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Research priorities for cancers of the oesophagus and stomach: recommendations from a United Kingdom & Ireland patient and healthcare professional partnership exercise

Christopher M. Jones[1,2]*, Wee Han Ng[3], Laura Tincknell[4], Dylan P. McClurg[1], Emily Adam[5], Pradeep Bhandari[6], Karen Campbell[7], Pinkie Chambers[8], Francesca D. Ciccarelli[9,10], Helen G. Coleman[11], Tom D. L. Crosby[12], Carmel Doyle[13], Jason Dunn[14,15], Jessie A. Elliott[16], Rebecca C. Fitzgerald[1,2], Kieran Foley[12,17], Vicky Goh[18,19], Heike I. Grabsch[,20,21], Trevor A. Graham[22], Michael P. W. Grocott[23,24], Sarah Gwynne[25], Jo Harvey[26], Marnix Jansen[27], Pernilla Lagergren[28,29], Claire Lamb[2], Lauren Leigh-Doyle[30], Farida Malik[31,32], Catriona R. Mayland[33], Mimi McCord[34], Alan Moss[35], Somnath Mukherjee[36], Russell D. Petty[37,38], Siddharth Rananaware[39], Joanne Reid[40], Greg Rubin[41], Elizabeth C. Smyth[36], Nigel J. Trudgill[26], Richard C. Turkington[42], Tim J. Underwood[43], Fiona M. Walter[44], Jessica Williams[45] & Christopher J. Peters[28*]

[1] Department of Oncology, University of Cambridge, Cambridge, UK
[2] Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK
[3] Department of Public Health & Primary Care, University of Cambridge, Cambridge, UK
[4] Imperial College Healthcare NHS Trust, London, UK
[5] Cicely Saunders Institute of Palliative Care & Rehabilitation, King's College London, London, UK
[6] Department of Gastroenterology, Portsmouth University Hospital NHS Trust, Portsmouth, UK
[7] School of Health & Social Care, Edinburgh Napier University, Edinburgh, UK
[8] Cancer Services, University College London Hospitals NHS Foundation Trust, London, UK
[9] Cancer Systems Biology Laboratory, The Francis Crick Institute, London, UK
[10] Centre for Cancer Evolution, Barts Cancer Institute, Queen Mary University of London, UK
[11] Centre for Public Health, Queen's University Belfast, Belfast, UK
[12] Velindre Cancer Centre, Velindre University NHS Trust, Cardiff, UK
[13] Oesophageal Cancer Fund, Dublin, Ireland
[14] Department of Gastroenterology, Guy's and St Thomas' NHS Foundation Trust, London, UK
[15] School of Cancer & Pharmaceutical Sciences, King's College London, London, UK
[16] Trinity St James's Cancer Institute, Trinity College Dublin and St James's Hospital, Dublin, Ireland
[17] School of Medicine, Cardiff University, Cardiff, UK
[18] School of Biomedical Engineering & Imaging Sciences, King's College London, London, UK
[19] Department of Radiology, Guy's & St Thomas' NHS Foundation Trust, London, UK
[20] Division of Pathology & Data analytics, Leeds Institute of Medical Research at St James's, University of Leeds, Leeds, UK
[21] Department of Pathology, GROW School for Oncology & Reproduction, Maastricht University Medical Center, Maastricht, The Netherlands
[22] Centre for Evolution & Cancer, The Institute of Cancer Research, London, UK
[23] NIHR Southampton Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust, Southampton, UK
[24] Faculty of Medicine, University of Southampton, Southampton, UK
[25] South West Wales Cancer Centre, Swansea Bay University Health Board, Swansea, UK
[26] Sandwell & West Birmingham Hospitals NHS Trust, Sandwell, UK
[27] Research Department of Pathology, University College London, London, UK
[28] Department of Surgery and Cancer, Imperial College London, London, UK

[29] Department of Molecular Medicine & Surgery, Karolinska Instituet, Stockholm, Sweden
[30] The Royal Marsden Hospital, The Royal Marsden NHS Foundation Trust, London, UK
[31] Eastbourne District General Hospital, East Sussex Healthcare NHS Trust, UK
[32] St Wilfrid's Hospice, Eastbourne, UK
[33] School of Medicine & Population Health, University of Sheffield, Sheffield, UK
[34] Heartburn Cancer UK, Hampshire, UK
[35] Action Against Heartburn, London, UK
[36] Oxford Cancer & Haematology Centre, Oxford University Hospitals NHS Foundation Trust, Oxford, UK
[37] Tayside Cancer Centre, Ninewells Hospital, Dundee, UK
[38] School of Medicine, University of Dundee, Dundee, UK
[39] Aberdeen, UK
[40] School of Nursing & Midwifery, Queen's University Belfast, Belfast, UK
[41] Population Health Sciences Institute, Newcastle University, Newcastle, UK
[42] School of Medicine, Dentistry & Biomedical Sciences, Queen's University Belfast, Belfast, UK
[43] School of Cancer Sciences, Faculty of Medicine, University of Southampton, Southampton, UK
[44] Wolfson Institute of Population Health, Queen Mary University of London, London, UK
[45] Therapies Department, Royal Surrey NHS Foundation Trust, London, UK

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[*]**Correspondence to:** Christopher M. Jones
Address: Early Cancer Institute
Cambridge Biomedical Campus
University of Cambridge
Cambridge, CB2 0XZ
United Kingdom
Tel: +44(0)1223763240
Email: cj480@cam.ac.uk

Christopher J. Peters
Address: Imperial College London
Academic Department of Surgery
Hammersmith Hospital
Du Cane Road
London, W12 OHS
United Kingdom
Tel: +44(0)20 3312 6666
Email: christopher.peters@imperial.ac.uk

ABSTRACT

Background: Cancers of the oesophagus and stomach are a major cause of morbidity and mortality. Research is crucial to improving outcomes. However, to maximise value and impact, areas of focus should be prioritised in partnership with patients.

Objective: We undertook a comprehensive analysis of UK and Ireland patient and healthcare professional (HCP) priorities for research into oesophagogastric cancers across the domains of prevention, diagnosis and staging, treatment, palliative care and survivorship.

Design: A scoping exercise sourced research questions from patients and HCPs. These were consolidated then confirmed by systematic review to represent a true research uncertainty. Research questions were scored on potential impact by an interdisciplinary group of HCPs and prioritized using a weighting derived from a patient survey.

