

A systematic literature review of reviews related to the impacts of catastrophic health expenditures related to cancer care



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Background

- Cancer care poses a substantial burden to patients and their families, and it is often not covered by national healthcare systems and health insurance.
- In 2019, the global prevalence of neoplasms was 6,273 per 100,000 patient population¹ with expectations of continual growth and an increase in financial strain to the global population.²
- Catastrophic health expenditures (CHEs) are a globally recognised key performance indicator to assess the direct impact of out-of-pocket (OOP) expenditures on the financial ability of households caring for patients to maintain their subsistence needs.
- The World Health Organization (WHO) uses a threshold of 10% or 25%^{3,4} as a global metric to indicate when OOP expenditures are considered “catastrophic”.
 - A CHE of more than 40% of household consumption is considered a risk to a household’s “financial protection” and is the CHE definition used by the WHO Regional Office for Europe.⁴
- The WHO lists the reduction of CHEs as a key sustainable development goal (SDG) to improve global health.⁴
- CHE is a reported function of the proportion (%) of OOP medical expenses (M) incurred after non-monetary (NM) expenses have been deducted from one’s income (C);⁴ CHE=M/C-NM.
- Although a substantial body of literature on CHE in cancer care has been published, the global prevalence has yet to be determined.

Research question:

- This systematic literature review (SLR) aims to characterise the prevalence and quality of evidence on reported levels of CHEs experienced by patients with cancer and their households, worldwide.

Methods

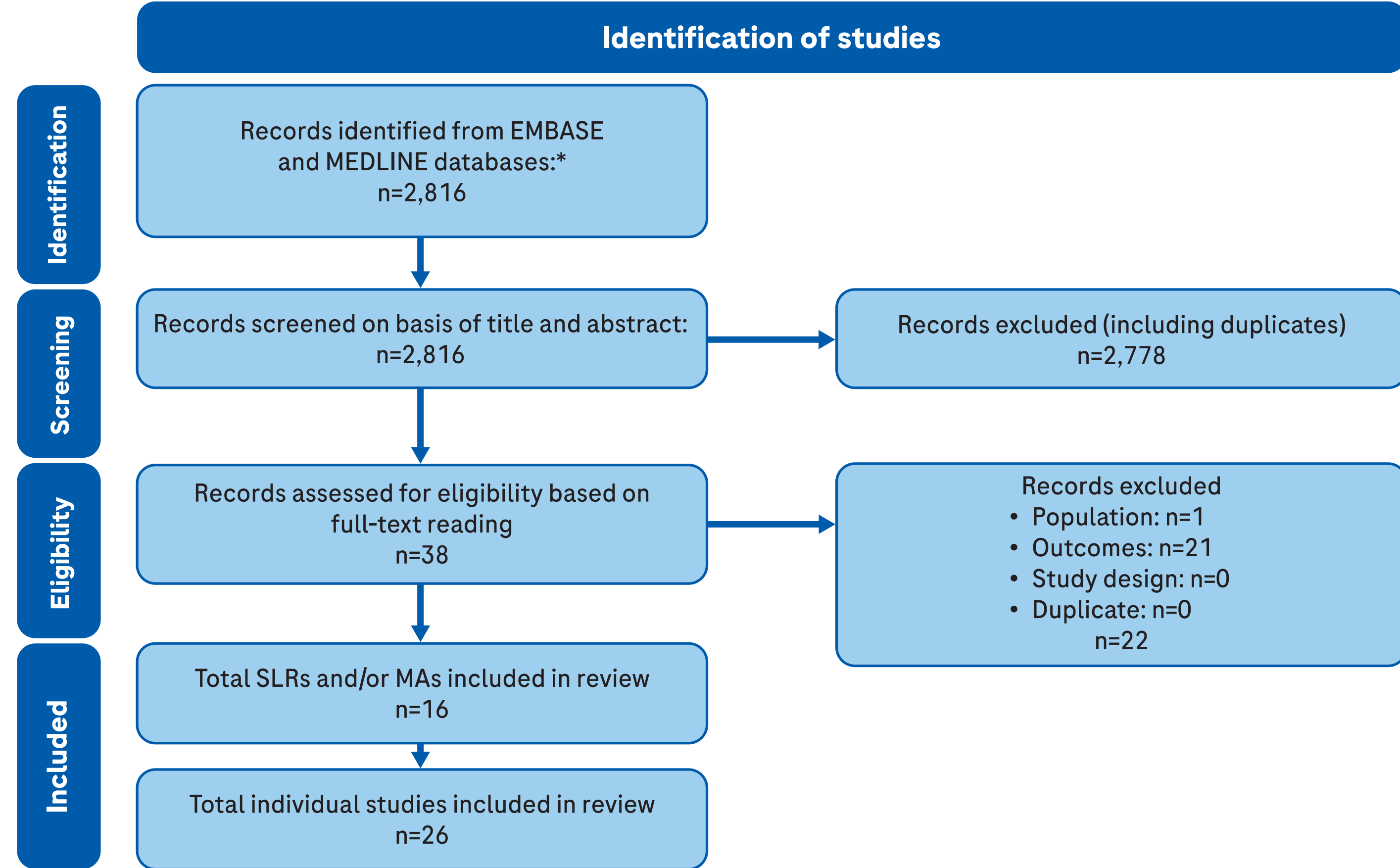
- A search for existing SLRs and/or meta-analyses (MAs) reporting on CHEs in EMBASE and MEDLINE was completed on 29 November 2022 and registered in PROSPERO (CRD42023404560).⁵
- The study selection process consisted of two key steps.
 - Abstracts and titles of records identified from the literature searches were reviewed in Abstrackr⁶ (key search terms can be found in the **Supplementary Materials**).
 - During title and abstract review, each publication was assessed for inclusion or exclusion by an independent reviewer, and 10% of the records were validated by a second independent reviewer.
 - Full-text versions of these studies underwent a more detailed examination to determine the final list of included studies.
 - All full-text versions were reviewed by two independent reviewers, and a third reviewer resolved any ensuing discrepancies.
- All records were judged for inclusion or exclusion based on the predefined Population, Intervention, Comparison, Outcomes and Study (PICOS) criteria (**Supplementary Table 1**).
- Quality assessment of the included SLRs and/or MAs was conducted using the AMSTAR 2⁷ checklist (**Supplementary Table 2**), which assesses critical domains and results in a confidence rating for the results of a review as critically low, low, moderate or high.
- From the included SLRs and/or MAs, individual studies reported within the SLRs that adhered to PICOS criteria were selected for data extraction; duplicates were excluded.
- Data extraction of the individual studies included the following elements: author details, year of publication, country, type of cancer, time frame, study design, sample size, disease pathway, CHE threshold, and the proportion of the population succumbing to the CHE threshold.

