

Global trends in psycho-oncology research investments 2016–2020: A content analysis

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Abstract

Objective: An estimated one-third of cancer patients experience a clinically significant psychological disorder, however it is unclear to what extent this is reflected in research funding. To address this a systematic analysis the allocation of psycho-oncology research funding globally between 2016 and 2020 was conducted.

Methods: A global dataset of 66,388 cancer research awards, from 2016 to 2020 inclusive and totalling \$24.5 billion USD was assembled from public and philanthropic funders. Each award was previously categorised by cancer site type and research theme, including psychosocial research and these awards were further sub-categorised for this analysis.

Results: There was \$523m of funding awarded for psychological research across 1122 studies: 2.14% of all cancer research funding during this period (\$24.5 billion). Median funding per award was \$97,473 (IQR \$36,864 – \$453,051). Within psychological research, mental health received most funding (\$174m, 33.5% of psychological funding). Cognitive behavioural therapy (CBT) focused research was the specific psychological support with the highest proportion of funding at \$14 million. By country of funder, the USA provided most investment (\$375.5 m, 71.8%).

Conclusions: Psycho-oncology research received relatively little funding, for example, when compared with pre-clinical cancer research. There needs to be a shift from pre-clinical science to research that benefits cancer patients in the shorter-term. Low- and middle-income countries, and ethnic minorities in higher-income settings, were underrepresented despite having a large cancer burden, indicating inequities that need to be addressed.

KEYWORDS

cancer, funding, oncology, psychiatry, psychology

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1 | INTRODUCTION

Cancer is a leading cause of global mortality, accounting for 10 million deaths worldwide.¹ The incidence of new cancer diagnoses is predicted to increase by almost 50% by 2040, with an estimated 28.4 million cases projected annually.² GLOBOCAN predicts this increase to be greatest in low human development regions at a 95% rise by 2040.²

Psycho-oncology is the multidisciplinary approach to supporting the emotional health of cancer patients.³ Up to 50% of cancer patients experience emotional distress triggered by physical symptoms and social upheaval resulting from their disease.⁴ An estimated one third fulfil diagnostic criteria for psychiatric illness during their cancer journey, including adjustment disorder, anxiety and depression.⁵ A diagnosis of cancer represents a greater risk for depression than other chronic illnesses such as diabetes, stroke and chronic obstructive pulmonary disease (COPD).⁶

The presence of comorbid mental illness in cancer patients has an economic impact on global healthcare systems by increasing length of hospitalisations, emergency department visits, prescription numbers and outpatient appointments.⁷ Cancer patients with depression have significantly greater healthcare costs compared to those without.⁸ Moreover, those with comorbid anxiety and depression are 4.4 times more likely to be hospitalised than patients without either diagnosis.⁷ Thus, psychological comorbidities in cancer patients are associated with increased healthcare resource use.

Psycho-oncology services have developed in many countries in order to address psychological and behavioural needs of patients.⁹ However, national guidelines are available in only a few countries, elsewhere, psychosocial oncology forms a part of broader psychological support rather than being a distinct service, with very limited or no psycho-oncology care in LMICs.¹⁰ In an analysis of service across 38 low-, middle- and high-income countries, 84% implemented psychosocial services during outpatient visits, and 81% during inpatient treatment.¹¹ Psychotherapeutic interventions have been shown to reduce anxiety and depression in cancer patients and improve general mental wellbeing.¹² Research suggests the benefit of these interventions comes broadly from enhancing a sense of meaning, integration of cancer within one's personal narrative, and challenging negative thought processes.¹³

The psychological consequences of cancer are now established as a domain of cancer research, with 1832 scientific papers published in the field between 1980 and 2021 by authors from 74 countries.¹⁴ Publication numbers have rapidly increased since 2010 and continues to grow at an annual rate of 13.9%.¹⁴ This is an area of oncology with huge impact both for patients and healthcare systems alike. However, the greatest barrier to participating in psycho-oncology research is a lack of funding.¹⁵ Currently, information available on funding for psycho-oncology research is limited and published analyses of cancer research funding have to date not explored psychological themes in detail.¹⁶

This study aimed to describe the allocation of public and philanthropic funding to psycho-oncology research globally between

2016 and 2020. We explored the distribution of funding between different areas of psychological research and how this varied by key themes such as cancer site, and country of origin.

2 | METHODS

The methodology used was based on that of previous research published by the authors in the fields of public health¹⁷ and oncology,¹⁸ and is briefly described here.