Results: There were 835 (395 HCP, 440 patient) respondents to the scoping (n=455) and prioritization (n=380) surveys. Across these, 4295 suggested research uncertainties were consolidated to 92 uncertainties that were prioritised. HCP respondents represented 25 professional groups from community and hospital settings. Patient weighting changed 22.2-46.3% of priority rankings established by HCPs. All domains were represented by the 20 highest priority questions, five of which focused on personalising and optimally combining treatment modalities. Two other key themes related to optimising nutrition and improving quality of life during and after treatment, including in patients not cured of their cancer.

Conclusion: This work highlights the impact of patient input on HCP-ranked research priorities and provides a robust list of priorities to guide funders, policy makers and researchers to support and undertake impactful research.

KEY WORDS

Gastric cancer; Oesophageal cancer; Barrett's oesophagus; Research Priority Setting; Priority setting partnership; Screening; Diagnosis; Surgery; Chemotherapy; Radiotherapy; Endoscopic treatment; Palliative care.

KEY MESSAGES

What is already known on this topic

- Oesophageal and gastric cancers are a significant global cause of morbidity and mortality with shared challenges in their diagnosis and management.
- In the UK, a previous priority setting partnership has identified specific priorities for Barrett's oesophagus research whilst a modified Delphi process has been used to establish research priorities for malignant oesophagogastric surgery, albeit based on input from clinicians alone.
- There is no prior patient and healthcare professional partnership exercise to guide policymakers, funders and researchers to undertake impactful research into oesophagogastric cancers.

What this study adds

- This study is the first to provide a joint patient and healthcare professional perspective on research priorities for oesophagogastric cancers across the domains of prevention, diagnosis and staging, treatment, palliative care and survivorship.
- We demonstrate that patient input is crucial to determining priorities for research into oesophagogastric cancer, with 22.2-46.3% of priority rankings established by HCP scoring changing in response to patient weighting.
- We identify key overall, and domain specific, priorities for oesophagogastric cancer care that include personalising and optimally combining or omitting treatment modalities, improving nutrition and enhancing quality of life during and after anti-cancer therapy.

How this study might affect research, practice or policy

- This study provides a robust list of priorities for research into oesophagogastric cancer in a process endorsed by major patient and healthcare professional organisations.
- The priorities outlined here should guide policymakers, funders and researchers regarding the areas in which their research can make the most impact.

INTRODUCTION

Oesophagogastric (OG) cancers are a leading cause of cancer-related morbidity and mortality[1,2]. The major subtypes are oesophageal adenocarcinoma (OAC), oesophageal squamous cell carcinoma (OSCC) and gastric adenocarcinoma (GAC)[3,4]. Worldwide, OAC and OSCC account each year for the loss of 13 million disability adjusted life years and 356,000 deaths[5]. However, whilst OSCC accounts for up to 90% of oesophageal cancer globally, the incidence of OAC has increased markedly over recent decades in some regions and is now the predominant form in over 20 high income countries[1]. This includes in Ireland and the United Kingdom (UK), where the age-standardised rate of OAC and OSCC is 16.2 and 4.6 per 100,000 person years for men and 4.0 and 3.5 per 100,000 person years for women, respectively[6]. The worldwide incidence of GAC surpasses that of OAC and OSCC combined, contributing annually to 19 million disability adjusted life years and 650,000 deaths[5,7]. However, GAC is more common in Asia, South America and eastern Europe, with a relatively lower age-standardised incidence in the UK and Ireland of around 5.2 per 100,000 person years[2].

There are multiple shared complexities in the diagnosis and management of patients with OG cancers[3,4]. They are frequently diagnosed in elderly patients with multiple comorbidities and in turn collectively impose significant nutritional morbidity and a high burden of symptoms[3,4]. They are also associated with a high rate of early metastatic spread and are often at an advanced stage at the point of diagnosis. This is despite recognised premalignant stages, such as Barrett's oesophagus (BO), squamous dysplasia and gastric metaplasia for OAC, OSCC and GAC, respectively. Diagnostic pathways for OG cancers are in addition complex and treatment is multimodal and intensive, often with several competing treatment options that each at best deliver moderate benefit[3,4].

Research is crucial to addressing these complexities and to improving outcomes for patients with OG cancer. However, finite resources mean it must be directed towards domains that have the most need. These areas of research prioritisation should be carefully selected. It is, for instance, apparent from other settings that research areas prioritised by researchers and healthcare professionals (HCPs) poorly align with those important to patients and carers who have lived experience of a disease[8-10]. It is also recognised that misalignment of priorities between HCPs and patients or their carers negatively impacts on patient recruitment and contributes to an avoidable waste of research funding. These challenges can be overcome by priority-setting patient-HCP partnerships using methodology established by the James Lind Alliance (JLA) or the Child Health and Nutrition Research Initiative (CHNRI)[11,12]. However, despite a previous JLA priority setting partnership relating to Barrett's oesophagus and gastro-oesophageal reflux disease, there has been no previous priority setting

exercise incorporating the views of patients who have had a diagnosis of an OG cancer nor previous work to understand relative areas of priority across all stages of the patient journey[13]. This is of importance to ensuring that research funding and resources are allocated to areas in which they can generate most impact for patients.

Given this, we undertook an exercise to understand the priorities of patients with OG cancer, their carers and HCPs for research within the domains of prevention, diagnosis and staging, treatment, palliative care and survivorship.

METHODS

Project oversight & governance

The National Cancer Research Institute (NCRI) OG subgroup and, following its closure, the UK & Ireland OG (UKIOG) Research Group, provided study oversight[14]. Both committees provide direction for the UK and Ireland OG trials community. A specific study leadership group of five patients, three scientists and 32 multi-disciplinary HCPs was established to design, lead and contribute to this research. These members were selected based on prior research impact and involvement in the NCRI group. Each steering group member declared conflicts of interest prior to supporting the project.

Project context, scope and objectives

The study leadership group established the overall study aim as improving the relevance and impact of research undertaken for OG cancers. Given that there had not been a previous priority setting exercise with patient involvement for OG cancers the study leadership group agreed on a broad remit to identify overall areas of research priority across all points of the OG cancer care pathway. In establishing this broad scope, the study leadership group recognized the need to simultaneously address discovery science, applied health and clinical research questions. In view of the fact that a prior research priority setting partnership focused on patients with BO, we chose to focus on patients with OG cancer and their carers, and not on patients diagnosed with a known premalignant precursor[13]. Given divergence in international practice and cultural differences that might influence priority setting, the study leadership group elected to only include respondents based in the UK, with a later expansion (for phase 3 of this work) to include respondents from the Republic of Ireland (RoI). A detailed overview of the project context is provided in **Table 1**[15].