Results

- The search strategy captured 2,816 studies from the EMBASE and MEDLINE databases, which were selected for first-level screening. After exclusion based on titles and abstracts, 38 studies were included for full-text second-level screening. A further 22 studies were excluded according to PICOS criteria.
- A total of 16 SLRs and/or MAs reporting on 26 individual studies focusing on CHE were included (**Figure 1**).
- Four of the 16 SLRs also performed MAs but the study selection did not adhere to the PICOS criteria, so these MAs were not included in this report.
- The AMSTAR 2 quality assessment of the 16 included SLRs and/or MAs revealed that the majority of the studies had critically low quality* (**Supplementary Table 2**).
- The majority of the 26 individual studies focused on the Asia-Pacific (APAC, n=18) geographic region, with a few reporting on oncology patients within North America (NA, n=6); a single study was reported in both Latin America (LATAM, n=1) and Europe, the Middle East and Africa (EMEA, n=1) regions (**Figure 2**);
 - Population-level CHE was most often reported for unspecified cancer populations (n=16). However, there were several disease-specific studies, including breast (n=4), cervical (n=1), colon (n=1), colorectal (n=2), head and neck (n=1), lung (n=1) and pancreatic cancer (n=1).
 - The sample sizes ranged from 61–47,992 patients (**Supplementary Table 3**).