Information on funding awards was obtained from the UberResearch Dimensions database (www.dimensions.ai). The Dimensions database includes 6 million grant awards worth US \$2.3 trillion from 656 funders worldwide, and includes both health and non-health research. Data was collected between 01/01/16 and 31/12/20. Data extracted included award title, abstract, funding amount (USD) and funding source. Data used in this paper were extracted from the larger cancer data set previously described.¹⁸

Ethical approval was not required for this study.

2.1 | Data analysis

Award values were collected in their original currency, and converted into United States dollars (USD) using the average exchange rate from during the year of the award. All awards were adjusted using the 2020 rate of inflation.

Titles and abstracts of awards were reviewed by IC and MD, and following discussions with co-authors, were further categorised into five cross-cutting research themes; public health, care delivery, physical effects of cancer, social, and psychological. Public health was used to categorise awards that related to cancer prevention, screening, and communication with patients and the public. Care delivery related to aspects of healthcare planning and individual delivery including e-Health, follow-up care, creation of clinical guidelines and clinical database production. Physical effects of cancer encompassed awards focused on the ways physical effects affect wellbeing in patients. Social awards focused on the effects of the social environment on patients from financial to support and stigma. Psychological themes are discussed in detail below. A comprehensive list of terms relating to each theme can be found in Supplement S1. MD and IC validated 5% ($n = 56$) of awards categorised by the other in a blinded manner for internal consistency; totalling 10% of the final sample ($n = 112$). Initial agreement was reached in 87%. Where disagreement occurred, final decisions were made by both authors in collaboration.

Discrete categorisation was employed for psychological awards, meaning no awards crossed into other psychological research themes. Of the 1158 psychological awards in this dataset funding information was not present for 36 individual awards, and these were excluded from the analyses (Figure 1).

Psychological awards were placed into five discrete themes, psychosexual, quality of life (QOL), behaviour change, treatment

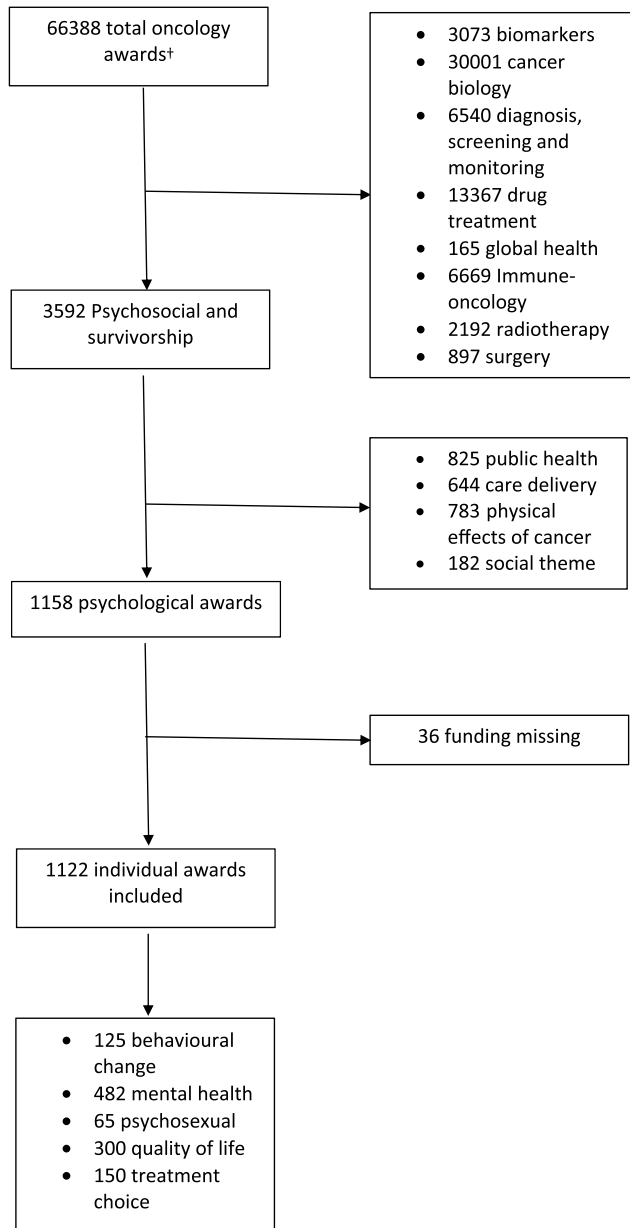


FIGURE 1 Flowchart of data inclusion † Dataset available from McIntosh et al (2023).²¹

choice and mental health. Psychosexual was used to categorise awards relating to the psychological and physiological morbidities associated with cancer and its treatment. Quality of life referred the effect of cancer of the holistic wellbeing of cancer patients. Behaviour change related to awards focusing on health promotion activities such as increasing screening attendances or reduction in cancer risk behaviours like smoking. Treatment choice was used to categorise awards where the primary aim was to assist patients or increase their involvement in treatment decisions. Mental health encompassed any award where the primary focus was an ICD-10 coded mental illness, or mental wellbeing as defined below. Examples of award titles categorised under each of the five main themes can be found in Supplement S2.

