.org/10.1007/s00520-013-1834-3
27. de Oliveira C, Bremner KE, Ni A et al (2014) Patient time and out-of-pocket costs for long-term prostate cancer survivors in Ontario, Canada. J Cancer Surviv 8:9–20. https://doi.org/10.1007/s11764-013-0305-7
28. Marti J, Hall PS, Hamilton P, Hulme CT, Jones H, Velikova G, Ashley L, Wright P (2016) The economic burden of cancer in the UK: a study of survivors treated with curative intent. Psycho-Oncology 25:77–83. https://doi.org/10.1002/pon.3877
29. Azzani M, Roslani AC, Su TT (2016) Financial burden of colorectal cancer treatment among patients and their families in a middle-income country. Support Care Cancer 24:4423–4432. https://doi.org/10.1007/s00520-016-3283-2
30. Sharp L, Timmons A (2016) Pre-diagnosis employment status and financial circumstances predict cancer-related financial stress and strain among breast and prostate cancer survivors. Support Care Cancer 24:699–709. https://doi.org/10.1007/s00520-015-2832-4
31. Paul C, Boyes A, Hall A, Bisquera A, Miller A, O'Brien L (2016) The impact of cancer diagnosis and treatment on employment, income, treatment decisions and financial assistance and their relationship to socioeconomic and disease factors. Support Care Cancer 24:4739–4746. https://doi.org/10.1007/s00520-016-3323-y
32. Collins DC, Coghlan M, Hennessy BT, Grogan L, Morris PG, Breathnach OS (2017) The impact of outpatient systemic anti-cancer treatment on patient costs and work practices. J Med Sci 186:81–87. https://doi.org/10.1007/s11845-016-1483-x
33. O'Ceilleachair A, Hanly P, Skally M et al (2017) Counting the cost of cancer: out-of-pocket payments made by colorectal cancer survivors. Support Care Cancer 25:2733–2741. https://doi.org/10.1007/s00520-017-3683-y
34. Gordon LG, Elliott TM, Olsen CM, Pandeya N, Whiteman DC, QSkin study (2018) Patient out-of-pocket medical expenses over 2 years among Queenslanders with and without a major cancer. J Prim Health 24:530–536. https://doi.org/10.1071/PY18003
35. Newton JC, Johnson CE, Hohnen H, Bulsara M, Ives A, McKiernan S, Platt V, McConigley R, Slavova-Azmanova NS, Saunders C (2018) Out-of-pocket expenses experienced by rural Western Australians diagnosed with cancer. Support Care Cancer 26:3543–3552. https://doi.org/10.1007/s00520-018-4205-2
36. Buttner M, Konig H-H, Lobner M et al (2019) Out-of-pocket-payments and the financial burden of 502 cancer patients of working age in Germany: results from a longitudinal study. Support Care Cancer 27:2221–2228. https://doi.org/10.1007/s00520-018-4498-1
37. Park J-H, Park E-C, Park J-H, Kim SG, Lee SY (2008) Job loss and re-employment of cancer patients in Korean employees: a nationwide retrospective cohort study. J Clin Oncol 26:1302–1309. https://doi.org/10.1200/JCO.2007.14.2984
38. Lauzier S, Maunsell E, Drolet M, Coyle D, Hebert-Croteau N, Brisson J, Masse B, Abdous B, Robidoux A, Robert J (2008) Wage losses in the year after breast cancer: extent and determinants among Canadian women. J Natl Cancer Inst 100:321–332. https://doi.org/10.1093/jnci/djn028
39. Ross L, Petersen MA, Johnsen AT, Lundstroem LH, Carlsen K, Groenvold M (2012) Factors associated with Danish cancer patients' return to work. A report from the population-based study "The Cancer Patient's World.". Cancer Epidemiol 36:222–229. https://doi.org/10.1016/j.canep.2011.06.001
40. van Muijen P, Duijts SFA, van der Beek AJ, Anema JR (2013) Prognostic factors of work disability in sick-listed cancer survivors. J Cancer Surviv 7:582–591. https://doi.org/10.1007/s11764-013-0297-3
41. Farkkila N, Torvinen S, Sintonen H et al (2015) Costs of colorectal cancer in different states of the disease. Acta Oncol 54:454–462. https://doi.org/10.3109/0284186X.2014.985797
42. Gordon LG, Beesley VL, Mihala G, Koczwara B, Lynch BM (2017) Reduced employment and financial hardship among middle-aged individuals with colorectal cancer. J Cancer Care:26. https://doi.org/10.1111/ecc.12744
43. Barbaret C, Brosse C, Rhondali W, Ruer M, Monsarrat L, Michaud P, Schott AM, Delgado-Guay M, Bruera E, Sanchez S, Filbet M (2017) Financial distress in patients with advanced cancer. PLoS One [Electronic Resource] 12:e0176470. https://doi.org/10.1371/journal.pone.0176470
44. Bennett D, Kearney T, Donnelly DW, Downing A, Wright P, Wilding S, Wagland R, Watson E, Glaser A, Gavin A (2018)

Factors influencing job loss and early retirement in working men with prostate cancer-findings from the population-based Life After Prostate Cancer Diagnosis (LAPCD) study. J Cancer Surviv 12: 669–678. https://doi.org/10.1007/s11764-018-0704-x
45. Arndt V, Koch-Gallenkamp L, Bertram H, et al (2019) Return to work after cancer. A multi-regional population-based study from Germany
46. Pearce A, Tomalin B, Kaambwa B, Horevoorts N, Duijts S, Mols F, van de Poll-Franse L, Koczwara B (2019) Financial toxicity is more than costs of care: the relationship between employment and financial toxicity in long-term cancer survivors. J Cancer Surviv 13:10–20. https://doi.org/10.1007/s11764-018-0723-7
47. Hanly P, Maguire R, Ceilleachair AO, Sharp L (2018) Financial hardship associated with colorectal cancer survivorship: the role of asset depletion and debt accumulation. Psycho-Oncology 27:2165–2171. https://doi.org/10.1002/pon.4786
48. Jeon S-H (2017) The long-term effects of cancer on employment and earnings. Health Econ 26:671–684. https://doi.org/10.1002/hec.3342
49. Timmons A, Gooberman-Hill R, Sharp L (2013) “It’s at a time in your life when you are most vulnerable”: a qualitative exploration of the financial impact of a cancer diagnosis and implications for financial protection in health. PLoS One 8:e77549. https://doi.org/10.1371/journal.pone.0077549
50. Ruger JP (2012) An alternative framework for analyzing financial protection in health. PLoS Med 9:e1001294. https://doi.org/10.1371/journal.pmed.1001294
51. Moreno-Serra R, Millett C, Smith PC (2011) Towards improved measurement of financial protection in health. PLoS Med 8: e1001087. https://doi.org/10.1371/journal.pmed.1001087
52. Azzani M, Roslani AC, Su TT (2015) The perceived cancer-related financial hardship among patients and their families: a systematic review. Support Care Cancer 23:889–898. https://doi.org/10.1007/s00520-014-2474-y
53. Goulart BHL, Unger JM, Chennupati S et al (2019) Effect of high patient out-of-pocket (OOP) cost for oral tyrosine kinase inhibitors (TKIs) on survival in EGFR and ALK positive stage IV non-small cell lung cancer (NSCLC). JCO 37:3–3. https://doi.org/10.1200/JCO.2019.37.27_suppl.3