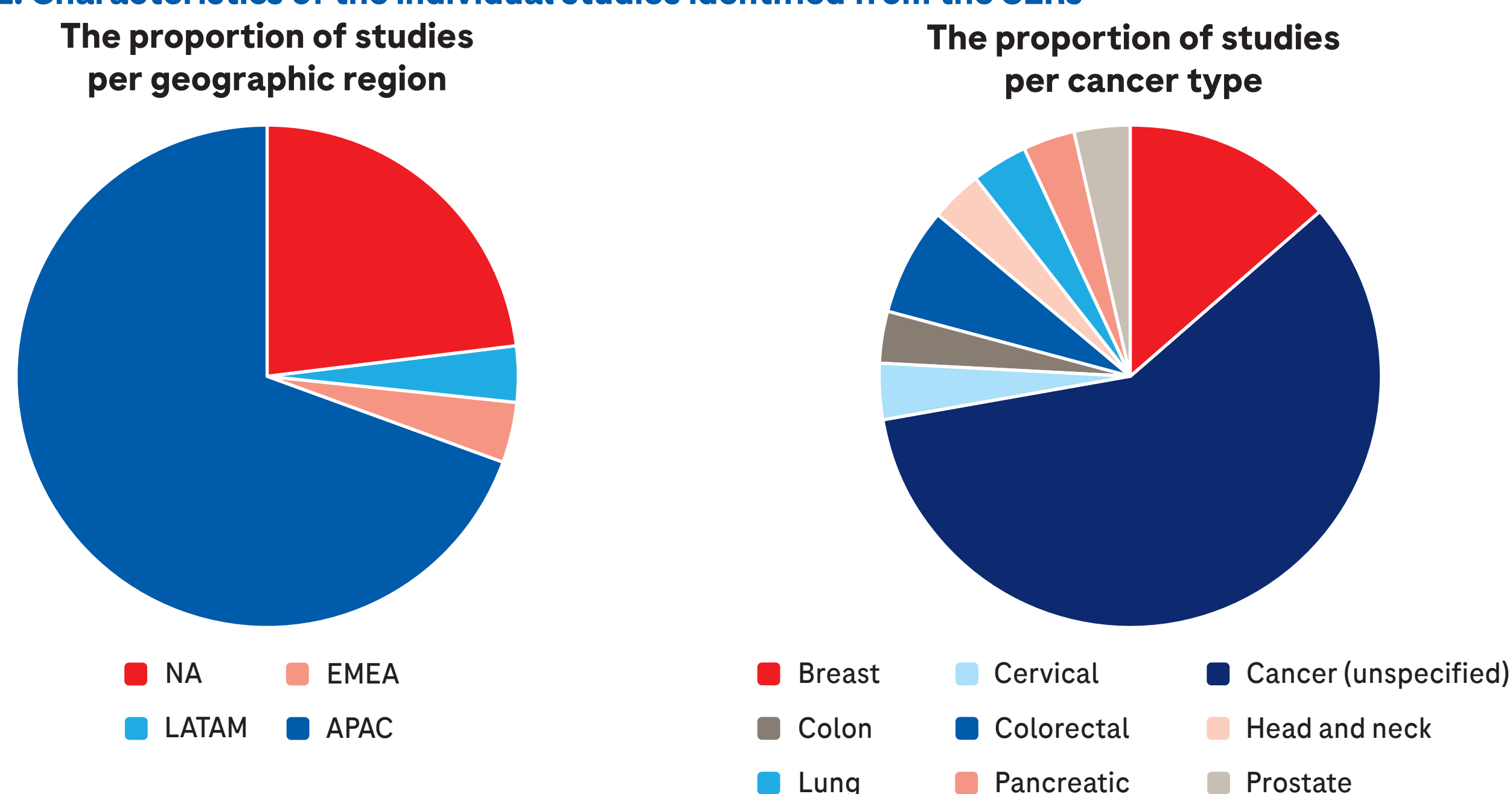
*The reviews included more than one critical flaw with or without non-critical weaknesses and did not provide accurate and comprehensive summaries of the available studies.

Figure 1. PRISMA



*A list of the key search terms used to identify the included records can be found in the **Supplementary Materials**.