The mental health awards were sub-grouped by the specific mental health theme of the research. Diagnoses classified under the International Classification of Disease 10th revision (ICD-10)¹⁹ included: Mood disorders (F30-39), PTSD (F43), anxiety disorders (F40-41), eating disorders (F50), sleep disorders (F51), and cognitive impairment (F0-5). Psychological support was used here to refer to any therapeutic modalities aimed at supporting patients and/or their care network.²⁰ Awards were classified as psychiatric prognostic markers when using the above ICD-10 coded disorders to predict outcomes such as mortality and quality of life. Grief encompassed not only pathological forms coded in ICD-10 (F43.81), but experiences within the spectrum of non-pathological responses to serious illnesses, such as anticipatory grief.²¹ The mental health effects of both cancer and cancer treatment were included. In this study 'post-traumatic' related to both post-traumatic stress disorder, and post-traumatic growth. Awards were classified under 'mental wellbeing' if they did not specifically look at ICD-10 coded disorders.

Phase of illness was reported based upon the Corbin and Strauss chronic illness trajectory model.²² This model was adapted for cancer illness journey to include survivorship. In this context pre-trajectory refers to the asymptomatic period before a patient is diagnosed with cancer. This stage was included as it encompassed cancer prevention strategies such as public health messages aiming to reduce cancer risk behaviours or increase participation in screening programmes. The trajectory onset phase related to any research starting at initial symptom presentation through the investigative process and ending at formal diagnosis of cancer whereby living with the disease begins.

Cancer sites of the proposed research were also collected. Abstracts that focused on protected characteristics such as sexuality and ethnicity were also reported. These included the effects of ethnicity/sexuality on access to psychological support, their prognostic value on mental health outcomes and differences in experience of cancer between groups. Findings have been reported by country of origin, funding body and year of award.

IBM SPSS version 28 statistical package was used for data preparation and analysis. Continuous variables were expressed as mean with standard deviation and medians with inter-quartile ranges (IQR). Categorical variables were expressed as a number (%).

3 | RESULTS

Global funding for all oncology research across 2016–2020 was \$24.5 billion (median award size of \$90,576, IQR \$36,663–316,416), with the vast majority (\$18b, 73.5%) for pre-clinical research.¹⁹ Here, there are 1122 publicly and philanthropically funded awards for psychological research, totalling \$523 million USD with a median award size of \$97,473 (IQR \$36,864–453,051) (Table 1). Psychological research therefore contributed to 2.14% of all global cancer research investment.

TABLE 1 Psycho-oncology funding 2016–2020 by research theme.

Research theme	N	% of total psychological N	Total funding \$	% of total psychological funding	Mean funding (SD) \$	Median \$ (IQR)
Psychological total	1122	100%	523,043,538	100%	466,171 (949,975)	97,473 (36,864-453,051)
Behavioural change	125	11.1%	102,800,918	19.7%	822,407 (1,090,653)	423,719 (999,037-79,121)
Mental health	482	43.0%	174,993,772	33.5%	363,058 (819,900)	73,443 (35,406-344,806)
Psychosexual	65	5.8%	24,849,906	4.8%	382,306 (779,477)	69,859 (35,573-377,932)
Quality of life	300	26.7%	135,035,687	25.8%	450,119 (945,766)	84,682 (35,876-393,381)
Treatment choice	150	13.4%	85,363,255	16.3%	569,088 (1,191,014)	154,369 (38,511-468,700)
Mental health subtheme						
Anxiety disorders	39	3.48%	14,897,792	2.85%	381,995 (1,799,390)	117,416 (33,012-99,914)
Cognitive impairment	77	6.86%	27,292,686	5.22%	354,450 (47,393)	59,107 (40,705-469,664)
Eating disorders	2	0.18%	77,450	0.01%	38,725 (2632)	38,725
Grief	21	1.87%	965,540	0.18%	45,978 (47,614)	35,816 (24,165-39,872)
Mental wellbeing	49	4.37%	11,596,496	2.22%	236,663 (572,401)	37,455 (24,907-97,924)
Mood disorders	31	2.76%	8,889,384	1.70%	286,754 (442,387)	60,502 (37,728-449,568)
Psychiatric prognostic markers	38	3.39%	15,122,747	2.89%	397,967 (837,028)	40,756 (26,040-291,727)
Psychological support	209	18.62%	90,942,514	17.39%	435,132 (759,888)	117,416 (39,082-463,161)
PTSD	7	0.62%	904,569	0.17%	129,224 (200,719)	97,473 (7249-12,0770)
Sleep disorders	10	0.89%	4,970,657	0.95%	497,066 (732,869)	235,000 (33,297-655,118)
Psychological support subtheme						
Art therapy	5	0.45%	3,855,124	0.74%	771,025 (579,062)	983,503 (184,506-1,251,305)
Behavioural therapy	1	0.09%	1,375,270	0.27%	687,635 (216,409)	687,635
CBT	31	2.76%	14,423,857	2.76%	465,286 (615,592)	386,973 (98,755-662,758)
Exercise therapy	13	1.16%	9,415,387	1.80%	724,261 (1,034,171)	385,309 (30,980-1,342,820)
Family therapy	23	2.05%	8,875,618	1.70%	385,896 (699,916)	41,621 (36,247-521,398)
Group therapy	11	0.98%	1,725,627	0.33%	156,875 (191,492)	116,097 (36,549-162,642)
Guided self-help	31	2.76%	13,899,805	2.66%	448,381 (642,917)	136,254 (36,549-469,664)
Hypnosis	6	0.53%	117,416	0.02%	87,454 (32,233)	88,120 (57,767-116,790)
Mindfulness	15	1.34%	5,733,482	1.10%	382,232 (871,266)	85,062 (30,768-230,000)
Other	60	5.34%	26,504,447	5.07%	441,741 (888,078)	82,905 (37,909-253,023)
Spirituality	10	0.89%	4,728,462	0.90%	472,846 (1,061,850)	135,617 (38,258-262,243)