Approach

The study approach is outlined in **Figure 1** and described in full within **Supplementary Materials.** Briefly, in phase 1, the study leadership group selected the CHNRI methodology and sought endorsement from relevant professional organisations and advocacy groups. In phase 2, areas of research uncertainty were gathered using a pre-piloted online scoping survey hosted by SurveyMonkey (SurveyMonkey Inc., California, USA ; **Supplementary File 1**). This was distributed to potential respondents via patient charities, a UK-wide distribution list of OG multidisciplinary teams, NCRI mailing lists, via mailing lists and webpages for partner professional organisations and through social media channels. CMJ additionally held meetings with relevant patient charities to publicise the survey. The survey opened for nine weeks between 1st November – 31st December 2021. Research uncertainties were grouped by similar theme and consolidated to a smaller number of research questions.

In phase three, each research question was systematically appraised to verify that it addressed a true research uncertainty. Research questions were then distributed to HCPs using a second pre-piloted SurveyMonkey survey **(Supplementary Files 2 & 3)**. This survey opened on 27th January 2025 and closed on 11th April 2025. Invites were distributed via partner professional organisations and a UK and Ireland-wide distribution list of OG MDTs, as well as in person at a clinical OG cancer meeting run by the UK & Ireland OG Group and via social media channels. Through this, HCPs provided a score based on pre-defined criteria **(Table 2)** for each question for which they had relevant knowledge. In tandem, a third pre-piloted SurveyMonkey survey **(Supplementary File 4)** was distributed to patients via social media and partner patient organisations and was open for responses from 27th January 2025 to 11th April 2025. This asked patients to identify the most important of the pre-defined scoring criteria for assessing the impact generated by research questions in each of the studied domains.

Scores provided by HCPs were averaged to provide an overall research priority score (RPS) for each question. Each RPS was then weighted by determining the proportion of patients who selected each criterion as their priority for each domain, and by multiplying this percentage by the score provided for that criterion by HCPs. The weighted criteria were then summed to provide a weighted RPS score. This is summarized by the following equation, within which the RPS and weight for each of the four criteria against which each uncertainty was scored are respectively represented by RPSn and Wn.

$$\frac{1}{\sum_{n=1}^{4} Wn} \times \sum_{n=1}^{4} RPSn \; x \; Wn$$

Given the breadth of expertise of the respondents approached to complete the phase 3 survey, we then sought to provide an insight into the extent to which their scoring agreed. To achieve this, we identified the average proportion of experts who selected the most common response for each domain within each research uncertainty. The average expert agreement (AEA) was then calculated as the mean of agreement scores across all four domains for each research uncertainty. We also sought to provide a directional AEA measure by recalculating the AEA based on whether expert responses agreed that the question was 'likely' or 'unlikely' to impact each criterion, regardless of whether this was felt to be 'very' or 'somewhat' likely or unlikely.

Each research uncertainty was ranked by RPS and weighed RPS scores within each *a priori* determined domain. These are tabulated. Weighted RPS scores were also compared and ranked across domains to create an overall list of the 20 highest-scoring research uncertainties. The correlation between weighted RPS and AEA was determined by determining the Pearson correlation coefficient. This and graphical illustrations of data from all surveys were calculated and generated using GraphPad Prism version 10.4.1 (GraphPad Software, California, USA) or R Studio version 2024.12.1 and the ggplot package. Sankey diagrams were generated using the open-source webpage, www.sankeymatic.com.

Patient & public involvement

Patients and representatives of patient charities were involved from the outset of this study and contributed to study design, including developing the research question, the scope of the work, the methods taken to address these and the interpretation of the data collected.

Role of the funding source

No specific funding was provided for this work, though Guts UK directly supported an independent information specialist who systematically appraised the final list of research uncertainties generated in phase 1 of this work.

Ethics & governance

Health Research Authority guidelines stipulate that ethical approval for patient-professional partnerships seeking to identify research priorities (i.e. from which there is not generalizable data) is not required and this was therefore not sought.

RESULTS

Phase 1: consensus process initiation & stakeholder engagement

A summary of the process used to derive research uncertainties is provided in **Figure 1**. The expertise provided by the Study Leadership Group is summarised in **Supplementary Table 2**. This group includes specialties involved in all stages of curative and non-curative OG cancer care, as well as two discovery/translational research scientists and an epidemiologist. The broad demographic mix of the Study Leadership Group is summarised in **Supplementary Figure 1**. This group comprised individuals from each of the four UK home nations as well as RoI. Formal endorsement for the aims and approach taken by this study was sought and obtained from 31 major patient-facing, HCP-focused (n=12) and specialty-specific (n=19) groups from the UK and RoI, as summarized in **Table 3**. CMJ and CP led the study leadership group.

Phase 2: scoping survey to identify research questions of interest

A total of 4295 individual research uncertainties were proposed by 455 respondents **(Figure 1)**. As outlined in **Table 4,** 41.5% (n=189/455) of these respondents were patients (n=144), their carers (n=40) or members of the public with an interest in OG cancer (n=5). This group is hereafter referred to as the patient cohort. A majority (64%; n=169/266) of HCP responses were received from doctors, albeit with contributions from 25 different professional groups based within hospital and community settings. Over half (57.1%; n=152/266) of HCPs were female whereas more than half (53.9%; n=103/189) of patient respondents were male. A majority (73.4%; n=195/266) of HCP respondents were aged under 50 years, whereas most (87.3%; n=165/189) patient respondents were aged over 50 years. Three quarters (73.3%; n=195/266) of HCPs and almost all (95%; n=183/189) patients were White.

Nine percent (n=389/4295) of the proposed research uncertainties were not interpretable and were excluded from further analysis. The domains to which the remaining 3906 uncertainties applied are summarised in **Supplementary Table 3**. The relative contribution of HCP and patient responses to each category is summarised in **Figure 2.** The highest number of uncertainties proposed by patients were for diagnosis and staging (n=576) and the lowest for palliative & supportive care (n=213) **(Figure 2A; Supplementary Table 3)**. Similarly, the diagnosis & staging domain received suggested areas of research priority from the highest number of HCPs (n=531), whereas palliative care received the fewest (n=244) **(Figure 2A)**.

These responses were consolidated using iterative categorisation to a list of 92 research uncertainties. Each was systematically appraised and confirmed as a true uncertainty, with none excluded. The

highest proportion (44.6%; n=41/92) of individual research ideas were provided for the treatment category, with 19.6% (n=18/92) ideas for each of prevention and survivorship, 9.8% (n=9/92) for diagnosis and staging, and 6.5% (n=6/92) for palliative care.