Figure 2. Characteristics of the individual studies identified from the SLRs

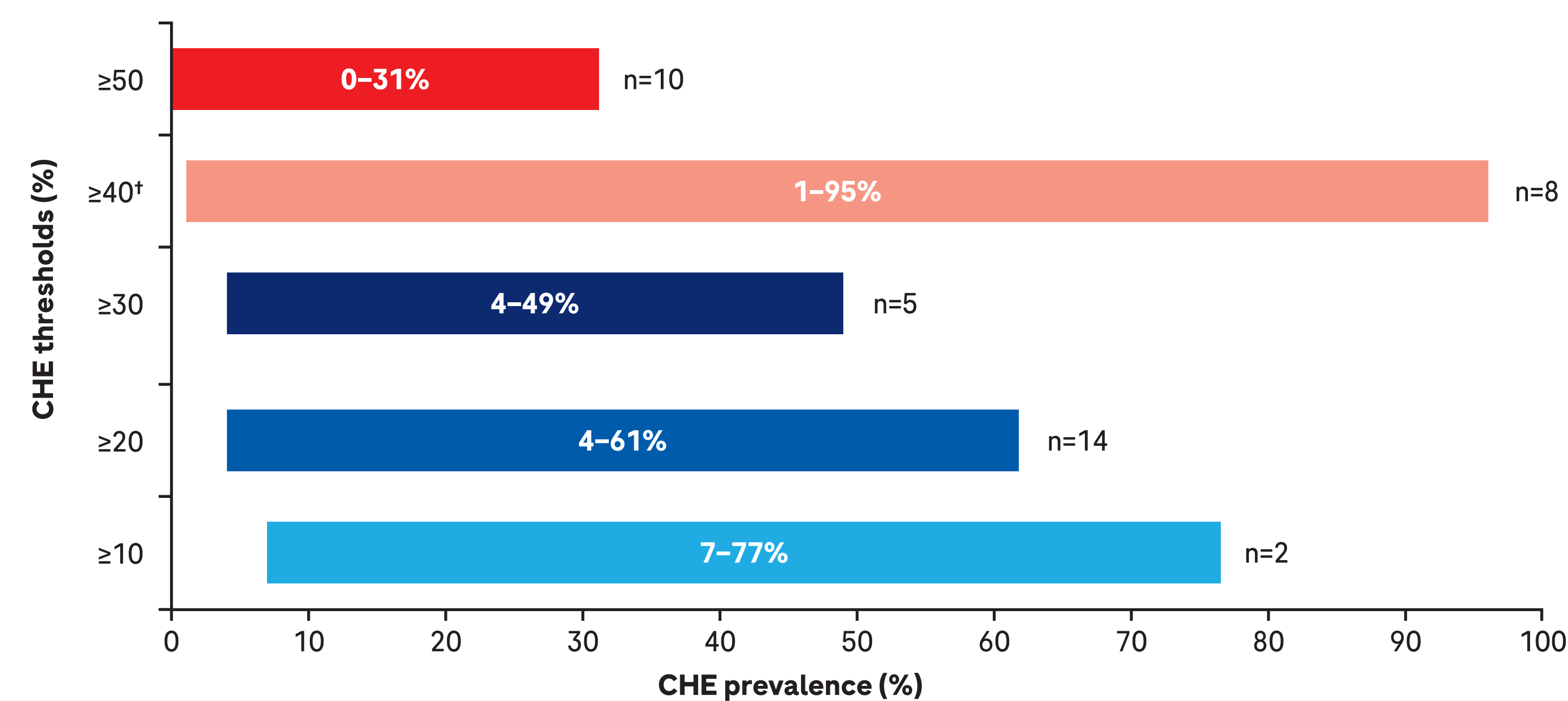


• Please see **Supplementary Table 3** for more information.

Results

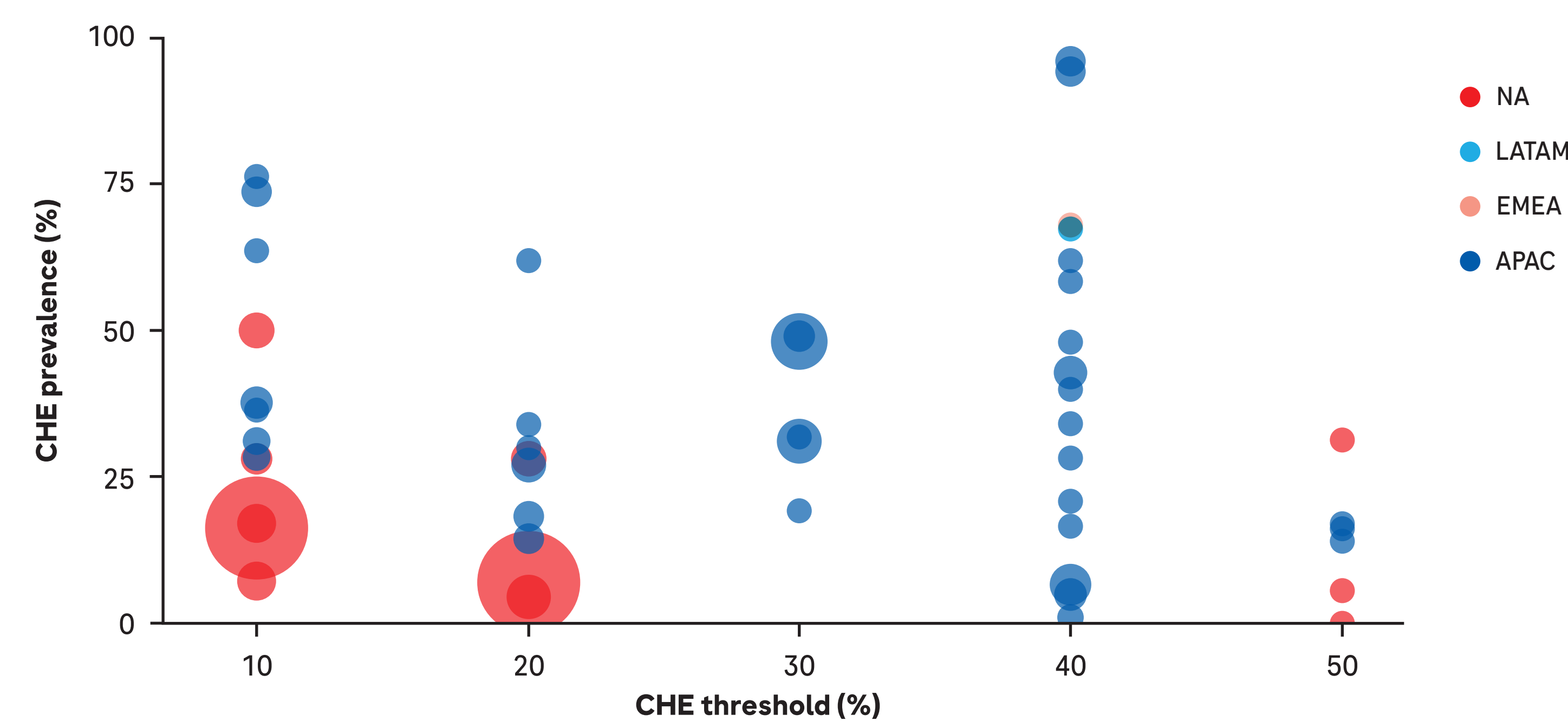
- The reported time frames assessing income and expenditure varied from 1 week to 1 year, and in some cases covered until the end of radiotherapy and/or post-operative treatment only.
- The treatment pathways for patients with cancer included in the individual studies were often unclear. Studies that reported time frames, most often referred to the start time as the “time of diagnosis”.
- Several studies identified CHE thresholds at 10%, 20%, 30%, 40% and 50% (**Figure 3** and **Supplementary Table 4**).
- The prevalence of households incurring OOP expenditures with the current thresholds for CHEs varied.
 - In 11 of the 14 individual studies where the CHE threshold was defined as ≥40%, the prevalence of CHE amongst households caring for patients with cancer was more than 30% (**Figure 4** and **Supplementary Table 4**).