Annually total funding in this area generally declined from \$160.0 m in 2016 to \$65.2 m in 2020 (Figure 2). However, the proportion of the \$24.5 billion total cancer funding¹⁹ awarded to psychological research over this period remained stable from 2.43% in 2016 to 2.24% in 2020 (Figure 2).

Table 1 shows the breakdown of awards by psychological research theme. Mental health was the research theme with the largest funding, receiving \$175 m (33.5%) for 482 (43.0%) awards.

Within the theme of mental health awards for psychological support totalled \$90.9 m with a median award size of \$117,416 (\$39,082-463-161).

3.1 | Cancer site

By cancer site, \$143 m (27.4%) was awarded to general cancer, and \$115 m (22%) to research focusing on multiple cancer types (Table 2). \$73.8 m (14.1%) was awarded to psycho-oncological breast cancer research; the largest amount for a single cancer site. Conversely, there was one renal award within the field of psycho-oncology, totalling \$17,612 (covering behavioural change).

When comparing research theme across cancer sites, breast cancer was consistently in the top 3 cancer sites for number of awards across all five major themes; psychosexual N = 11 (16.4%),

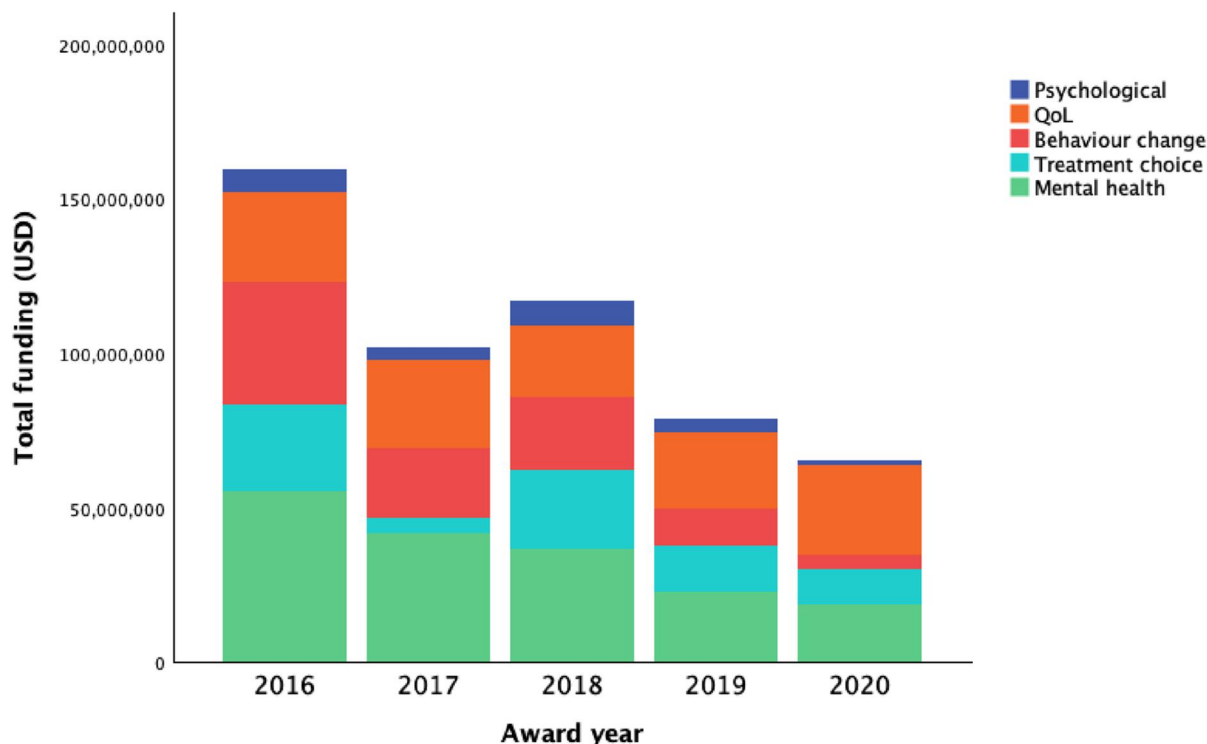


FIGURE 2 Yearly proportion of funding allocated to each major research theme.

mental health $N = 90$ (18.3%), treatment choice $N = 29$ (18.8%), behaviour change $N = 21$ (16.7%), QOL $N = 37$ (11.6%).

23.9% of psychosexual research was conducted on prostate cancer ($N = 16/67$) accounting for \$9.8 m. In our dataset there was one psychosexual award in the field female gynaecological cancers for cervical cancer totalling \$146,435. Behaviour change research was most frequently carried out in breast ($N = 21$), cervical ($N = 9$), lung ($N = 18$) and skin cancers ($N = 9$).

Within this dataset 64 (5.7%) individual awards focused on metastatic cancers, across all cancer types, totalling \$45.3 m (8.7%) of funding. The mean awards size for metastatic cancers was \$708,486 (\$1.7 m).

3.2 | Funding country