Phase 3: formulation & ranking of research questions

The phase 3 surveys received 129 HCP responses and 251 patient responses. The number of respondents for each criterion within each domain is summarised in **Supplementary Tables 4-8**. As with the phase 2 survey, a majority (n=76/129; 58.9%) of HCP respondents were female, mostly aged 50 years or under (77.5%; n=100/129) and around two thirds (64.3%; n=83/129) were White. There was less diverse specialty representation than in the first survey round and, again, doctors represented the highest proportion (67.4%; n=87/129) of respondents. In contrast, just over half (51%; n=122/251) of patient respondents were male. Most (88.4%; n=222/251) were aged over 50 years and all but one were White. The proportional contribution of patients, their carers and interested members of the public was similar in the second round of surveys to that in the first round. All patient respondents answered questions relating to all domains.

The patient responses that were used to weight RPS scores are outlined in **Figure 2**. These show that patients prioritised different forms of impact dependent on the disease setting. Interestingly, a greater proportion of patients prioritised quality of life as the goal for treatment research than prioritised longer life (37% vs. 26%). In contrast, quality of life was the priority for only 13% and 15% of patients in the prevention and diagnosis domains, for which equitable benefit (38% and 34%) and generating new knowledge (33% and 22%) were instead the foremost priorities for patients.

A summary of the impact of patient weighting on priority rankings for each of the studied domains is provided in **Supplementary Figures 2-6.** Applying patient weighting resulted in the most changes to priority ranking within the treatment domain, where it altered the position of 46.3% (n=19/41) of the research uncertainties **(Supplementary Figure 4)**. Rankings for a third of the research uncertainties within the palliative care domain (n=2/6; **Supplementary Figure 5**) and survivorship domain (n=6/18; **Supplementary Figure 6**) were also changed, whilst 27.8% (n=5/18) and 22.2% (n=2/9) of the uncertainties in the respective diagnosis and staging **(Supplementary Figure 3)**, and prevention **(Supplementary Figure 2)** domains were re-prioritised based on patient weighting.

As summarised in **Supplementary Tables 8-12**, weighted RPS scores ranged from 0.44-0.85 and the range for AEA and directional AEA were respectively 0.39-0.71, and 0.56-0.98. There was a weak-

moderate positive correlation between weighted RPS and AEA (r=0.4762, 95% confidence interval (CI) 0.30-0.62; p<0.0001) but a strong positive correlation between weighted RPS and directional AEA (r=0.91, 95%CI 0.87-0.94; p<0.0001) **(Supplementary Figure 7).**

The 20 highest scoring research uncertainties are summarised in **Table 5**. Sixty percent (n=12/20) relate to the treatment domain, 15% (n=3/20) each to prevention and survivorship and 5% (n=1/20) each to diagnosis and staging, and to palliative care. The top five research uncertainties for each domain are listed in **Table 6**. For prevention, these centre on screening for, and monitoring, premalignant disease in addition to identifying the causes for a rise in the incidence of gastric and oesophageal cancer amongst the young. In contrast, the lowest priority research uncertainties within the prevention domain **(Supplementary Table 9)** focus on identifying the contribution to cancer risk made by age more broadly and by other unmodifiable risk factors such as sex and family history. The relationship between monitoring modifiable health behaviours and the early detection of OG cancers was a low priority for diagnosis and staging **(Supplementary Table 10)**, as was research focused on improving the tolerability of endoscopy and selecting those who should receive diagnostic investigations. Instead, diagnosis and staging priorities related to increasing the proportion of patients who present for diagnostic investigations and on optimising the tests they then receive.

Priorities for treatment **(Supplementary Table 11)** related most strongly to optimizing treatment combinations for OG cancer care and, more specifically, for selecting patients most likely to benefit from immune checkpoint inhibition and those most likely to benefit from adjuvant treatment. In contrast, research focused on the use of complementary therapies, on communication to patients who are to receive treatment for an OG cancer and on the use of non-invasive ventilation following an oesophagectomy were felt to have the lowest priority. Optimizing and delivering nutrition is the fourth highest scoring priority in the treatment domain, the highest ranked priority for palliative care research **(Supplementary Table 12)** and the second highest priority for survivorship **(Supplementary Table 13)**. Psychological support and research to control symptoms are similarly prioritized for palliative care, whilst other priorities for survivorship include identifying the long-term effects of prehabilitation and monitoring for disease recurrence following treatment. The lowest priority survivorship uncertainties relate to the financial cost to society of OG cancer, the presence of felt stigma following an OG cancer diagnosis and whether speech and language therapy input improves outcomes.

DISCUSSION

OG cancers are a major global cause of morbidity and mortality[3,4]. Research is key to reducing the adverse impacts of these malignancies but resources are limited[16]. There is therefore a need to identify areas of research that deliver the greatest impact for patients and society. We provide this here through a comprehensive exercise that has identified and prioritised 92 research uncertainties relating to all phases of OG cancer care. There was a very strong correlation (r=0.91) between weighted RPS and directional AEA, which in the context of previous CHNRI exercises indicates a very high degree of agreement between individual HCPs, and between HCPs and patients, when scoring the highest-ranked research uncertainties[15].

Overall, the highest ranked priorities point to a shared emphasis between HCPs and patients on personalising treatment approaches, including through optimally combining or omitting treatment modalities. These areas together form the basis for considerable ongoing and recently published trials activity, albeit largely focused on comparisons drawn from biomarker unselected groups such as in the neoadjuvant Neo-AEGIS, ESOPEC, SANO and NEEDS trials[17-20]. Emphasising the relevance of the priorities developed here to pre-clinical as well as clinical settings, future treatment personalisation will be contingent on the discovery and translational science driven identification of multi-omic biomarkers. Research questions focused on nutritional support were also strongly prioritised across treatment, palliative care and survivorship domains. This is of particular interest given that this is an area that has previously received minimal research focus[21].

The data presented here are also notable for the extent to which they highlight areas in which HCP priorities for research misalign with those of patients. This was most evident within the treatment domain, within which almost half of the priority rankings were changed by patient scores. This reflected a strong emphasis from patients on research focused on improving morbidity that is further demonstrated by the prioritisation of quality of life related research questions in the survivorship and palliative care domains. These and other non-treatment settings accounted for eight of the 20 most highly ranked research priorities. However, recent data indicate that whilst treatment related funding accounts for a third of global public and philanthropic cancer research spend, the areas of prevention, diagnosis and screening together receive just 10% of funding whilst survivorship receives only 5%[16].