Figure 3. Prevalence range of CHE* reported by the individual studies



*There is great variation in CHE definitions across the individual studies. *The WHO Regional Office for Europe defines CHE as expenditure ≥40%.¹

Figure 4. Prevalence of CHE per region per threshold reported by the individual studies



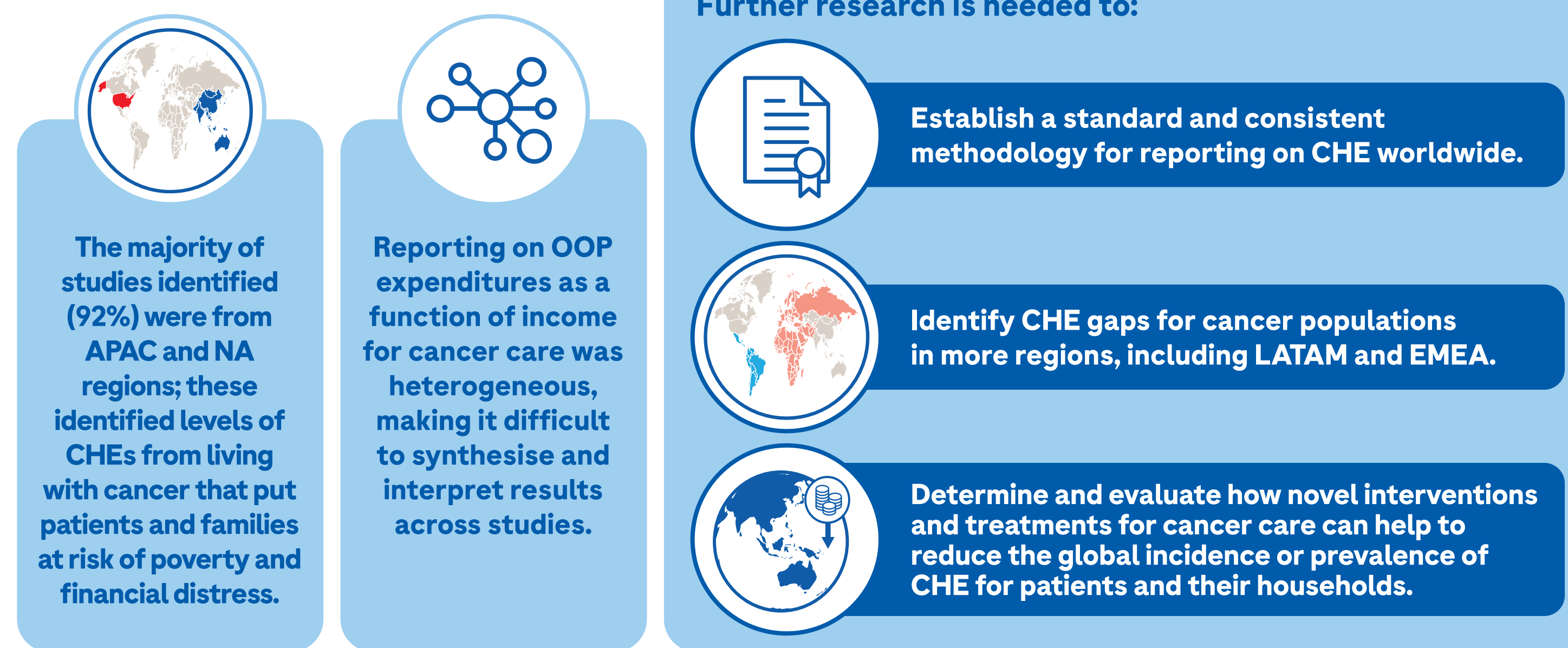
• Please see **Supplementary Table 4** for more information.

Limitations

- All SLRs and/MAs included were of low or critically low quality.*
- Studies used various definitions of CHE thresholds and few specified the included patients’ disease stage and/or expense time frame. These would be expected to strongly impact healthcare expenditure.
- There is heterogeneity in reporting across the individual studies included in the SLRs. Publications included in this review varied in definitions of CHE, making it difficult to generalise conclusions across all studies and countries.
- The definition of OOP healthcare expenditure varied among studies, with a considerable number not clearly defining healthcare expenditure.
- The study did not explore the impact of the inflation of medical costs over time or national health coverage on OOP cancer care.
- The SLRs were limited to studies in English-speaking countries and would benefit from the inclusion of studies from non-English-speaking countries.