By country of funding, the USA contributed 71.8% of funding (\$375.5 m) (Table 2), followed by the UK (\$36.4 m; 7.0%) and EU (\$22.8 m; 4.4%). Funding from Asian countries was contributed by China ($N = 28$) and Japan ($N = 264$) totalling \$12.5 m. As the only South American country with funders in our database, Brazil awards ($N = 31$) contributed a total of \$1.3 m (median award size \$36,845). The National Cancer Institute was the single largest funder totalling \$215.5 m (41.2%) over the study period (Supplement S3).

3.3 | Stage of illness

Breakdown of funding by stage of illness can be found in Table 2 where data is presented in order of disease progression. Research

focused on the 'living with disease' stage received the greatest amount of funding with \$214.8 m (21.3%).

There were 36 awards given for QOL research at the end of life (dying phase), totalling \$23.2 m. Within the theme of 'mental health' research, \$83.7 m ($N = 287$) was awarded for research whilst living with disease, and \$21.9 m ($N = 45$) during the dying stage. When comparing funding for all five major research themes across the dying phase of illness we found no awards for psychosexual research, 39 (12.3%, \$23.2 m) for QOL and 47 (9.5%, \$21.9 m) for mental health.

3.4 | Protected characteristics

56 awards focused on protected characteristics within a psychological theme; 50 on ethnicity and 6 sexuality. Ethnicity research totalled \$49.7 m; 9.5% of psycho-oncology funding. Median award size for research focusing specifically on ethnicity and sexuality was \$513,402 and \$212,374 respectively. The USA were the largest contributor to ethnicity research with a combined \$44.2 m (62.8%).

16 awards focused on the effects of ethnicity on QoL, and 16 on mental health. Four awards focused on sexuality in psychosexual research and two on QoL; totalling \$3.5 m (0.67%) in funding.

4 | DISCUSSION

This study, to the best of our knowledge, provides the first systematic description of the allocation of psycho-oncology research funding. Psycho-oncology research makes up just 2.14% of all cancer research funding. This compares to the \$17.7 billion (73.5%) presently

TABLE 2 Psycho-oncology funding by cancer site, funding country and stage of illness.