These data together reinforce the value of research prioritization approaches such as the HCP-patient partnership method used here. The conclusions reached are supported by the many other strengths of this project, which has achieved considerable endorsement and support from all major relevant patient- and HCP- facing charities and professional organisations, as well as major cancer research

funding bodies. This has broadened its scope and provides a pathway for considerable potential impact. The overall numbers of respondents is high with good representation from patients as well as a diversity of HCP professions and specialties from within the hospital setting as well as the community. Importantly, over 40 responses were received to almost all criteria across all studied domains. This is of pertinence given recognition that previous CHNRI exercises have demonstrated considerable convergence of opinion with at least 40 scoring experts, and is supported by the high AEA values seen for high-scoring research priorities[15]. This is particularly impressive given the breadth of topics covered by this work, which essentially extend from disease prevention through to palliative care and survivorship.

There are nevertheless also limitations to the data. Firstly, Black and minority ethnic populations are underrepresented amongst patient respondents for phases 2 and 3 of this work. It is known that the incidence of OAC, which is the highest prevalence type of OG cancer in the UK and Ireland, is highest amongst a White population[22]. However, groups such as Bangladeshi women are thought to have a higher incidence of oesophageal cancer than White women, whilst Black Caribbean men and women have a higher incidence of gastric cancer[22]. Individuals from these populations, who are already poorly represented in clinical trials, are not captured by this work and the extent to which the weighted research priorities apply to them is therefore uncertain.

The HCP group is, in contrast, more demographically diverse but there was less input from several specialties and professions during phase 3 of this work than was achieved in phase 2. The study may also be impacted by the long time period between the culmination of the first survey in late 2021 and the end of the final prioritization round in early 2025. This is double the usual length of most JLA priority setting partnerships, which generally extend for around 18 months. However, the exercise here is notable for its considerable scope, the large number of initially proposed research uncertainties and the rigor employed to ensure that only true uncertainties were prioritized. Finally, the breadth of the approach used in this work may mean that more nuanced questions relating to specific aspects of OG cancer care were lost whilst consolidating the proposed research uncertainties. However, this work has focused on guiding funders, policy makers and researchers towards the most impactful areas of research for each domain and there may then be a need for further prioritization of research ideas within each of the identified priorities. The extent to which these uncertainties apply to countries outside of the UK and RoI is also uncertain, though there they are in the main likely to reflect globally shared challenges.

There is a great deal to be gained by exploring these areas in future work. In tandem, the comprehensive overall and domain specific priorities outlined here should serve to motivate patients, HCPs and scientists to develop research in previously underexplored and underappreciated areas. They also serve as a blueprint for funders to prioritise and allocate discovery, translational and clinical research spend to ensure that it provides the greatest possible benefit for patients and society.

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DATA SHARING

The dataset summarised here is available from the corresponding authors on reasonable request.

COMPETING INTERESTS

CMJ has received consulting fees from Candesic for work outside the scope of this project. LT is currently employed by Applied Medical Resources Corporation. PC has received research grant funding from Pfizer and Gilead. MJ is the Chair of the Research Committee for the Pathological Society of Great Britain & Northern Ireland. TDLC is a trustee of the UK and Ireland Oesophagogastric Cancer Group (UKIOG). CD is the Chief Executive Officer of Oesophageal Cancer Fund. JE has received educational grants from Medtronic and J&J. RCF developed the capsule sponge technology and associated patents which were licensed to Covidien (now Medtronic) by the Medical Research Council. RCF is a shareholder in Cyted Health, sits on the advisory board for AstraZeneca and the Cancer Research UK Functional Genomics Centre, and consults for AstraZeneca and 23andMe. KF receives research funding from the National Institute for Health Research (NIHR), the National Imaging Academy of Wales (NIAW) and Velindre Cancer Centre. SG receives funding from the NIHR for her role as medical lead of the UK Radiotherapy Trials Quality Assurance (RTTQA) group. VG sits on the advisory board for Siemens Healthineers. MG serves on the medical advisory board, has received research funding from, and undertakes consultancy for Becton Dickinson Ltd. ECS reports personal fees from Amgen, Daiichi Sankyo, Merck, Viracta, Astellas, Novartis, Pfizer, Zymeworks, and BeiGene; a grant from Roche; grants and personal fees from BMS and AstraZeneca; consulting fees from Gilead and TCypherBio; advisory board membership with Jazz; and personal fees and non-financial support from Mirati, outside the submitted work. ECS is the chair of the European Organisation for Research and Treatment of Cancer Gastrointestinal Group (2024–27) and is a trustee of UKIOG. AM was the founding Chair of Action Against Heartburn. MM is the Chairman and founder of Heartburn Cancer UK. RDP is the subject editor for Clinical Studies at the British Journal of Cancer. RDP also declares Consulting or Advisory Role for Amgen, AstraZeneca, BMS, Servier, Astellas; Speaker fees received from BMS, Servicer; Travel Grant received from BMS, MSD; Institutional Research grants received from Amgen, Basilea, AstraZeneca, BMS, Five Prime Therapeutics, Platinum Therapeutics, Roche, MSD, Moderna, Astellas. NT is Clinical Lead for the National Oesophagogastric Cancer Audit, a committee member for the British Society of Gastroenterology and Research Lead for the Joint Advisory Group on Endoscopy (JAG). RCT reports personal fees from AstraZeneca, Eli Lilly, Astellas, Beigene and Almac Diagnostic Services. TU is Director of Research for the Association of Upper Gastrointestinal Surgeons. CJP is a trustee of UKIOG and Chair of the UKIOG Research Group, has received consultancy fees from AXA Healthcare, TTP and AstraZeneca, and has received speaker fees from BMS.

CONTRIBUTORS

CMJ and CP devised the study. CMJ designed the study, undertook the initial literature review, drafted all three study surveys and, with WHN, distributed the surveys. CMJ, WHN, LT, DPM and CP processed the results of the first survey. CMJ and CP quality assured questions generated in phase 1 of the survey. CMJ and WHN processed the results of the second survey, which CMJ analysed. CMJ generated all data representations CMJ, EA, PB, KC, PC, FDC, HGC, TDLC, CD, JD, JAE, RCF, KF, VG, HIG, TAG, MPWG, SG, JH, MJ, PL, CL, LLD, FM, CRM, MM, AM, SM, RDP, SR, JR, GR, ECS, NJT, RCT, TJU, FMW, JW and CJP are members of the study leadership group, which provided input into all phases of the study work. All contributors interpreted the results of the first and second survey, and all contributed to the development and refinement of related research questions. CMJ authored the first draft of the manuscript and is the guarantor for the study. All authors have read and contributed to subsequent versions of the manuscript.