*The reviews included more than one critical flaw with or without non-critical weaknesses and did not provide accurate and comprehensive summaries of the available studies.

Conclusions



Abbreviations

AMSTAR 2, A MeaSurement Tool to Assess systematic Reviews, revised; C, income; APAC, Asia-Pacific; CHE, catastrophic health expenditure; EMEA, Europe, the Middle East and Africa; LATAM, Latin America; M, medical expenses; MA, meta-analyses; NA, North America; NM, non-monetary expenses; OOP, out of pocket; PICOS, Population, Intervention, Comparison, Outcomes and Study; SLR, systematic literature review; WHO, World Health Organization.

Acknowledgements

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Supplementary material

Supplementary Table 1. PICOS inclusion and exclusion criteria

	Inclusion	Exclusion
Population	Cancer	Non-cancer
Intervention	Not applicable	Not applicable
Comparator	None	Not applicable
Outcomes	Primary (traditional): ¹ CHE thresholds (%) Proportion (%) experiencing CHE (%) based on CHE thresholds	Non-CHE outcomes – HCRU Non-CHE outcomes – CEA Non-CHE outcomes – Cost consequence Non-CHE outcomes – Clinical Non-CHE outcomes – Psychosocial Non-CHE outcomes – BOI Non-CHE outcomes – Socioeconomic factors
Study design	Peer-reviewed SLRs and/or MAs	Empirical studies (e.g. surveys, RCTs, observational studies), non-systemic SLRs, review papers

Key search terms used to identify the included records

The following search terms were used to identify 2,816 records for inclusion from EMBASE and MEDLINE databases:

‘neoplasm*’:ab,ti OR ‘cancer’:ab,ti OR ‘neoplasm’/exp OR ‘malignant neoplasm’/exp

AND

‘systematic review’/exp OR ‘systematic review’ OR ‘metaanalysis’/exp OR ‘meta analysis’ OR (systematic AND (‘review’/exp OR ‘review’ OR ‘review’/it)) OR ‘catastrophic health expenditure’/exp OR ‘out of pocket cost’/exp OR ‘out of pocket expenditure’/exp OR ‘out of pocketexpense’/exp OR ‘poverty level’/exp OR ‘health insurance’/expOR ‘cost’/exp OR ‘copayment’/exp OR ‘out of pocket’:ab,ti OR coinsurance:ab,ti OR deductible*:ab,tiOR copay*:ab,ti OR ‘catastrophic expense*’:ab,ti OR (‘out of pocket’ NEAR/2 cost*):ab,ti OR (transport* NEAR/2 cost*):ab,ti OR (travel* NEAR/2 cost*):ab,ti OR (caregiv* NEAR/2 cost*):ab,ti OR (‘care giv*’ NEAR/2 cost*):ab,ti

AND

‘systematic review’/exp OR ‘systematic review’ OR ‘metaanalysis’/exp OR ‘meta analysis’ OR (systematic AND (‘review’/exp OR ‘review’ OR ‘review’/it))

NOT

‘animal’/exp NOT ‘human’/exp OR ‘book’/exp OR ‘book’ OR ‘conference paper’/exp OR ‘conferencepaper’ OR ‘editorial’/exp OR ‘editorial’ OR ‘letter’/exp OR ‘letter’OR ‘note’/exp OR ‘note’ OR book:it,pt OR ‘edited book’:it,pt OR ‘case report’:it,pt OR ‘case reports’:it,pt OR comment:it,pt ORconference:it,pt OR editorial:it,pt OR letter:it,pt OR news:it,ptOR note:it,pt OR proceeding:it,pt