Cancer site	N	% of total psychological N	Total funding \$	% of total sum	Mean funding (SD) \$	Median (IQR) \$
Bladder	8	0.7%	3,876,118	0.7%	484515 (570,445)	347,542 (113,651-497,292)
Bone	2	0.2%	91,679	0.0%	45840 (63,619)	45,840
Brain	25	2.2%	6,438,256	1.2%	257530 (589,889)	60,412 (31,291-295,668)
Breast	185	16.5%	73,899,251	14.1%	399455 (811,790)	85,309 (37,440-417,594)
Cancer general	375	33.4%	143,552,167	27.4%	382806 (761,302)	70,000 (34,197-419,157)
Cervical	17	1.5%	3,545,504	0.7%	208559 (184,274)	162,455 (36,336-326,907)
Colorectal	25	2.2%	8,315,426	1.6%	332617 (688,999)	78,811 (43,314-285,678)
Haematological	39	3.5%	15,057,991	2.9%	386102 (659,555)	123,799 (40,432-429,146)
Head and neck	30	2.7%	11,256,776	2.2%	375226 (1,032,820)	68,557 (34,340-429,146)
Liver	1	0.1%	184,077	0.0%	184077	184,077
Lung	48	4.3%	42,402,519	8.1%	883386 (1,801,340)	193,486 (32,374-1,111,336)
Mesothelioma	1	0.1%	118,468	0.0%	118468	118,468
Multiple	229	20.4%	115,226,779	22.0%	503174 (1,014,642)	104,578 (38,094-466,322)
Other	13	1.2%	7,531,244	1.4%	579326 (1,657,915)	48,441 (12,884-244,348)
Ovarian	12	1.1%	9,091,975	1.7%	757665 (1,061,628)	446,126 (111,915-616,639)
Pancreatic	14	1.2%	3,105,306	0.6%	221808 (268,040)	119,036 (39,814-358,189)
Prostate	67	6.0%	57,711,623	11.0%	861368 (1,339,545)	226,485 (69,859-1,021,440)
Renal	1	0.1%	17,612	0.0%	17,612	17,612
Skin	17	1.5%	13,243,565	2.5%	779,033 (968,143)	432,187 (180,231-907,433)
Testicular	3	0.3%	638,645	0.1%	212,882 (288,709)	81,012
Thyroid	6	0.5%	6,789,036	1.3%	1,131,506 (770,228.67)	873,105 (678,197-1,683,127)
Upper GI	4	0.4%	949,521	0.2%	237,380 (296,000)	128,917 (32,090-551,134)
Funding country						
Australia	25	2.2%	12,654,811	2.4%	506,192 (586,865)	302,235 (105,016-562,243)
Belgium	38	3.4%	11,207,614	2.1%	294,937 (953,960)	116,581 (58,290-146,988)
Brazil	31	2.8%	1,254,851	0.2%	40,479 (6976)	36,845 (35,816-50,330)
Canada	142	12.7%	13,988,212	2.7%	98,509 (302,576)	52,836 (14,481-84,857)
China	28	2.5%	1,497,824	0.3%	53,494 (38,528)	30,768 (27,768-78,459)
Czech Republic	5	0.4%	2,130,335	0.4%	426,067 (201,776)	471,960 (234,943-594,244)
Denmark	3	0.2%	66,552	0.0%	33,276 (23,035)	33,276
EU	5	0.4%	22,799,847	4.4%	4,559,969 (1,306,931)	4,495,537 (3,483,676-5,668,480)
Finland	1	0.1%	269,214	0.1%	269,214	269,214
France	3	0.3%	1,402,308	0.3%	467,436 (1930)	466,322
Germany	2	0.2%	245,597	0.0%	122,799 (13,468)	122,799
Ireland	11	1.0%	2,121,687	0.4%	192,881 (220,489)	143,750 (2864-227,483)
Japan	264	23.5%	10,983,046	2.1%	41,602 (38,867)	36,595 (25,273-40,432)
Netherlands	42	3.7%	17,988,503	3.4%	428,298 (104,090)	466,322 (449,568-471,565)
New Zealand	3	0.3%	394,966	0.1%	131,655 (194,635)	19,340
Norway	6	0.5%	2,607,060	0.5%	434,510 (837,271)	96,318 (52,478-661,689)

TABLE 2 (Continued)