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those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

LIST OF TABLES

• This exercise focuses on identifying areas to be prioritised in research to improve the care of patients with an oesophagogastric cancer diagnosis within the United Kingdom and Republic of Ireland. • Research priorities were sought for all aspects of oesophagogastric cancer care; effectively stretching from prevention through to death or long-term survivorship. • There was no pre-defined timeline for impact from the research priorities established by this process. • The list of research priorities was intended to shape the awards available from major funding bodies and to therefore promote research with greater impact for patients.

Table 1: Pre-defined context and aims for the research priority setting exercise. These were formulated at the outset of the project by the Study Leadership Group following recommendations from Child Health and Nutrition Research Initiative guidelines[23].

Will it benefit all patients?

- Is the research question likely to benefit all or at least a majority of patients, or will it apply to only a subpopulation?

Will it generate substantial new knowledge?

- Will this research represent a substantial increase in our knowledge of oesophagogastric cancers and how to care for them, or does it represent a smaller incremental improvement?

Will it mean patients live longer?

- Will this research provide the potential for patients with a diagnosis of an oesophagogastric cancer to live longer?

Will it mean patients have a better quality of life?

- Will this research improve the quality of life of patients with an oesophagogastric cancer diagnosis?

Table 2: Criteria for scoring research uncertainties.

Patient advocacy organisations & research funding bodies
• Action Against Heartburn • Cancer Research UK • GUTS UK • Gutsy Group • Heartburn Cancer UK • Laurie Todd Foundation • Macmillan Cancer Support • Ochre • Oesophageal Cancer Fund • Oesophageal Patients Association • OG Cancer NI • Oxfordshire Oesophageal & Stomach Organisation
Healthcare professional/Specialty-specific organisations
• Association of Cancer Physicians • Association of Chartered Physiotherapists in Oncology and Palliative Care • Association for Palliative Medicine of Great Britain & Ireland • Association of Upper Gastrointestinal Surgery of Great Britain & Ireland • British Dietetic Association • British Oncology Pharmacy Association • British Society of Gastroenterology • British Society of Gastrointestinal & Abdominal Radiology • Faculty of Public Health • National Cancer Research Institute (NCRI)* • NCRI Clinical & Translational Radiotherapy Research Working Group (CTRad)** • NCRI Oesophagogastric Research Subgroup* • The Primary Care Society for Gastroenterology • Royal College of Anaesthetists • Royal College of Pathologists • Royal College of Radiologists • Royal College of Speech & Language Therapy • UK & Ireland Oesophagogastric Group • UK Oncology Nursing Society

Table 3: A list of patient-advocacy, research funding and healthcare professional or specialty specific organisations that formally endorsed this work. Each organisation supported in distributing and publicising the survey. *The National Cancer Research Institute has now closed, as has the associated Oesophagogastric Research Subgroup, the functions of which have transferred to the UK & Ireland Oesophagogastric Group. **CTRad is now part of the UK Collaborative for Cancer Clinical Research.

	Phase 2 survey				Phase 3 survey			
	HCP		Patient*		HCP		Patient*	
	n=266		n=189		n=129		n=251	
	n	%	n	%	n	%	n	%
Gender								
Male	108	40.6	103	53.9	50	38.8	122	51.0
Female	152	57.1	83	43.5	76	58.9	128	48.6
Not disclosed/Other**	6	2.3	3	1.6	3	2.3	1	0.4
Age* **								
18-30	22	8.3	3	1.6	5	3.9	4	1.6
31-40	97	36.5	8	4.2	38	29.5	9	3.6
41-50	76	28.6	12	6.3	57	44.2	16	6.4
51-60	60	22.6	41	21.5	22	17.1	53	21.1
61-70	10	3.8	59	30.9	6	4.7	84	33.5
71-80	0	0.0	57	29.8	0	0.0	68	27.1
81-90	0	0.0	8	4.2	0	0.0	17	6.8
Not disclosed	1	0.4	1	0.5	1	0.8	0	0.0
Ethnicity								
Arab	5	1.9	0	0.0	3	2.3	0	0.0
Asian – Bangladeshi or British Bangladeshi	0	0.0	0	0.0	2	1.6	0	0.0
Asian – Chinese or British Chinese	6	2.3	0	0.0	3	2.3	1	0.4
Asian – Indian or British Indian	18	6.8	0	0.0	12	9.3	3	1.1
Asian – Pakistani or British Pakistani	1	0.4	0	0.0	1	0.8	0	0.0
Black – African or Black British African	2	0.8	0	0.0	2	1.6	1	0.4
British Sri Lankan	1	0.4	0	0.0	0	0.0	0	0.0
Indo-Mauritian	1	0.4	0	0.0	0	0.0	0	0.0
Mixed – White/Asian	3	1.1	0	0.0	2	1.6	0	0.0
Other Asian background	5	1.9	0	0.0	7	5.4	0	0.0
Other Mixed background	2	0.8	0	0.0	2	1.6	1	0.4
Other White background	27	10.2	5	2.6	12	9.3	7	2.8
White – British	170	63.9	163	85.3	70	54.3	214	85.3
White - Irish	25	9.4	20	10.5	13	10.1	24	9.6
Not disclosed	0	0.0	1	0.5	0	0.0	0	0.0
Respondent group – patients								
Patient			144	75.4			181	72.1
Family member or carer			40	21.0			40	15.9
Member of public with significant interest			5	2.6			13	5.1
Respondent group - professionals								
AP – gastroenterology	6	2.3			2	1.6		
AP - oncology	2	0.8			4	3.1		
AP – palliative care	4	1.5			0	0.0		
AP – surgery	1	0.4			1	0.8		
Dietetics	22	8.3			16	12.4		
Doctor – anaesthetics	6	2.3			1	0.8		
Doctor – clinical oncology	30	11.3			18	14.0		
Doctor – gastroenterology	22	8.3			8	6.2		
Doctor – general practice	15	5.6			1	0.8		
Doctor – care of the elderly	6	2.3			1	0.8		
Doctor – medical oncology	19	7.1			26	20.2		