Supplementary Table 2. AMSTAR 2 quality assessment of the included SLRs

SLR authors	Publication year	Region	Funding	Relevant studies within the SLR	MA included	AMSTAR 2 quality score
Altice et al. ²	2017	Global	National Cancer Institute K01 Career Development Grant	5 of 45	No	Critically low
Boby et al. ³	2016	APAC	Not reported	5 of 22	No	Critically low
Bordonaro et al. ⁴	2021	Global	None	3 of 32	No	Critically low
Bygrave et al. ⁵	2021	APAC	None	1 of 19	No	Critically low
Chakrabarty et al. ⁶	2017	APAC	None	1 of 6	No	Critically low
Dhankhar et al. ⁷	2021	APAC	Not reported	4 of 23	Yes	Low
Doshmangir et al. ⁸	2021	Global	Tabriz Health Services Management Research Center at Tabriz University of Medical Sciences	18 of 33	Yes	Low
Doshmangir et al. ⁹	2020	EMEA	Tabriz University of Medical Sciences	1 of 53	Yes	Low
Gordon et al. ¹⁰	2017	Global	None	4 of 25	No	Low
Hanratty et al. ¹¹	2007	Global	UK Medical Research Council (Special Training Fellowship in Health of the Public Research)	2 of 20	No	Critically low
Iragorri et al. ¹²	2021	Global	None	27 of 105	No	Critically low
Jaspers et al. ¹³	2015	Global	Not reported	3 of 64	No	Critically low
Longo et al. ¹⁴	2020	Global	Not reported	5 of 30	No	Critically low
Parker et al. ¹⁵	2022	Global	PhD stipend from Monash University Department Scholarship	1 of 20	No	Critically low
Smith et al. ¹⁶	2019	NA	The University of Texas MD Anderson Cancer Center Duncan Family Institute for Cancer Prevention and Risk Assessment NCI Cancer Center Support Grant	1 of 74	Yes	Critically low
Valtorta, Hanratty. ¹⁷	2013	Global	NIHR Career Development Fellowship	3 of 35	No	Critically low

Critically low quality: The reviews revealed more than one critical flaw and did not provide accurate and comprehensive summaries of the results.

Low quality: The reviews had one critical flaw and may not have provided accurate and comprehensive summaries of the results.

Supplementary Table 3. Overview of the individual studies identified from the SLRs

Individual study	Region	Country	Disease	Sample size
Azzani et al. (2017) ¹⁸	APAC	Malaysia	Colorectal cancer	138
Banthin, Bernard (2006) ¹⁹	NA	USA	Colon cancer	47,992
Basavaiah et al. (2018) ²⁰	APAC	India	Pancreatic cancer	98
Chauhan et al. (2019) ²¹	APAC	India	Head and neck cancer	447
Choi et al. (2014) ²²	APAC	South Korea	Cancer	211
Choi et al. (2015) ²³	APAC	South Korea	Cancer	3,684
Davidoff et al. (2012) ²⁴	NA	USA	Cancer	1,868
Emanuel et al. (2000) ²⁵	NA	USA	Cancer	988
Guy et al. (2015) ²⁶	NA	USA	Cancer	4,271
Houts et al. (1984) ²⁷	NA	USA	Cancer	139
Jagsi et al. (2018) ²⁸	NA	USA	Breast cancer	2,502
Jain et al. (2016) ²⁹	APAC	India	Breast cancer	221
Kavosi et al. (2014) ³⁰	EMEA	Iran	Cancer	245
Kim, Kwon (2015) ³¹	APAC	South Korea	Cancer	617
Lee, Yoon (2019) ³²	APAC	South Korea	Cancer	1,380
Leng et al. (2019) ³³	APAC	China	Cancer	792
Mahal et al. (2004) ³⁴	APAC	India	Cancer	881
Newton et al. (2018) ³⁵	APAC	Australia	Breast, lung, colorectal and prostate cancer	400
O'Neill et al. (2015) ³⁶	LATAM	Haiti	Breast cancer	61
Rajpal et al. (2018) ³⁷	APAC	India	Cancer	274
Singh et al. (2020) ³⁸	APAC	India	Cervical cancer	248
The Action Study Group (2015) ³⁹	APAC	Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam	Cancer	4,584
The Action Study Group (2017) ⁴⁰	APAC	Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Vietnam	Cancer	9,513
Tripathy et al. (2016) ⁴¹	APAC	India	Cancer	1,093
Zhao et al. (2016) ⁴²	APAC	China	Cancer	318
Zheng et al. (2018) ⁴³	APAC	China	Cancer	1,344

Supplementary Table 4. CHE thresholds and prevalence reported by the individual studies