Cancer site	N	% of total psychological N	Total funding \$	% of total sum	Mean funding (SD) \$	Median (IQR) \$
Poland	7	0.6%	180,797	0.0%	25,828 (16,941)	31,141 (2003-40,144)
Portugal	5	0.4%	479,698	0.1%	95,940 (62,284)	61,289 (47,910-161,295)
Russia	10	0.9%	168,772	0.0%	16,877 (50,671)	854 (832-912)
Slovakia	1	0.1%	87,077	0.0%	87,077	87,077
Spain	3	0.3%	127,661	0.0%	42,554 (34,128)	30,328
Sweden	35	3.1%	5,342,247	1.0%	152,636 (123,990)	98,374 (69,859-257,005)
Switzerland	8	0.7%	3,110,067	0.6%	388,758 (229,143)	502,376
UK	75	6.7%	36,444,398	7.0%	485,925 (891,039)	203,445 (62,458-395,353)
USA	370	33.0%	375,490,394	71.8%	1,014,839 (1,276,774)	567,031 (182,176-1,416,635)
Stage of illness						
Pre-trajectory	98	8.7%	75,818,859	14.5%	773,662 (975,223)	350,137 (75,071-1,097,329)
Trajectory onset	83	7.4%	52,043,568	10%	627,031 (1,181,345)	179,849 (57,816-496,320)
Living with disease	617	55.0%	214,825,246	21.3%	348,177 (746,088)	72,252 (35,394-329,264)
Remission/survivorship	214	19.1%	111,291,534	21.3%	520,054 (935,655)	115,345 (38,357-517,603)
Dying phase	106	9.4%	67,963,768	13%	641,168 (80,093)	80,093 (35,045-487,277)

allocated to pre-clinical cancer research.¹⁸ As cancer diagnoses increase,² so too will demand for psychological support. Projected increases in survivorship will require exploration of the long-term psychological sequelae of cancer treatment, identification of risk factors and development of preventative strategies. Without a strong investment pipeline for new research these needs will not be met.

Annual funding totals did not significantly change between 2016 and 2020 despite the 3-fold rise in psycho-oncology publications during this time.¹⁴ Despite the growth of research outputs, we are yet to see a significant associated increase in global investment in this area. However, it may take time for the increased research activity to be reflected in funding applications and awards.

Over one third of funding in this area between 2016 and 2020 went towards mental health research; receiving seven times more funding than psychosexual research over the same period. Despite affecting 30% of cancer patients,²³ psychosexual research was the smallest area of funding in our dataset. Prostate cancer received by far the greatest proportion of psychosexual research funding, however gynaecological cancers received little attention in this regard. The singular award in this area titled "Examining the psychosexual impact of human papillomavirus testing in routine cervical screening" was focused on cervical screening rather than the impact of living with gynaecological cancer or its treatment, representing a significant oversight also reflected in wider research funding.²⁴

Behaviour change and treatment choice represent further areas of psycho-oncology where funding does not reflect clinical demand, with a combined investment of just \$188.2 m over the 4 years analysed. Behaviour change was assessed in our study in the context of cancer prevention and promotion of treatment adherence. These

aspects of health psychology are particularly important as uptake of cancer screening programmes is generally poor, with less than half of those eligible attending cervical screening in the UK.²⁵ More research into novel interventions that build on theoretical models is needed for successful health promotion in this area. Moreover, placing the patient at the forefront of decision making is important for improving health outcomes, reducing costs and enhancing the patient-doctor relationship.²⁶ With such wide-ranging benefits it is clear that finding ways of effectively engaging of patients in their treatment decisions is key.

Despite 70% of cancer deaths occurring in low- and middle-income countries (LMIC),²⁷ there is very little global health research focused on this area. Given how the Dimensions database captures investments from the majority of the world's largest R&D funders, there are unlikely to be large sums of money missed. The psychological needs and outcomes of people living with cancer in these countries are likely to differ from high income areas. We already know that individuals spend up to 60% of their incomes on medicines in LMICs, and therefore this out of pocket expenditure can be a barrier to seeking healthcare.²⁸ Access to cancer treatments and palliative care are also poorer, and often non-existent. The effects of these health inequalities on the mental wellbeing of patients in LMIC require systematic exploration. Additionally, tailoring psychological support to those from diverse cultural backgrounds requires an evidence base that is currently not well understood nor is being supported through investments in new research. As countries assess healthcare structure in a post-pandemic environment, the limited capacity to manage non-communicable diseases such as cancer is problematic for population health. Most lower-income countries are

unlikely to meet their Sustainable Development Goal targets,²⁹ particularly SDG3.4 concerning mortality reductions from non-communicable diseases and promotion of mental health and well-being. Ambitions around Universal Health Coverage are also for many a long way off, with the COVID-19 pandemic having greatly disrupted routine health systems around the world.³⁰

There are also inequities around research in vulnerable populations in high-income settings. Our results indicate that protected characteristics are rarely looked at (56 of 1122 awards) despite ethnic minorities having poorer cancer outcomes.³¹ For example, Latino communities based in the USA appear to be particularly vulnerable to psychological distress and poor health-related QOL.³² However, few psychological interventions have been culturally adapted for use in Latino communities.³³ African American breast cancer survivors have been shown to have poorer health-related quality of life compared to white survivors.³⁴ However there is mixed evidence regarding health-related quality of life of Black Americans likely reflecting socioeconomic disparities between sample groups. Despite this, there is a substantial evidence base pointing to poorer psychological outcomes for ethnic minority patients but significantly less research funded into ways to mitigate this.