Doctor – pathology	10	3.8		3	2.3	
Doctor – palliative care	23	8.6		1	0.8	
Doctor – public health	3	1.1		1	0.8	
Doctor – radiologist	16	6.0		11	8.5	
Doctor – surgeon	19	7.1		16	12.4	
Occupational therapy	1	0.4		0	0.0	
Pharmacy	5	1.9		0	0.0	
Physiotherapy	8	3.0		0	0.0	
Radiographer – therapy	8	3.0		1	0.8	
Specialist nurse – care of the elderly	1	0.4		0	0.0	
Specialist nurse – endoscopy	4	1.5		0	0.0	
Specialist nurse – oncology/surgery	14	5.3		5	3.9	
Specialist nurse – palliative care	3	1.1		1	0.8	
Speech & language therapy	16	6.0		0	0.0	

Table 4: Demographic characteristics and stated interest in oesophagogastric cancers for respondents to both online surveys. *Includes patients, their carers and non-healthcare professionals who have a significant interest in oesophagogastric cancers. **Unknown entries relate to those for which the respondent did not answer or actively selected an option indicating that they preferred not to respond. AP, advanced practitioner; HCP, healthcare professional.

	Domain	Research question	Weighted RPS	Directional AEA
1	Treatment	Which treatment combinations are the most effective treatment for patients with an oesophageal or stomach cancer?	0.85	0.97
2	Treatment	Which patients with oesophageal or gastric cancer should receive immunotherapy?	0.84	0.97
3	Treatment	Which patients should get more treatment following an operation or radiotherapy?	0.83	0.98
4	Treatment	What is the best way to support a patient's nutrition whilst they are receiving treatment for an oesophageal or gastric cancer?	0.83	0.95
5	Prevention	Who should be screened for oesophageal and gastric cancer?	0.81	0.94
6	Treatment	What is the best way to treat early oesophageal or gastric cancers?	0.81	0.95
7	Treatment	What is the best way to treat Barrett's oesophagus that is at high risk of becoming cancerous?	0.80	0.95
8	Treatment	How can we better personalise a patient's treatment for an oesophageal or gastric cancer?	0.80	0.94
9	Treatment	Are there a group of patients with oesophageal or gastric cancer who can be spared surgery, and how is this best done?	0.80	0.90
10	Prevention	Why are rates of oesophageal and gastric cancer increasing in younger people?	0.79	0.95
11	Treatment	How do we support nutrition in patients with incurable oesophageal (gullet) or gastric (stomach) cancer?	0.78	0.85
12	Treatment	What is the best way of delivering prehabilitation before receiving oesophageal (gullet) and gastric (stomach) treatment?	0.78	0.92
13	Palliative care	Which measures are the most effective to maximise quality of life and control symptoms in patients with incurable oesophageal and gastric cancer?	0.77	0.78
14	Prevention	How do we most effectively monitor patients with Barrett's oesophagus?	0.77	0.89
15	Survivorship	Does delivering prehabilitation before receiving oesophageal and gastric cancer treatment provide long term health benefits?	0.76	0.86
16	Diagnosis & staging	What stops oesophageal and gastric cancers being diagnosed earlier?	0.76	0.91
17	Survivorship	How do we support long-term nutrition in patients who have received treatment for an oesophageal or gastric cancer?	0.76	0.84
18	Treatment	How do we reduce the long-term side effects of surgery for oesophageal or gastric cancer?	0.76	0.87
19	Survivorship	How should we monitor patients who have had an oesophageal or gastric cancer treatment so that we can spot any signs that it has recurred?	0.76	0.88
20	Treatment	How do we support new surgical innovations to reach patients with OG cancer?	0.75	0.90

Table 5: Top twenty research priorities across all domains. The ten research questions with the highest weighted research priority score (RPS) are shown. The average expert agreement (AEA) is shown for individual responses and for the overall direction (i.e. likely vs. unlikely) of the responses.

		Increased knowledge	Reduced morbidity/ improved QoL	Reduced mortality/ increased length of life	Equitable benefit	RPS	Weighted RPS	AEA	Directional AEA
Prevention									
1	Who should be screened for oesophageal and gastric cancer?	0.83	0.81	0.82	0.83	0.81	0.81	0.55	0.94
2	Why are rates of oesophageal and gastric cancer increasing in younger people?	0.83	0.77	0.77	0.83	0.79	0.79	0.71	0.95
3	How do we most effectively monitor patients with Barrett's oesophagus?	0.78	0.76	0.76	0.78	0.77	0.77	0.59	0.89
4	What public health interventions are useful for reducing the number of oesophageal and gastric cancer diagnoses?	0.74	0.73	0.72	0.74	0.73	0.74	0.60	0.86
5	Does monitoring Barrett's oesophagus increase how long a person lives?	0.75	0.70	0.72	0.70	0.72	0.72	0.56	0.82
Diagnosis & staging									
1	What stops oesophageal and gastric cancers being diagnosed earlier?	0.76	0.76	0.76	0.77	0.76	0.76	0.65	0.91
2	How can the public's knowledge of oesophageal and gastric cancers be improved?	0.76	0.76	0.73	0.75	0.75	0.75	0.57	0.88
3	Can tests for oesophageal and gastric cancer be made more accurate?	0.75	0.75	0.73	0.73	0.74	0.74	0.68	0.89
4	Which is the best test for diagnosing oesophageal and gastric cancers?	0.74	0.71	0.71	0.75	0.73	0.73	0.58	0.85
5	What public health interventions are useful for diagnosing oesophageal and gastric cancers earlier?	0.73	0.74	0.71	0.74	0.73	0.73	0.63	0.87
Treatment									
1	Which treatment combinations are the most effective treatment for patients with an oesophageal or stomach cancer?	0.88	0.84	0.87	0.84	0.86	0.85	0.51	0.97
2	Which patients with oesophageal or gastric cancer should receive immunotherapy?	0.86	0.84	0.84	0.84	0.85	0.84	0.52	0.97
3	Which patients should get more treatment following an operation or radiotherapy?	0.86	0.82	0.83	0.84	0.84	0.83	0.58	0.98
4	What is the best way to support a patient's nutrition whilst they are receiving treatment for an oesophageal or gastric cancer?	0.82	0.85	0.80	0.83	0.82	0.83	0.57	0.95
5	What is the best way to treat early oesophageal or gastric cancers?	0.81	0.81	0.80	0.81	0.81	0.81	0.62	0.95