Individual study	Time frame	Disease pathway	CHE threshold definition	CHE prevalence per threshold	
Azzani et al. (2017) ¹⁸	1 year	From diagnosis	Colorectal cancer management expenditure/non-food expenditure ≥40%	≥40%: 47.8%	
Banthin, Bernard (2006) ¹⁹	1 year	Unclear	Healthcare expenditure/ tax-adjusted household income ≥10% and ≥20%	≥10%: 16.0%	≥20%: 6.7%
Basavaiah et al. (2018) ²⁰	First hospital visit until post-operative recovery	From diagnosis	OOP healthcare expenditure/ annual household income ≥10%	≥10%: 76.5%	
Chauhan et al. (2019) ²¹	Until end of radiotherapy treatment	From diagnosis	OOP treatment cancer expenditure/ non-food household consumption ≥40%	≥40%: 34.0%	
Choi et al. (2014) ²²	1 year	Unclear	OOP healthcare expenditure/ (subsistence expenditure - household food expenditure) ≥40%	≥40%: 39.8%	
Choi et al. (2015) ²³	1 year	Unclear	OOP direct healthcare expenditure/ (subsistence expenditure - household food expenditure) ≥40%	≥40%: 6.2%	
Davidoff et al. (2012) ²⁴	2 years	From diagnosis	OOP direct healthcare expenditure/ annual household income ≥10% and ≥20%	≥10%: 49.9%	≥20%: 27.6%
Emanuel et al. (2000) ²⁵	~6 months	Terminal	OOP healthcare expenditure/ annual household income ≥10%	Low care need ≥10%: 17.0%	High care need ≥10%: 28.0%
Guy et al. (2015) ²⁶	1 year	Cancer survivors	OOP healthcare expenditure/ annual household income ≥20%	≥20%: 4.3%	
Houts et al. (1984) ²⁶	1 week	Unclear	Indirect healthcare expenditure/ weekly income ≥50%	≥50% income dependent: <\$10,000: 31.0% \$10,000-\$20,000: 16.0% \$20,000-\$30,000: 5.0% >\$30,000: 0%	
Jagsi et al. (2018) ²⁸	1 year	From diagnosis	OOP healthcare expenditure/ annual household income & OOP indirect non-medical expenditure/ annual household income ≥10%	≥10%: 17.0%	≥10%: 7.0%
Jain et al. (2016) ²⁹	Unclear	From diagnosis	OOP healthcare expenditure/ non-food household consumption ≥40%	≥40%: 84.0%	
Kavosi et al. (2014) ³⁰	Unclear	Unclear	Healthcare expenditure/ (subsistence expenditure - household food expenditure) ≥40%	≥40%: 67.9%	
Kim, Kwon (2015) ³¹	Unclear	Unclear	OOP healthcare expenditure/ annual household income ≥10% and ≥20%	2009: ≥10%: 28.6% ≥20%: 14.6%	2010: ≥10%: 31.0% ≥20%: 18.2%
Lee, Yoon (2019) ³²	1 year	Unclear	OOP hospital expenditure/ household non-food consumption ≥10%, ≥20% and ≥40%	≥10%: 37.2%	≥20%: 26.9% ≥ 40%: 4.7%
Leng et al. (2019) ³³	Unclear	Terminal	OOP healthcare expenditure/ household income ≥40%	Rural: 96.1%	Urban: 94.3%
Mahal et al. (2004) ³⁴	Unclear	Unclear	OOP hospital expenditure/(household consumption - survival consumption) ≥30%	Female: 49.0%	Male: 48.8%
Newton et al. (2018) ³⁵	3 months	From diagnosis	OOP healthcare expenditure/ annual household income ≥10–20%, 20–40% and ≥40%	≥10–20%: 7.0%	20–40%: 4.0% ≥40%: 1.0%
O'Neill et al. (2015) ³⁶	Unclear	Unclear	OOP non-medical expenses/ annual household income ≥40%	≥40%: 67.0%	
Rajpal et al. (2018) ³⁷	1 year	Unclear	OOP household inpatient treatment expenditure/ total household expenditure ≥10%, ≥20% and ≥40%	Public sector hospitals: ≥10%: 36.3% ≥20%: 33.7% ≥40%: 28.0%	Private sector hospitals: ≥10%: 63.8% ≥20%: 61.6% ≥40%: 58.2%
Singh et al. (2020) ³⁸	Until end of radiotherapy treatment	From diagnosis	OOP treatment cancer expenditure/ non-food household consumption ≥40%	≥40%: 62.0%	
The Action Study Group (2015) ³⁹	3 months	From diagnosis	OOP healthcare expenditure/ annual household income ≥30%	≥30%: 31.0%	
The Action Study Group (2017) ⁴⁰	12 months	From diagnosis	OOP healthcare expenditure/ annual household income ≥30%	≥30%: 48.0%	
Tripathy et al. (2016) ⁴¹	1 year	Unclear	OOP healthcare expenditure/ annual household income ≥10%	≥10%: 74.0%	
Zhao et al. (2016) ⁴²	1 year	Unclear	Direct healthcare expenditure/ annual household income & direct and indirect healthcare expenditure/ annual household income ≥20%, ≥30%, ≥40% and ≥50%	≥20%: 25.9% ≥30%: 19.1% ≥40%: 16.3% ≥50%: 14.0%	≥20%: 30.0% ≥30%: 23.1% ≥40%: 20.6% ≥50%: 16.7%
Zheng et al. (2018) ⁴³	1 year	Unclear	OOP healthcare expenditure/ household non-food expenditure ≥40%	≥40%: 42.8%	

Abbreviations

AMSTAR 2, A MeaSurement Tool to Assess systematic Reviews, revised; APAC, Asia-Pacific; BOI, burden of illness; CEA, cost-effectiveness analysis; CHE, catastrophic health expenditure; EMEA, Europe, the Middle East and Africa; HCRU, Health Care Resource Utilisation; LATAM, Latin America; MA, meta-analyses; NA, North America; OOP, out of pocket; PICOS, Population, Intervention, Comparison, Outcomes and Study; RCT, randomised controlled trial; SLR, systematic literature review.

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