There were just 300 individual awards in the area of QOL. Outcome measures in oncology using QOL are infrequently used in clinical trials especially at the end of the patient's life. Focus instead falls within the active treatment stage. A cross-sectional analysis of published clinical trials found that only 1 of the 74 studies included assessed QOL until the end of life. Our results underpin this finding, with only 12% of QOL awards funded during this stage of illness; a clear gap in research knowledge that funders can prioritise moving forward.

With regards to the dying phase of the cancer journey, there is uncertainty in the evidence regarding psychological burden for patients and their families.^{35,36} Current estimates of the prevalence of depression in cancer patients at the end of life are imprecise, ranging from 2% to 56%.³⁷ Studies of depression in oncology patients often neglect to distinguish between stages of illness, leading to broad estimates of prevalence, and uncertainty surrounding the effects of dying on psychological outcomes.³⁸ It is important to develop a strong evidence base, from which clinicians can draw that clearly establishes what are normal versus abnormal reaction to dying. The funding of new research in this area is necessary to support evidence-based practice and progress this area of oncology.

5 | STUDY LIMITATIONS

Private and commercial funding sources were not included in the data presented in this study. Such sources are not made publicly available to interrogate in the level of detail required for this analysis. Given that the majority of industry funding is focused on drug development and testing rather than psychological research,³³ our results likely overestimate the proportion of cancer research funding allocated to psychological research. Whilst most of the major funders

of oncology research openly document their funding decisions, Cancer Research UK (CRUK) do not release information at the level of individual awards. Whilst top-level funding amounts were considered in the main analysis, we did not have sufficiently granular detail to consider them here. However, as the source of around 50% of publicly funded cancer research in the UK³⁹ the omission of CRUK data may limit the inferences that can be concluded from our data. A more transparent approach from CRUK going forward is vital, to allow priority-setting exercises to be better informed and to help reduce unnecessary duplication in research. Additionally, although the Dimensions database provides a relatively comprehensive overview of the dominant global health funders in higher-income settings, the availability of data from smaller funders from middle- or lower-income countries is currently limited.

Our analyses provide a review of 2020 funding data, and thus an insight into the diversion of funding early in the COVID-19 pandemic. The significant drop in 2020 is an indication that there will be future gaps in knowledge for other areas of health, including oncology. The full impact of the pandemic on funding for psycho-oncology research will likely not be fully realised until more recent funding cycles are assessed. It will be hugely important for future priority-setting exercises to consider these anticipated drops in funding, and to understand which areas of oncology, and psycho-oncology research were most impacted.

5.1 | Clinical implications

This study identifies a number of key areas within the field of psycho-oncology that are currently receiving relatively little funding, suggesting new areas of future research growth. Despite affecting 30% of cancer patients,²³ psychosexual research was the smallest area among the five top-level categories in our dataset with 4.8% of funding. Psychosexual side effects may therefore be poorly understood given their implications for survivorship QOL. Additionally, the range of approaches to psychological support currently funded is narrow, and dominated by established cognitive therapies. This could be limiting the clinical support funded by healthcare systems thereby restricting access to holistic treatments such as mindfulness and spirituality centred therapies.

6 | CONCLUSIONS

Bibliometrics analyses point to a growth in psycho-oncology research with which funding is not keeping pace. There is a growing need to prioritise the mental wellbeing of cancer patients as survival increases requiring an evidence base to guide clinical practice. There needs to be a shift from pre-clinical science to research that benefits cancer patients in the shorter-term. As global trends in cancer shift towards greater burden in low- and middle-income countries, funders must focus on identifying the unique psychological needs in these areas. Psychological support in particular must reflect the diverse

ethnic and cultural backgrounds of patients requiring it. There are clear inequities in the global oncology research portfolio, with both patients in lower-income countries and vulnerable individuals in higher-income settings being relatively neglected in the research environment.

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CONFLICT OF INTEREST STATEMENT

SMCI reports honoraria from MSD, Roche, BD and Astra Zeneca, advisory boards for Roche, Lilly, MSD, and Astra Zeneca, conference travel and support from Roche, Lilly, and MSD and institutional research funding from Novartis. RIC reports institutional research funding from Astra Zeneca and SECA. None of the other co-authors have any declarations of interest to report.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from <http://www.dimensions.ai>. Restrictions apply to the availability of these data, which were used under license for this study. A sample of the data (up to 100 awards) are available with the permission of the corresponding author.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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