Palliative care									
1	How do we support nutrition in patients with incurable oesophageal or gastric cancer?	0.77	0.80	0.70	0.77	0.75	0.78	0.50	0.85
2	Which measures are the most effective to maximise quality of life and control symptoms in patients with incurable oesophageal and gastric cancer?	0.77	0.80	0.52	0.77	0.70	0.77	0.50	0.78
3	What is the need for, and the most effective way of providing, psychological support for patients with incurable oesophageal or gastric cancer?	0.77	0.76	0.41	0.77	0.65	0.72	0.48	0.78
4	Do bisphosphonates improve a patient's lifespan or quality of life when oesophageal or gastric cancer has spread to the bone?	0.73	0.73	0.53	0.66	0.66	0.71	0.57	0.75
5	Which patients with oesophageal or gastric cancer should be referred for support from palliative care services, and at which point in their cancer journey?	0.65	0.72	0.49	0.66	0.63	0.69	0.41	0.69
Survivorship									
1	Does delivering prehabilitation before receiving oesophageal and gastric cancer treatment provide long term health benefits?	0.76	0.80	0.70	0.76	0.75	0.76	0.57	0.86
2	How do we support long-term nutrition in patients who have received treatment for an oesophageal or gastric cancer?	0.78	0.79	0.66	0.78	0.75	0.76	0.50	0.84
3	How should we monitor patients who have had an oesophageal or gastric cancer treatment for signs of recurrence?	0.79	0.75	0.74	0.79	0.76	0.76	0.59	0.88
4	How does the treatment received for an oesophageal or gastric cancer influence long-term quality of life?	0.76	0.79	0.58	0.75	0.72	0.74	0.52	0.82
5	Which medical conditions worsen or are more likely to develop in patients who have received treatment for an oesophageal or gastric cancer?	0.77	0.75	0.67	0.73	0.73	0.73	0.64	0.85

Table 6: Top five research priorities by domain. The five research questions with the highest weighted research priority score (RPS) are shown for each domain. The average expert agreement (AEA) is shown for individual responses and for the overall direction (i.e. likely vs. unlikely) of the responses.

FIGURE LEGENDS

Figure 1: A summary of the process used to derive research priorities. HCP: healthcare professional; OG: oesophagogastric. *Patients refers to responses from patients, their carers and lay-persons with an interest in OG cancer.

Figure 2: A summary of the relative contributions made by healthcare professionals and patients to questions generated within each domain. (A) Alluvial plot in which each respondent is represented in the left vertical bar and the domains to which they contributed at least one uncertainty represented on the right. Flows represent each respondent and do not differ in size by the number of uncertainties proposed for each domain by each respondent. **(B)** Bubble plot detailing the contribution made by each profession and specialty to the questions generated within each domain. In this, bubble size and colour represent the magnitude of each specialty's contribution.

Figure 3: Proportion of the 251 responding patients* selecting each weighting criterion for each of the studied domains. *Patients refers to patients (n=181), carers (n=40) and non-healthcare professionals with an interest in oesophageal and/or gastric cancer (n=13). Seventeen respondents did not stipulate which of these categories they belong to.

SUPPLEMENTARY INFORMATION – FIGURES

Supplementary Figure 1: A summary of the demographics of the study leadership group. Two steering group members did not declare demographic information. Ethnicity groupings in which there was only 1 response are collated to protect respondent confidentiality.

Supplementary Figure 2: Impact of patient weighting on relative priority for research uncertainties within the prevention domain.

Supplementary Figure 3: Impact of patient weighting on relative priority for research uncertainties within the diagnosis & staging domain.

Supplementary Figure 4: Impact of patient weighting on relative priority for research uncertainties within the treatment domain.

Supplementary Figure 5: Impact of patient weighting on relative priority for research uncertainties within the palliative care domain.

Supplementary Figure 6: Impact of patient weighting on relative priority for research uncertainties within the survivorship domain.

Supplementary Figure 7: A summary of the correlation between (A) weighted RPS and AEA, and (B) weighted RPS and directional AEA.

SUPPLEMENTARY INFORMATION – TABLES

Supplementary Table 1: A list of search terms used to systematically appraise evidence relating to each research uncertainty. Research uncertainties were to be removed if there was existing level 1 (i.e. systematic review or meta-analysis) evidence that answered all aspects of the proposed uncertainty.

Supplementary Table 2: A list of healthcare professional members of the study leadership group and their medical or scientific specialty area. Clinicians are highlighted with an asterix. Five additional patient representatives are not shown in this table.

Supplementary Table 3: A summary of the number of research uncertainties proposed in phase 1 of this study by disease domain and respondent type. Priorities in the 'others' category were subsequently allocated to the domain most relevant to them. HCP, healthcare professional.

Supplementary Table 4: Number of respondents for each subcategory of each prevention-related research question.

Supplementary Table 5: Number of respondents for each subcategory of each diagnosis & staging-related research question.

Supplementary Table 6: Number of respondents for each subcategory of each treatment-related research question.

Supplementary Table 7: Number of respondents for each subcategory of each palliative care-related research question.

Supplementary Table 8: Number of respondents for each subcategory of each survivorship-related research question.

Supplementary Table 9: Prevention research priorities. Scores are listed by weighted research priority score (RPS). The average expert agreement (AEA) is shown for individual responses and for the overall direction (i.e. likely vs. unlikely) of the responses.

Supplementary Table 10: Diagnosis & staging research priorities. Scores are listed by weighted research priority score (RPS). The average expert agreement (AEA) is shown for individual responses and for the overall direction (i.e. likely vs. unlikely) of the responses.

Supplementary Table 11: Treatment-related research priorities. Scores are listed by weighted research priority score (RPS). The average expert agreement (AEA) is shown for individual responses and for the overall direction (i.e. likely vs. unlikely) of the responses.

Supplementary Table 12: Palliative care research priorities. Scores are listed by weighted research priority score (RPS). The average expert agreement (AEA) is shown for individual responses and for the overall direction (i.e. likely vs. unlikely) of the responses.

Supplementary Table 13: Survivorship research priorities. Scores are listed by weighted research priority score (RPS). The average expert agreement (AEA) is shown for individual responses and for the overall direction (i.e. likely vs. unlikely) of the responses.

SUPPLEMENTARY FILES

Supplementary materials: methods

Supplementary File 1: phase 1 survey for patients, carers and interested members of the public.

Supplementary File 2: phase 1 survey for healthcare professionals.

Supplementary File 3: phase 2 survey for healthcare professionals.

Supplementary File 4: summary of modifications to phase 2 surveys.

Supplementary File 5: phase 2 survey for patients, carers and interested members of the public.